

Field and Laboratory Investigations
of Antarctic Meteorites Collected
by United States Expeditions,
1985–1987

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and Glenn J. MacPherson*

EDITORS

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ABSTRACT

Marvin, Ursula B., and Glenn J. MacPherson, editors. Field and Laboratory Investigations of Antarctic Meteorites Collected by United States Expeditions, 1985-1987. *Smithsonian Contributions to the Earth Sciences*, number 30, 116 pages, frontispiece, 38 figures, 9 tables, 1992.—This monograph describes the meteorite collecting activities of the United States Antarctic Search for Meteorites (ANSMET) expeditions during the 1984-1985, 1985-1986, and 1986-1987 field seasons. Descriptions and classifications are given of most specimens collected during those expeditions with the exceptions of the types 4, 5, and 6 ordinary chondrites, whose properties are tabulated. Two articles are included that summarize data on the terrestrial ages and thermoluminescence properties of Antarctic meteorites. The Appendix lists all ANSMET specimens classified as of June 1987, in numerical order for each locality and by meteorite class.

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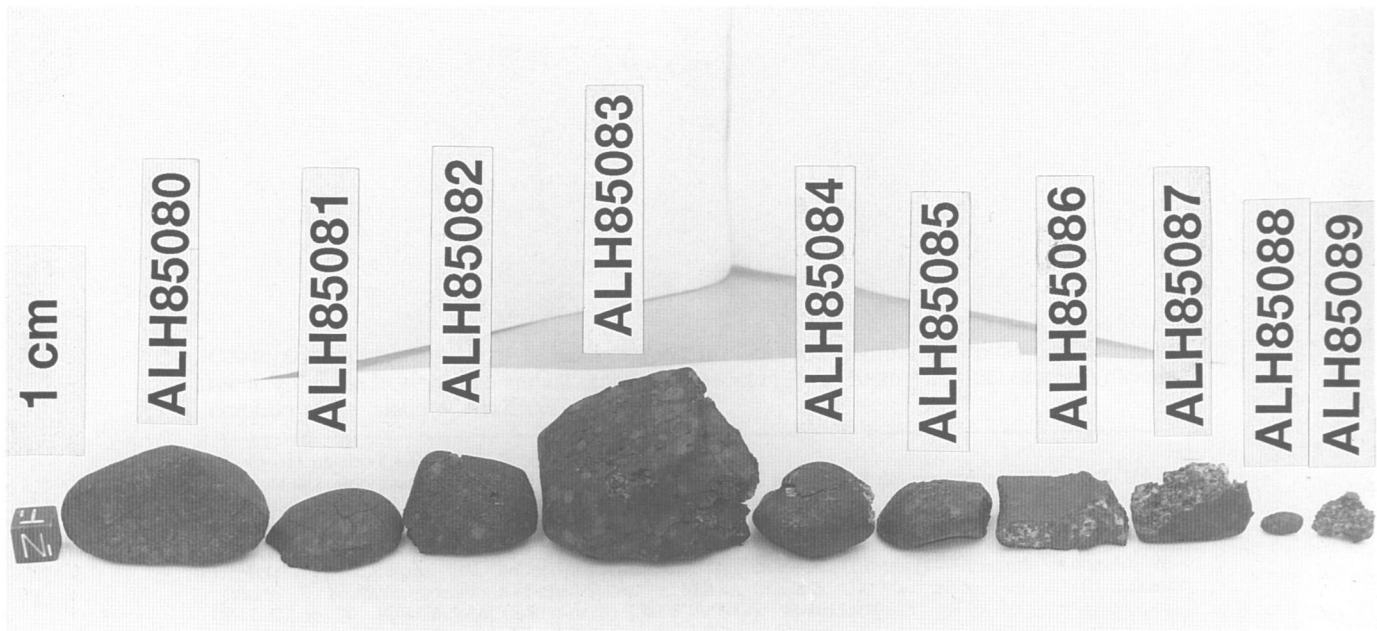
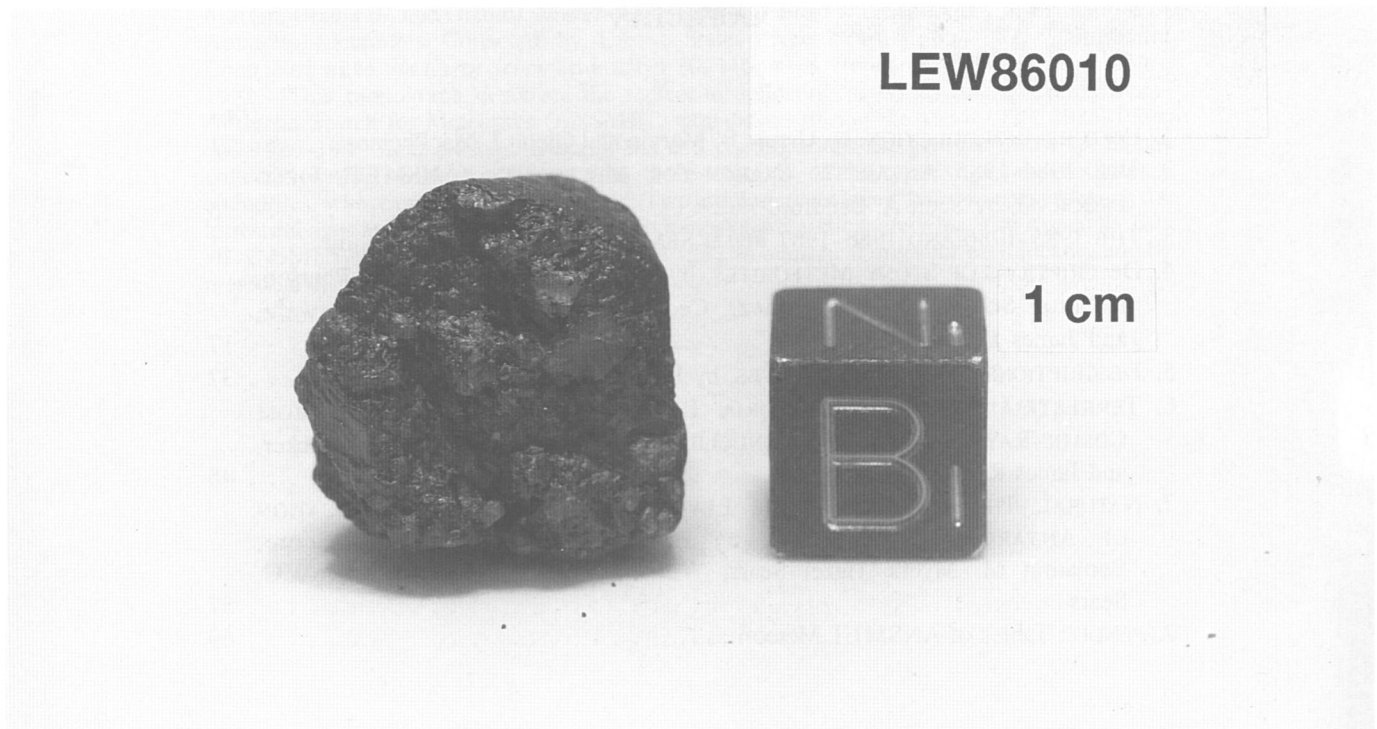
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FRONTISPIECE.—Two of the most interesting meteorites collected during the field seasons described in this volume were also among the smallest. LEW86010 (top) was initially believed to be a terrestrial igneous rock, until examination of a thin section showed it to be the second example of one of the very rarest meteorite types—an angrite. The photo shows the entire specimen prior to sampling. ALH85085 (bottom, shown in a “group photo” with the other ALH8508x specimens) was also not recognized as being unusual until thin section examination and electron microprobe analyses revealed its unique characteristics.

Field and Laboratory Investigations of Antarctic Meteorites Collected by United States Expeditions, 1985–1987

1. Editors' Introduction

Ursula B. Marvin and Glenn J. MacPherson

This is the fifth publication in the Smithsonian Contributions to the Earth Sciences series to present the results of the yearly United States Antarctic Search for Meteorites (ANSMET) expeditions to Antarctica. This issue describes the 1984–1985, 1985–1986, and 1986–1987 field seasons (Figure 1-1). Descriptions and classifications are given of most of the meteorites collected during those expeditions with the exceptions of types 4, 5, and 6 ordinary chondrites, whose properties are tabulated in the Appendix. Two articles are included that summarize data on the terrestrial ages and thermoluminescence properties of Antarctic meteorites. Appendix Table A lists all meteorites classified through June 1987 in numerical order for each locality; Appendix Table B lists specimens in consecutive order by meteorite class; Appendix Table C summarizes the total numbers of meteorites collected by ANSMET through 1986, by type.

The numbers and main categories of meteorite specimens collected in the 1984–1985, 1985–1986, and 1986–1987 seasons are listed in Table 1-1. Total numbers and aggregate weights of specimens of each meteorite class are given in Appendix Table B. The aggregate weights are of interest because of the inherent intractability of the pairing problem. We are unlikely ever to obtain secure counts of the number of falls of each meteorite class represented on the Antarctic stranding surfaces, and so we cannot compare numbers of Antarctic falls

with those in the rest of the world. We can, however, obtain aggregate weights and, allowing for the vagaries of discovery, gain a general idea of how relative proportions of meteorite classes in the Antarctic collections compare with those found elsewhere. The system for naming Antarctic meteorites was changed in 1982 by the dropping of a letter (A, for example) to designate the collecting expedition. When the system was originally adopted, some members of the Nomenclature Committee looked forward optimistically to a time when two or more expeditions, from different countries or organizations, might visit an area such as the Allan Hills during the same season. They foresaw the need for a letter (A, B, C) to identify each one. Hence, letters and numbers in a name such as ALHA76001 were chosen to indicate place, expedition, year, and specimen number: ALH (Allan Hills), A (Expedition A), 76 (1976), 001 (Specimen 1). In practice, however, meteoritists viewed the expedition number as incomprehensible and unnecessary. It has been dropped for all meteorites collected after the 1981 season; thus, the first Allan Hills specimen of 1982 was ALH82001.

The ANSMET program is governed by an interagency agreement between the National Science Foundation, the Smithsonian Institution, and the National Aeronautics and Space Administration. At the request of the scientific community, procedures (based on those used for lunar samples) were adopted for collecting specimens by sterile techniques and keeping them frozen until they are processed in nitrogen-filled cabinets at the Johnson Space Center at Houston. Details of the field and laboratory procedures are outlined in the first

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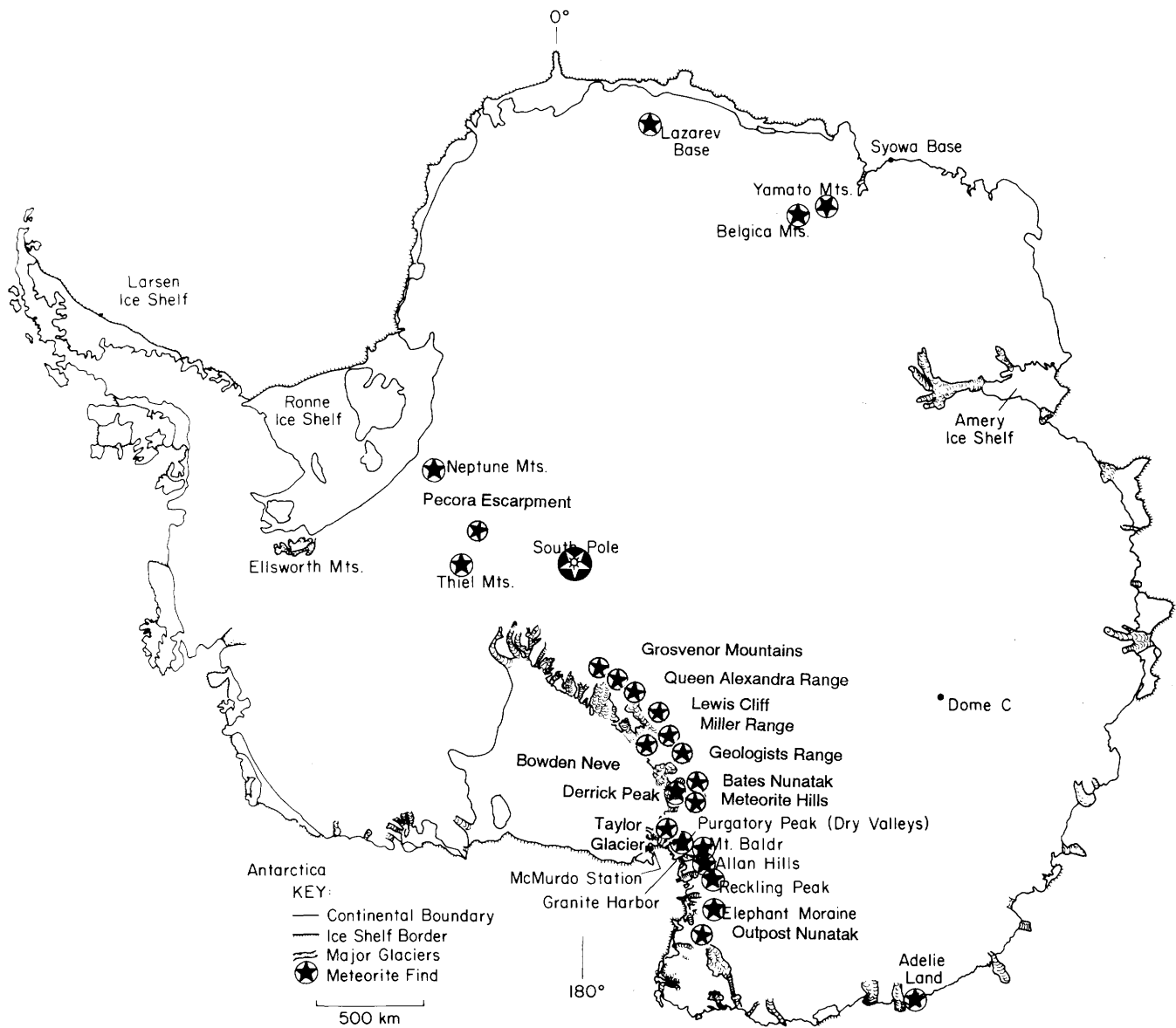


FIGURE 1-1.—Outline map of Antarctica showing sites of meteorite finds.

publication in this series (Marvin and Mason, 1980). In order to distribute research samples quickly and widely, all newly classified specimens are described in the *Antarctic Meteorite Newsletters*; these are mailed, on request, to investigators throughout the world. Any scientist wishing to obtain samples may submit a request, describing the proposed research and the numbers, weights, and types of samples required, to the Meteorite Working Group, a committee with a rotating membership responsible for monitoring the program and allocating samples. Requests for the *Antarctic Meteorite Newsletter* or for research materials should be addressed to the Secretary, Meteorite Working Group, NASA Johnson Space Center, Code SN2, Houston, Texas 77058.

The Antarctic Meteorite Working Group meets twice each

year, usually in April and October. Each issue of the newsletter publishes dates of meetings and deadlines for requests. Sample requests are welcome from all qualified scientists and are considered on the basis of their merit regardless of whether a scientist is funded for meteorite research. The allocation of Antarctic meteorite samples does not in any way commit a funding agency to support the proposed research.

For references on Antarctic meteorites, see the earlier publications in this series (Marvin and Mason, editors, 1980, 1982, 1984; Marvin and MacPherson, editors, 1989) and the computerized lists of publications from the Antarctic Meteorite Bibliography, which may be obtained on request from the Lunar and Planetary Institute, 3600 Bay Area Blvd., Houston, Texas 77058-1113. The Bibliography references articles in

TABLE 1-1.—Numbers of classified meteorite specimens collected in the 1984–1985, 1985–1986, and 1986–1987 field seasons.

Meteorite Type	Locality	1984	1985	1986	Total
Achondrites	Allan Hills	22	2		24
	Elephant Moraine	1			1
	Lewis Cliff		9	5	14
	TOTAL	23	11	5	39
Enstatite Chondrites	Allan Hills	8	2		10
	TOTAL	8	2	0	10
Unique Chondrites	Allan Hills		2		2
	Lewis Cliff		1		1
	TOTAL	0	3	0	3
Ordinary Chondrites	Allan Hills	204	139	13	356
	Bowden Neve		1		1
	Dominion Range		11		11
	Elephant Moraine	7		3	10
	Geologists Range		2		2
	Grosvenor Mountains		17		17
	Lewis Cliff		152	491	643
	Miller Range		1		1
	Rekling Peak			6	6
	TOTAL	211	323	513	1047
Carbonaceous Chondrites	Allan Hills	27	13		40
	Lewis Cliff		5		5
	MacAlpine Hills			7	7
	Grosvenor Mountains		1		1
	TOTAL	27	19	7	53
Stony-Irons	Lewis Cliff			1	1
	Queen Alexandra Range			1	1
	TOTAL	0	0	2	2
Irons	Allan Hills	2			2
	Elephant Moraine	1			1
	Grosvenor Mountains		1		1
	Lewis Cliff		1	4	5
	TOTAL	3	2	4	9

Meteoritics, in the annual Proceedings of the Lunar and Planetary Science Conferences at Houston, the Symposiums on Antarctic Meteorites held by the National Institute of Polar Research in Tokyo, and numerous other sources.

Libraries of polished thin sections are maintained in Washington, Houston, and Tokyo for the use of visitors who wish to make petrographic examinations. To obtain meteorite samples collected by parties sponsored by the Japanese Antarctic Research Expeditions, or to use the thin section library in Tokyo, contact Dr. Keizo Yanai, Curator, at the National Institute of Polar Research, 9-10 Kaga 1-chome, Itabashi-ku, Tokyo 173, Japan. To use the thin section library at the Johnson Space Center at Houston, contact the Secretary of the Meteorite Working Group at the address given above. To use the thin section library at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, contact Roy S. Clarke, Jr., Curator.

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 1980. Catalog of Antarctic Meteorites, 1977–1978. *Smithsonian Contributions to the Earth Sciences*, 23: 50 pages.
1982. Catalog of Meteorites from Victoria Land, Antarctica, 1978–1980. *Smithsonian Contributions to the Earth Sciences*, 24: 97 pages.
1984. Field and Laboratory Investigations of Meteorites from Victoria Land, Antarctica. *Smithsonian Contributions to the Earth Sciences*, 26: 138 pages.
- Marvin, Ursula B., and Glenn J. MacPherson, editors
 1989. Field and Laboratory Investigations of Meteorites from Victoria Land and the Thiel Mountains Region, Antarctica, 1982–1983 and 1983–1984. *Smithsonian Contributions to the Earth Sciences*, 28: 146 pages.

2. The 1984–1985 Antarctic Search for Meteorites (ANSMET) Field Program

Scott A. Sandford

The purpose of the 1984–1985 ANSMET (Antarctic Search for Meteorites) expedition was to recover meteorites from the Main, Near Western, Middle Western, and Far Western icefields in the Allan Hills area and to carry out a reconnaissance of other nearby blue icefields. A brief summary of the locations visited is provided in Table 2-1. Figures 2-1 and 2-2 contain maps of these locations and the routes taken between them.

Expedition members included leader W.A. Cassidy (University of Pittsburgh, Pittsburgh, Pennsylvania), Catherine King-Frazier (James Madison University, Harrisonburg, Virginia), John Schutt (University of Pittsburgh, Pittsburgh, Pennsylvania), Roberta Score (National Aeronautics and Space Administration/Johnson Space Center, Houston, Texas), Carl Thompson (Canterbury, New Zealand), Robert Walker (Washington University, St. Louis, Missouri), and the author (then at Washington University, St. Louis, Missouri).

The expedition proper began in late November 1984 when all the members except for Cassidy gathered at McMurdo Station on Ross Island; Cassidy joined the party at a later date. The first week was spent at McMurdo Station, undergoing survival training (for two days, on the lower slopes of Mt. Erebus) and gathering and preparing the expedition's gear for transportation to the Allan Hills area.

During the 6 weeks of the expedition the party lived entirely in Scott tents, two persons to a tent. Typical "non-storm" day temperatures were in the -5° to -10° F range with windchill factors generally falling between -10° and -40° F. Since it was the austral summer, the sun never set during the entire expedition. As a result, work days tended to be long, weather permitting. The entire day was usually spent away from camp. Cooking was done over portable, single burner gas stoves.

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Water was obtained by melting snow and ice. Lunches were generally very simple affairs, because most food froze solid once it was taken from the tents (although the author did determine that thinly sliced pastrami, when put in a plastic bag and taped against the engine block of a snowmobile, would remain partially thawed until lunchtime). Typical lunches consisted of chocolate bars, raisins, and similar items.

After a delay of several days due to bad weather, the party was transported to the Allan Hills on December 8 using UH-1N Huey helicopters with an intermediate refueling stop at Marble Point on the Antarctic mainland (Figure 2-1). The group was accompanied by a two man photography team from public television station WQED (Pittsburgh) who were filming sequences for a documentary. Some of this footage was subsequently shown in the seven part film series PLANET EARTH. The film crew left on 10 December.

The first camp was made between the Allan Hills Main Icefield and the Near Western Icefield (Figure 2-2). The camp remained in its first location for 8 days, during which the two nearest icefields were searched for meteorites (Table 2-1, Figure 2-2). Approximately 80 meteorite fragments were found during this period. The collection procedure consisted of search, collection, and surveying. During the search phase the snowmobiles were driven en echelon (similar to the pattern used by the fighter plane squadrons of WWII) in order to cover the maximum possible area in each sweep. This line formation swept back and forth over the icefield until a meteorite was spotted. Once found, meteorites were photographed, assigned a sample number, and enclosed in several successive sample bags (Figure 2-3). The position of the meteorite was then determined relative to survey reference points. All the meteorites were kept frozen until they arrived at the curatorial facility at the Johnson Space Center in Houston.

On December 17 the camp was moved to a new site at the Middle Western Icefield (Figure 2-2). The Middle Western

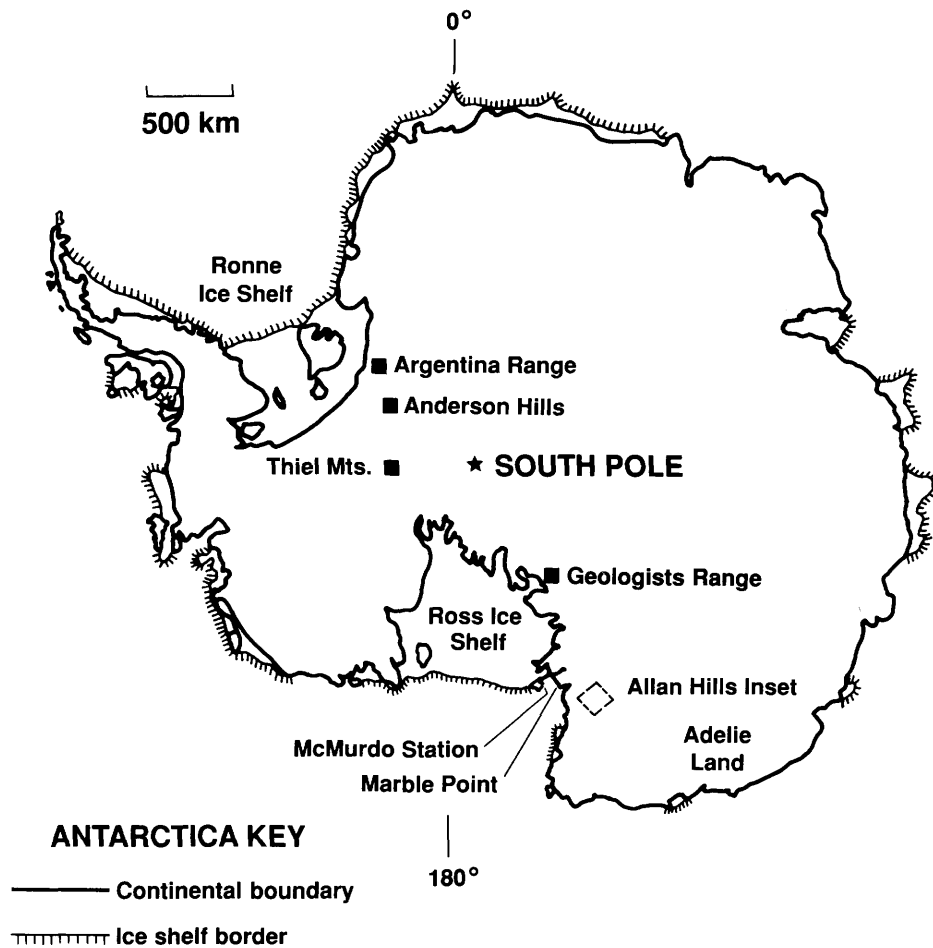


FIGURE 2-1.—A map of the continent of Antarctica. Major sites visited by expedition members during the 1984–1985 field season are marked on the map. The positions of many of these sites are also listed in Table 2-1. The boxed portion represents the extent of the area enclosed in the map in Figure 2-2.

TABLE 2-1.—Antarctic locations mentioned in the text.

Icefield	Location	Dates and camps
McMurdo Station	(77°30'S, 166°40'E)	
Near Western Icefield	(76°44'S, 158°49'E)	8–17 Dec 1984 (Camp 1)
Middle Western Icefield	(76°50'S, 158°26'E)	17–21 Dec 1984 (Camps 2 and 4)
Far Western Icefield	(76°54'S, 157°01'E)	21 Dec 1984–6 Jan 1985 (Camp 3)
Elephant Moraine	(76°11'S, 157°10'E)	8–10 Jan 1985
Allan Hills Main Icefield	(76°41'S, 159°17'E)	9–15 Jan 1985
Battlement Nunataks	(76°32'S, 159°21'E)	13 Jan 1985
Trinity Nunataks	(76°26'S, 160°38'E)	Not Reached
Odell Glacier Camp	(76°47'S, 159°35'E)	15–19 Jan 1985 (Camp 7)
Carapace Nunatak	(76°53'S, 159°24'E)	16 Jan 1985
Natural Rock Arch	(76°45.5'S, 159°57.7'E)	Discovered 17 Jan 1985
Geologists Range	(82°30'S, 155°30'E)	Aerial Recon 25 Jan 1985
Anderson Hills	(84°30'S, 84°00'W)	Aerial Recon 25 Jan 1985

Icefield was searched from December 18 to December 21 and approximately 30 additional meteorites were found. All traverses were made using snowmobiles to pull trains consisting of 1 to 3 Nansen or Knudsen sleds. Traverses at this location were made with the snowmobiles in single file to minimize risks associated with crevasses. On December 21, the camp was moved to the Far Western Icefield (Figure 2-2). The southeastern arm of the icefield was extensively searched and about 120 meteorites were found. The northwestern arm of the icefield was quickly surveyed but not thoroughly searched. Christmas Eve was celebrated by cramming 6 people in one Scott tent and sharing a meal of ham, lobster, shrimp, and yams.

On January 6 the party returned to the Middle Western Icefield and made an additional search for meteorites. On the 8th, Schutt and Sandford made a trip to Elephant Moraine (Figure 2-2) in order to meet with two geologists (Gunther Faure and Karen Taylor of Ohio State University, Columbus, Ohio) and to escort them back to the Allan Hills area. The rest of the party proceeded on to the Allan Hills Main Icefield.

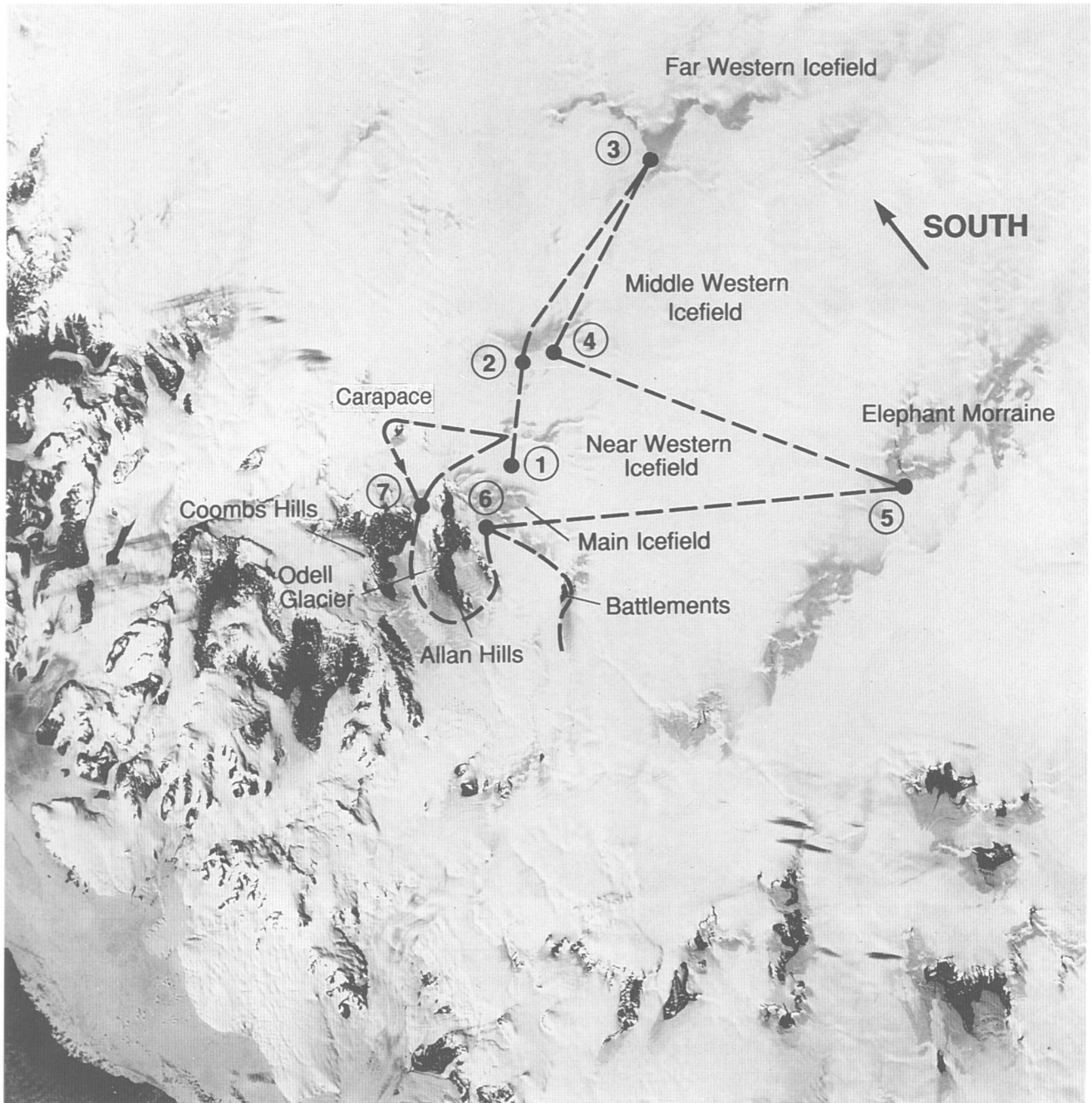


FIGURE 2-2.—A map of the Allan Hills area. Major traverses made during the 1984–1985 field season are shown as dashed lines and the camp sites are given as numbered dots. The positions of many of the features on the map can be found in Table 2-1.

While at Elephant Moraine, Sandford and Schutt found an additional 9 meteorites, including one of the season’s few iron meteorites.

The Elephant Moraine party then proceeded to the Allan Hills Main Icefield where the entire expedition was reunited on January 10. Bill Cassidy joined the party on January 12. The Main Icefield camp was maintained until January 15. During

this time the party searched the nearby icefield and visited the blue icefield associated with the Battlement Nunataks; no meteorites were found there.

While at the Allan Hills Main Icefield, an experiment was set up to determine the extent to which wind moves rocks and meteorites on the ice. Rocks spanning a range of sizes (about 1 to 10 cm in diameter) were placed on the icefield in two lines



FIGURE 2-3.—The author with the largest meteorite found during the 1984–1985 field season. This meteorite is an ordinary chondrite.

perpendicular to the prevailing wind direction. One line of rocks was placed directly on the ice while the other line of rocks was buried just below the surface of the ice. Both lines were examined during the next year to see how various sized rocks were excavated and moved by the wind. After one year the buried rocks were found to have been entirely exposed by wind ablation of the ice. While the larger rocks had been moved very little, some of the middle-sized rocks had moved downwind by distances in excess of 100 meters. Many of the smaller rocks were never found again.

On the 15th, camp was broken and a traverse to the Trinity Nunatak area was begun. Unfortunately, this traverse had to be abandoned since a recent snowfall had covered up many of the crevasses along the way and travelling conditions were hazardous. The party therefore proceeded instead up the Odell Glacier and established camp at its head. Additional reconnaissance trips from this camp were made to the Odell Glacier and the blue ice near the Carapace Nunatak (see Figure 2-2). It was during one of these day trips that the author discovered the natural rock arch shown in Figure 2-4. As far as the author has been able to ascertain, this is the only known rock arch in Antarctica.

TABLE 2-2.—Summary of identified meteorites found.

Meteorite class	Number found
Ordinary Chondrites	
H	112
L	63
LL	15
Enstatite Chondrites	
E3	1
E4	7
Carbonaceous Chondrites	
C2	24
C3V	2
C4	2
Irons	3
Ureilites	1
Diogenites	1
Aubrites	18
Unique Achondrites	3

The entire party was airlifted out of the field and returned to McMurdo Station on January 19. Overall, the expedition enjoyed generally good weather, and most of the time was spent successfully hunting for meteorites. A total of 274



FIGURE 2-4.—This natural rock arch lies on the western slopes of the Coombs Hills overlooking the Odell Glacier in southern Victoria Land. The arch is at approximately $76^{\circ}45.5'S$, $159^{\circ}57.7'E$ and is the only formation of its type known to exist on the southern continent. The arch is estimated to be about 15 meters in height and width.

meteorite fragments were found, ranging in size from about $0.5 \times 0.5 \times 0.1$ cm (0.4 g) to one stone measuring $32 \times 22 \times 18$ cm (16,000 g) (see Figure 2-3). Most of these samples have now been examined and a summary of the breakdown by type is given in Table 2-2. Of special interest are a $17 \times 9.5 \times 6.5$ cm diogenite and 3 unique achondrites.

At this point, most of the expedition personnel returned to the United States. Three of the party members (Cassidy, Score, and Sandford) remained and on January 25 participated in an airborne reconnaissance (using a C-130 Hercules aircraft) of potential meteorite-bearing icefields near the Geologists Range and the Anderson Hills in the Patuxent Range (see Figure 2-1). The latter site looks promising and future expeditions to this area are being planned. Additional reconnaissance of icefields near the Argentina Range had to be cancelled when an

exploratory "ski-drag" landing in the Anderson Hills damaged the landing gear of the aircraft and it was forced to return to McMurdo Station.

On January 28 an additional flight was made to the Amundsen-Scott Station at the south pole. This trip was made in order to change the sample surface of an electrostatic dust collector which is in continuous operation at the pole. The collection surface was returned to the University of Pittsburgh for examination for extraterrestrial dust particles.

ACKNOWLEDGMENTS.—I would like to thank co-expedition member Robbie Score for providing the latest summary of the meteorite types found in the 1984–1985 field season, and for spurring my memory concerning various details of the trip. My thanks go also to Mike Zolensky for updating me on the status of the rock movement experiment at the Alan Hills Main Icefield.

3. The 1985–1986 and 1986–1987 Field Seasons

William A. Cassidy

The 1985–1986 Field Season in the Allan Hills Region and Reckling Peak

Four members of the 1985–1986 Antarctic Search for Meteorites (ANSMET) field party went to the Allan Hills, a proven source of meteorites in Southern Victoria Land, and also made an exploratory trip to Reckling Peak: J. Schutt (University of Pittsburgh), Ludolph Schultz (Max Planck Institute, Mainz, Federal Republic of Germany), Michael Zolensky (NASA/Johnson Space Center), and Ernst Zinner (Washington University). The geography of this area, and ANSMET expeditions to it, have been described in detail previously (e.g., Cassidy, 1989), so only a summary of the results during the 1986–1986 season are presented here.

Starting in 1976 the Allan Hills yielded meteorites in 10 consecutive austral summers, and by the start of the 1985–1986 field season only about 40% of the available blue ice area in the Far Western Icefield remained to be systematically searched. This was done over the course of approximately 6 weeks from 7 December 1985 on, during which over 140 meteorites were recovered. A reconnaissance visit to another nearby small icefield yielded only one specimen. Two reconnaissance searches for meteorites on blue icefields near Reckling Peak during this season produced no meteorite finds. Finally, at the end of the season, the field party returned to the Allan Hills Main Icefield and during the course of random searches and traverses there 17 more meteorites were recovered.

The 1985–1986 Field Season near Beardmore Glacier

The other four members of the 1985–1986 field party were stationed at Beardmore Camp: Peter Englert (San Jose State University), Twyla Thomas (United States National Museum), Carl Thompson (Methven, New Zealand), and the author. From

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this base we investigated possible occurrences of meteorites near Lewis Cliff, Otway Massif, Grosvenor Mountains, Dominion Range, Geologists Range, and Milan Ridge (Figure 3-1). Only sparse meteorite occurrences were discovered at Otway Massif and other sites in the Grosvenor Mountains. A potentially more productive location lies adjacent to Dominion Range. A few specimens were recovered at Geologists Range and one at Milan Ridge. Many were found on the surface of an ice tongue immediately to the east of Lewis Cliff; this area was exceptionally productive.

On December 11 we made a 69-mile round trip on snowmobiles out of Beardmore Camp and discovered our first meteorites: 5 specimens lying on ice about one kilometer east of the ice tongue below Lewis Cliff. We returned to this site, and to the ice tongue itself, three times between December 12 and December 16 and collected 13 additional specimens.

On December 20, we were put in by helicopter at Otway Massif, where we occupied the site called Camp 1 (Figures 3-1 and 3-2). GRO85203 (Figure 3-2) marks a site where we left at least 20 large and small meteorite fragments undisturbed on the ice. They all appeared to belong to the same fall. If we had collected them the total mass would have added unduly to the cargo we had to transport.

On December 23, we abandoned Camp 1 and made the 36-mile traverse to Camp 2, near Mt. Raymond (Figure 3-3). This picturesque campsite is located in a shallow, somewhat protected valley between rounded, dunelike snow masses. We remained at Camp 2 from December 23 to December 28.

On December 28 we traversed 40 miles to Camp 3, above the Scott Icefalls (Figures 3-1 and 3-4), where a large area of exposed ice between our camp and the Icefalls is visible on aerial photos. The ice, unfortunately, was covered by a thin layer of snow. Little searching was done because of the snow cover and semi-whiteout conditions; moreover, crevasses are common in this area and some were difficult to identify under the existing conditions. Nonetheless, we found four specimens

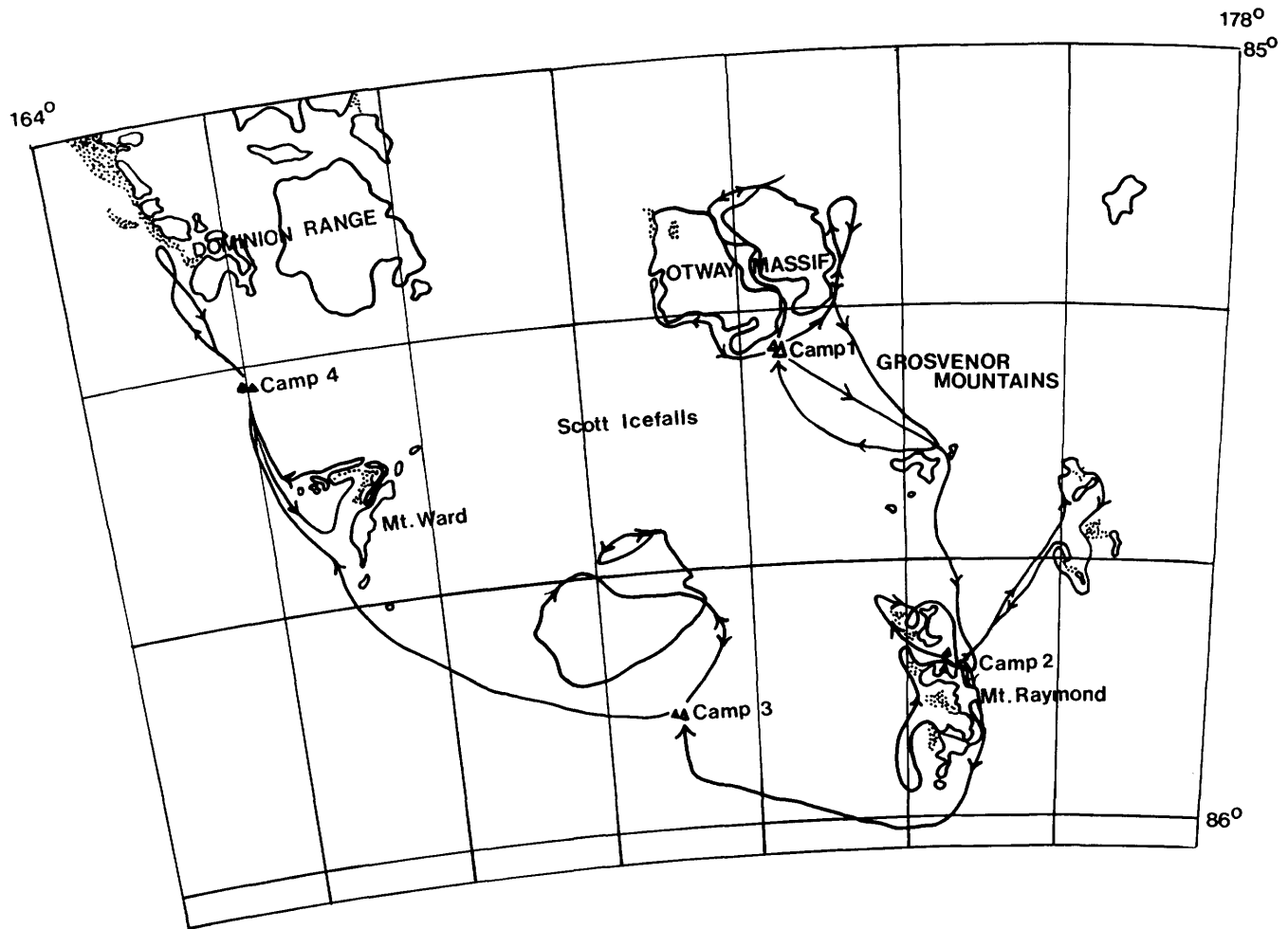


FIGURE 3-1.—Map showing locations in the vicinity of Dominion Range and the Grosvenor Mountains that were visited during the 1985-1986 field season.

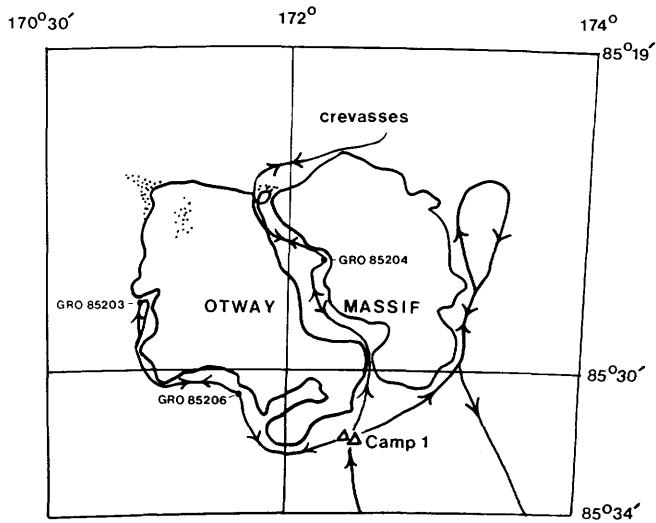


FIGURE 3-2.—Enlarged map of the region around Otway Massif. Meteorite recovery locations at Otway Massif, Mt. Raymond (Figure 3-3), and south of Scott Icefalls (Figure 3-4) are labelled GRO (for Grosvenor Mountains).

(shown on Figure 3-4). We plan to return to this site in the future in the hope of finding the ice swept clean.

On December 31 we made the traverse to Camp 4 (Figure 3-5), a 52-mile trip, and remained there until January 4. Our reconnaissance searches and recoveries are detailed in Figures 3-4 and 3-5. We were picked up by helicopter at Camp 4 on January 4 and returned to the Beardmore Camp.

The period between December 20 and January 4 was notable for the large proportion of fresh-appearing meteorites that we collected. Many had fusion crusts intact or nearly so. Many were larger than those we had been accustomed to finding. It will be interesting to determine whether or not these individuals have younger-than-average terrestrial ages.

On January 7 we established a new base of operations near Coalsack Bluff at the site of the old "Hard Times" camp, where paleontologists processed the first vertebrate fossils found in Antarctica. The fossil site was discovered in November, 1969, and the camp was occupied during that summer. Traces of the old camp remain: the generator shack was full of snow to its roof but had a wind scoop on two sides; a number of double

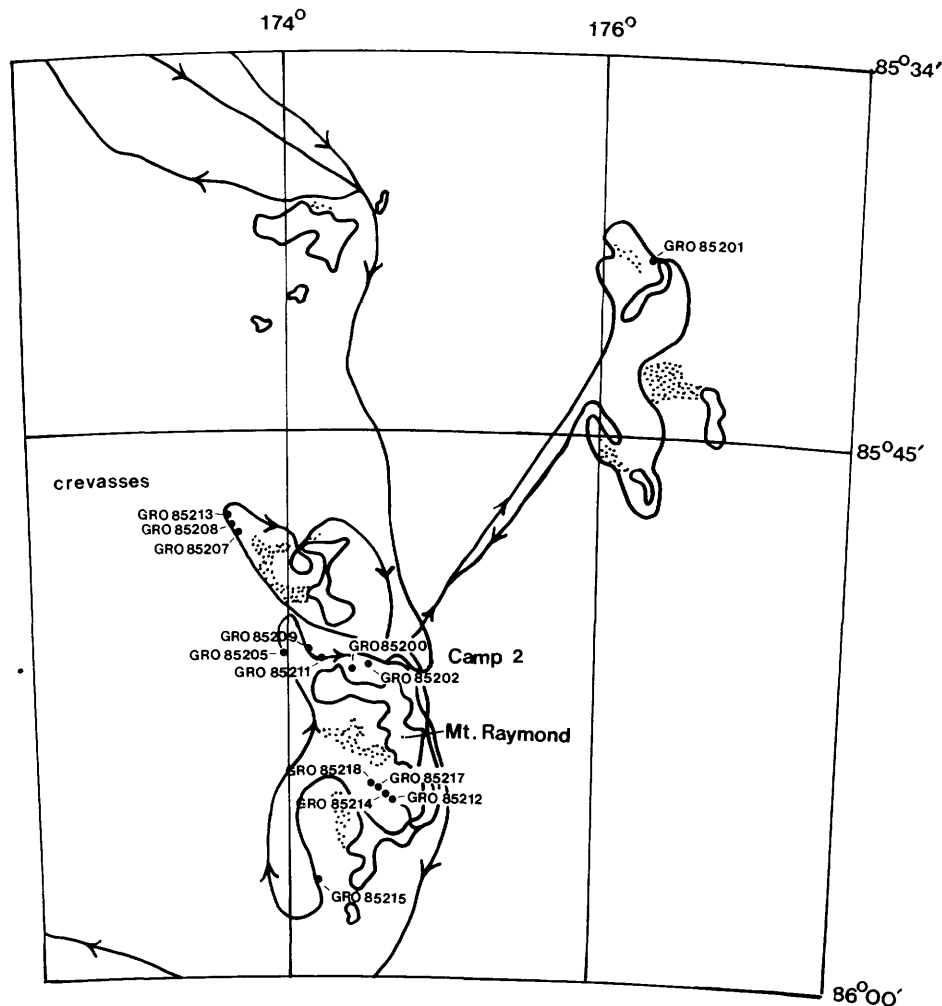


FIGURE 3-3.—Map of the Mt. Raymond area of the Grosvenor Mountains.

two-by-fours, nailed together and sticking up out of the snow, still had electrical wiring stapled to them; and the tops of 55-gallon drums were exposed at the current snow surface. Large cans of mandarin oranges and grated cheese had been left in a cache, and were still edible. This is a convenient campsite, because when storms threaten a party can quickly drive the 28 miles to the Beardmore Camp which never seems to have bad weather in the summer. Throughout that season the heavy windstorms stopped north of Mt. Sirius.

We used a scheduled helicopter flight on January 12 to make a reconnaissance survey along the Ice Plateau/Transantarctic Mountains boundary line, as far north as the Geologists Range. Meteorites associated with this site have the symbol GEO on the map (Figure 3-6). We found three specimens on a small ice patch west of Mt. Summerson, and collected two of them in a 20 mph wind with blowing snow. We later recovered one fragment on the ice above the valley next to Milan Ridge (symbol MIL, for Miller Range; Figure 3-7).

On January 16 a four-person party from the U.S. Geological

Survey, led by Gary Parasso, arrived at the Lewis Cliff Ice Tongue from the Beardmore Camp and established a baseline for us. They put in two stations on rocky hilltops that describe a line running approximately north-south, parallel to the eastern side of the upper part of the ice tongue. All mapping of this area will be done with reference to these two points.

We systematically searched the entire upper level of the ice tongue, collecting numerous specimens and mapping their locations. Recovered specimens at the Lewis Cliff site were typically small, with very few completely fusion-encrusted individuals. Many of the specimens were severely weathered, which made it difficult to distinguish them from the ferruginous Ferrar dolerites that are scattered liberally across the ice surface. Weathered coal fragments and pieces of grey shaly sandstone, both common on the ice surface, presented additional difficulties because they tend to resemble carbonaceous chondrites. These terrestrial rocks made systematic searching highly tedious and added pleasure to the rare discovery of an exceptionally large meteorite specimen. Two

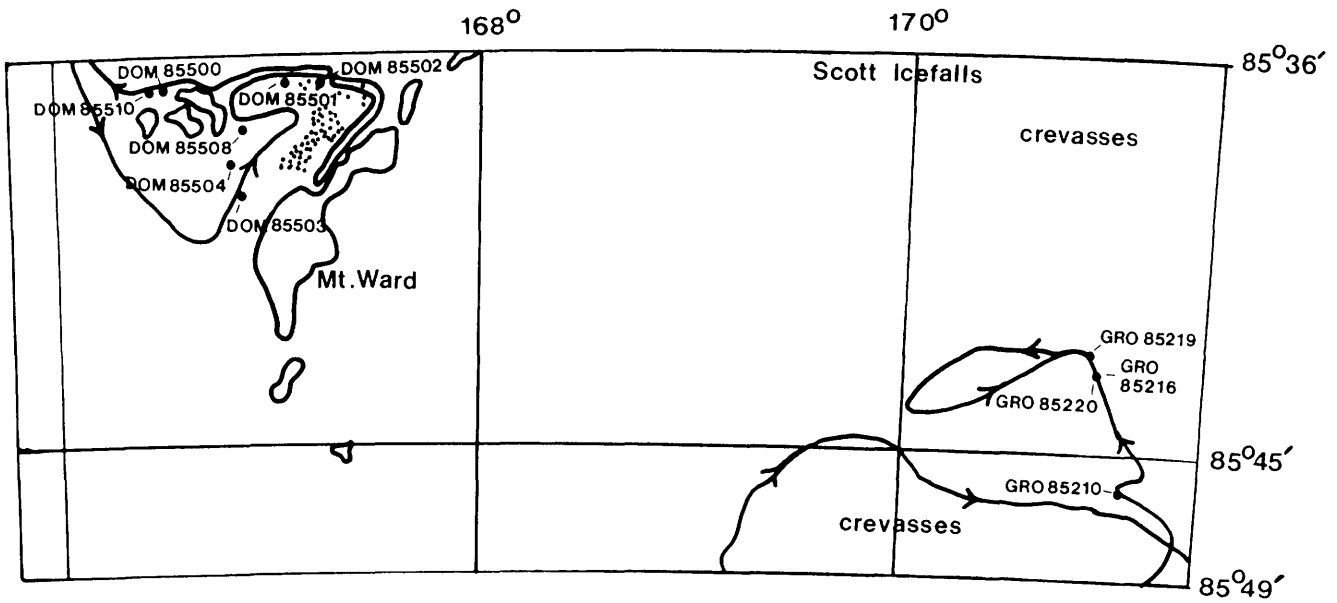


FIGURE 3-4.—Map of the region near Camp 3 where four meteorites were found. At upper left is the Mt. Ward area, where a number of meteorites were found during the traverse to Camp 4.

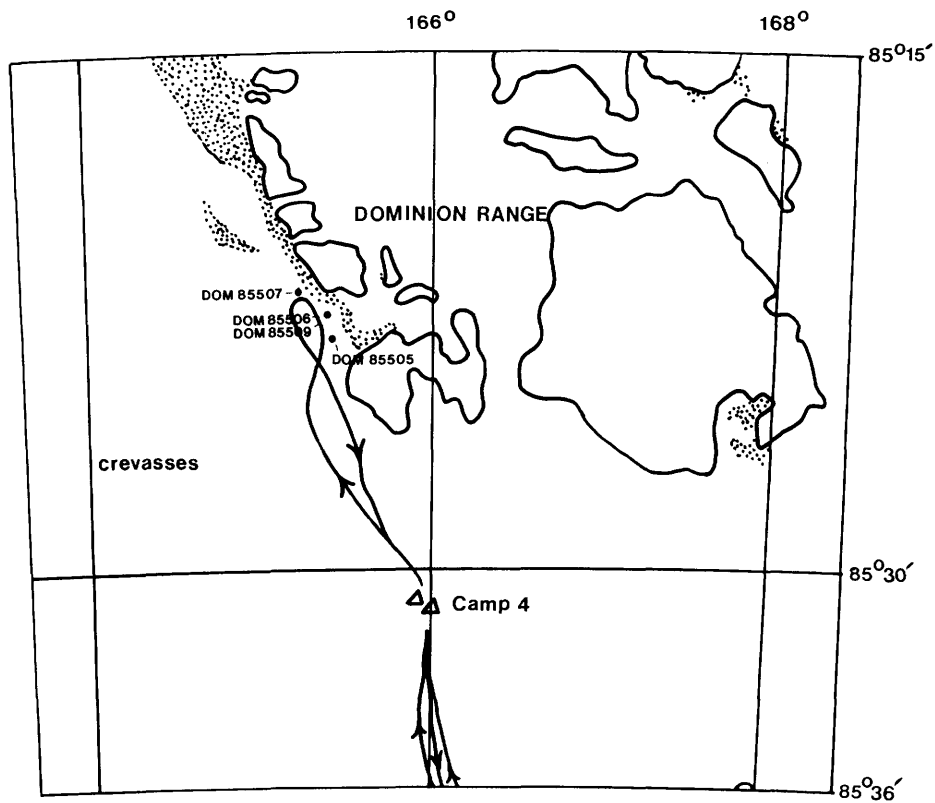


FIGURE 3-5.—Map of the Dominion Range (DOM) in the vicinity of Camp 4.

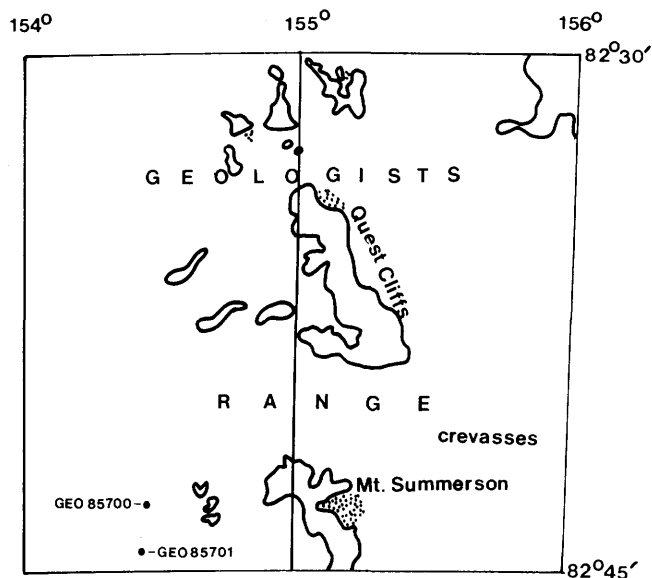


FIGURE 3-6.—Map of the Geologists Range where two meteorites (GEO) were recovered during a reconnaissance survey in the 1985–1986 field season.

such finds were LEW85320 (110 kg) and LEW85319 (11 kg), both H5 chondrites found on the slope between the upper level and the lower level of the ice tongue. These specimens may represent a paired fall.

The meteorite specimens on the upper ice tongue are very heterogeneously distributed. They occupy a narrow zone at the southern (upstream) end and a much wider zone at the northern end, just above the slope down to the lower level. These distributions are real, and the boundary between the zones is sharp, but the cause is not obvious.

A symmetrically patterned suite of ice samples was collected for $\delta^{18}\text{O}$ determinations by Peter Englert. Unfortunately, the samples were lost in transit to, or at, McMurdo Station.

In summary, the 1985–1986 field season was very successful and the Lewis Cliff Ice Tongue was established as a major new source of Antarctic meteorites.

The 1986–1987 Field Season

Members of the 1986–1987 party were Christian Koeberl (University of Vienna), Louis Lindner (National Institute for Nuclear Physics and High Energy Physics, Amsterdam), Austin Mardon (Texas A&M University), John Schutt (University of Pittsburgh), Keizo Yanai (National Institute of Polar Research, Tokyo), and the author. The entire field season was

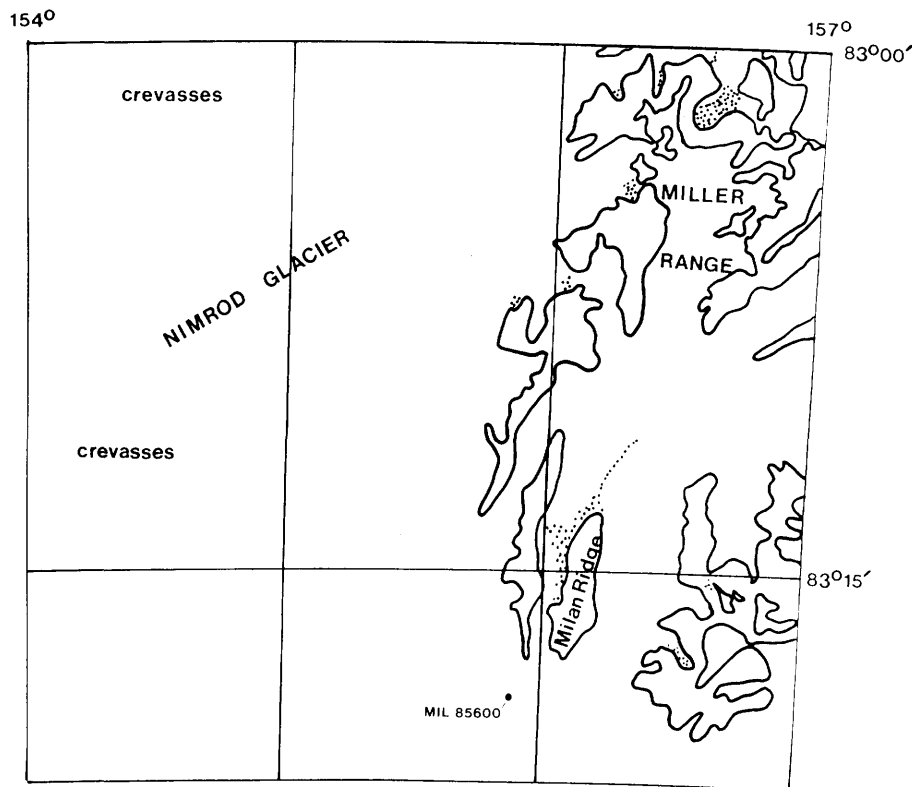


FIGURE 3-7.—Map of the Miller Range (MIL), showing the location where a meteorite was found near Milan Ridge during the 1985–1986 field season.

spent at the Lewis Cliff Ice Tongue because of the importance of this newly discovered stranding surface. We were in the field from December 6 to January 21. We concentrated mainly on foot searches in the southern part of the lower ice tongue, just below the step, where relatively high densities of small meteorite fragments were found. We collected and mapped all of our finds.

We also began finding meteorites along the southern edge of an extensive moraine that lies east of the ice tongue. Fragments occurred among the rocks as far as 20 meters into the moraine, making the search procedure particularly difficult; this was the first time any of us had had to search on our hands and knees. Most of the specimens we collected are weathered fragments of ordinary chondrites with minor patches of fusion crust; most of them probably are paired. We named this area Meteorite Moraine.

Ordinary chondrites dominate the accumulations on the lower ice tongue as well as in Meteorite Moraine. Interesting distributions of specimens with differing thermoluminescence properties are described by Hasan et al. (Article 7).

We carried out an ice sampling program in which we duplicated Englert's pattern of the previous season and also sampled at 10-meter intervals along a line crossing the boundary of the meteorite distribution field on the upper ice tongue. On a reconnaissance survey we discovered a significant accumulation of meteorites on exposed ice around Goodwin Nunataks, about 50 kilometers south (i.e., upstream) of the Lewis Cliff Ice Tongue. That accumulation was left in place for a future field season when we can put in a camp nearby.

The total number of probable meteorite specimens from Lewis Cliff Ice Tongue and Meteorite Moraine is now over 700.

Stratigraphic Features at the Lewis Cliff Ice Tongue

Lewis Cliff Ice Tongue is a promising site for establishing an ice-stratigraphic series that would provide a new reference framework within which to evaluate the observed distribution of meteorites on the stranding surface. The main time markers are dust bands composed of volcanic ash that dip into the ice. It appears that an essentially horizontal series of tephra deposits have been tilted and exposed at the surface by wind ablation. We have been mapping and sampling these bands.

Other interesting features at the ice tongue are bed-load dust bands and regelated ice. Ice at the bed of a glacier or moving ice sheet can be melted for short periods and refrozen. The melted stage lasts long enough for extensive, but not complete, degassing to occur. As a result, the regelated (recrystallized) ice is mostly bubble-free; the remaining bubbles often form linear trains suggestive of streaming. Dust and rocks, the latter often rounded and glacially striated, can be entrained in regelated ice and carried slowly downstream parallel to the bed of the glacier. If the ice reaches a barrier it may buckle or shear, and in either case regelated ice, with its load of sediment, then can be thrust to the surface. If only the finer particles reach the

surface, they form dust bands composed of basal rock detritus instead of tephra. If larger rocks are brought to a surface where ablation is taking place, a mass of unsorted glacial debris soon litters the ice on either side of the dust band. This sedimentary cover effectively slows the ablation process and the result, after a period of time, is an ice ridge strewn with a thin veneer of boulders and cobbles with a planar core of glacial debris. This is a so-called ice-core moraine. Ice-core moraines are structural features that can yield stratigraphic information because they preserve a record of forces that have acted to distort the original simple stratigraphic sequence.

Much less well understood at the Lewis Cliff Ice Tongue are bands of evaporite-type mineral deposits that apparently extend in a planar array along levels stratigraphically higher than the interface between regelated ice and unmelted ice. They seem to be parallel and close to this boundary, but detached from it. They may be related to the regelation process but the nature of this relation is not clear. In any case, although they may not represent time horizons, the evaporite deposits probably give stratigraphic data, at least over the short range.

With the available stratigraphic and structural clues at the Lewis Cliff Ice Tongue, it should be possible to establish a relative stratigraphic sequence across the meteorite stranding surface. If we then can determine absolute ages for some of the marker horizons we will have what amounts to an ice core laid out horizontally at the surface. Such an expanse of ice, where dated dust bands can be mapped in context with distributions of meteorite terrestrial ages, will provide an excellent testing ground for the different models of the meteorite stranding mechanism.

ACKNOWLEDGMENTS.—During the 1986–1987 field season, Gunter Faure of Ohio State University led a party to the Allan Hills, Reckling Moraine, and Elephant Moraine, principally to study moraines associated with meteorite stranding surfaces. During the course of their field work, they came across 22 meteorites (plus 2 possible meteorites), collected them in a careful manner, and turned them over to our group at the end of the season. We are very grateful for this action on their part. Members of their group were G. Faure, D. Buchanan, E. Hagen, and M. Strobel.

We also acknowledge with thanks the efforts of the U.S.G.S. group that surveyed our mapping baseline. The members of that field team were G. Parasso, E. Eckel, M. Hower, and G. Sandul. We are indebted to all the dedicated professionals listed above. This work was supported by NSF Grant DPP 83-14496.

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4. Descriptions of Stony Meteorites

Brian Mason, Glenn J. MacPherson, Roberta Score, Rene Martinez, Cecilia Satterwhite, Carol Schwarz, and James L. Gooding

This article gives descriptions of the achondrites, mesosiderites, and the more unusual chondrites (unique, carbonaceous, enstatite, and type 3 ordinary chondrites) collected during the 1984–1985, 1985–1986, and 1986–1987 field seasons. Summary data for the other ordinary chondrites are included in the Appendix. Within the carbonaceous and enstatite chondrites, the specimens are grouped according to the Van Schmus-Wood (1967) classification, and the descriptions follow the order of increasing petrographic type. The descriptions are based largely on those published in the *Antarctic Meteorite Newsletter*, with additional information as available. The letter-number designation concurs with the guidelines recommended by the Committee on Nomenclature of the Meteoritical Society, and carries the following information: location, e.g., ALH, Allan Hills; field season, e.g., 84, 1984–1985 field season; xxx, digits indicating sequential number of the specimen. The original weight of the specimen is given to the nearest 0.1 gram.

Chondrites

UNCLASSIFIED OR UNIQUE

FIGURES 4-1, 4-2, 4-3

ALH85085 (11.9 g).—This small stone is entirely covered with an iridescent brown fusion crust. The interior is black with abundant small (~1 mm) white inclusions. Some oxidation is present.

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Detailed petrographic studies of this unusual meteorite have been published by Scott (1988), Weisberg et al. (1988), and Grossman et al. (1988); the following description is taken from these three papers. ALH85085 consists of ~5%–10% chondrules (mostly of the radial pyroxene and cryptocrystalline varieties), ~5% dark lithic clasts, 20%–23% metal, and ~60%–70% silicate fragments. There is little or no true matrix. Electron microscope examination reveals the presence of numerous (100 or more per thin section) but tiny (<120 μm) and volumetrically-minor refractory inclusions. Weisberg et al. (1988) and Scott (1988) found rare grains of osbornite (TiN). Silicate phases in chondrules and fragments are very iron poor: the olivine composition is Fa_{0-40} , with most Fa_{0-5} and only rare grains as Fe-rich as Fa_{50} ; low calcium pyroxene is Fs_{0-25} . Many lithic clasts appear to be C1 fragments or C2 matrix lumps rich in sulfide, magnetite framboids, platelets and spheroids, and a presumably hydrous matrix that gives low microprobe analysis totals; also present are “reduced” clasts that are rich in tiny metal grains.

Estimates of bulk composition from broad- or rastered-beam electron microprobe analyses show that ALH85085 has roughly chondritic ratios of refractory lithophile elements, is greatly depleted in volatile elements such as Na, Mn, and S, and is greatly enriched in siderophile elements such as Fe and Ni. Grossman et al. (1988) and Weisberg et al. (1988) note that ALH85085 has close affinities with the Renazzo-type carbonaceous chondrites, although only the former authors advocate classifying it as such; Weisberg et al. (1988) and Scott (1988) regard ALH85085 as a new variety of chondrite. The oxygen isotope composition of bulk ALH85085 (Clayton and Mayeda, 1988) is similar to those of bulk Renazzo and Al Rais. Wasson and Kallemeyn (1990) give trace and minor element data for

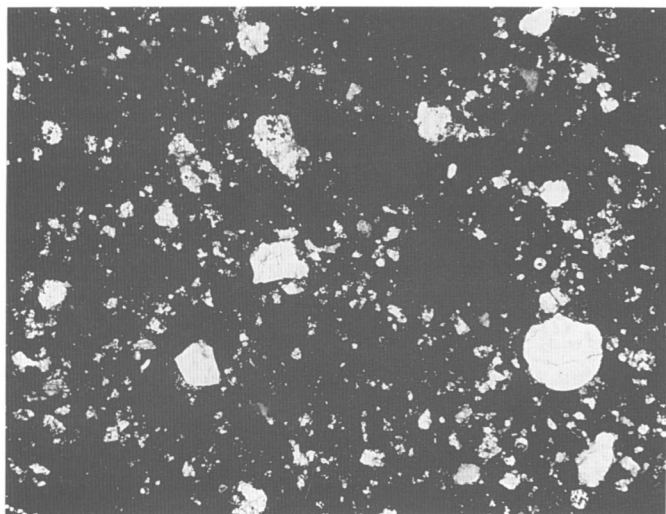


FIGURE 4-1.—Photomicrograph of the unique chondrite ALH85085. Microchondrules, chondrule fragments, and mineral grains are the main features visible in this photo. The largest chondrule is cryptocrystalline; the largest fragment is a piece of a porphyritic chondrule. The dark background is not matrix but, rather, abundant metal plus underexposed silicate grains. Width of field is 1.1 mm.

ALH85085 and argue that it is not a true chondrite at all but, rather, predominantly the product of an impact ejecta cloud. Grady and Pillinger (1989) found ALH85085 to have the highest enrichment of ^{15}N ever measured in any whole-rock meteorite.

ALH85151 (13.9 g).—Traces of dull black fusion crust remain on an exterior surface that is otherwise dull brownish-gray and heavily pitted; clasts and inclusions are present in relief. One notable clast is black with small white inclusions.

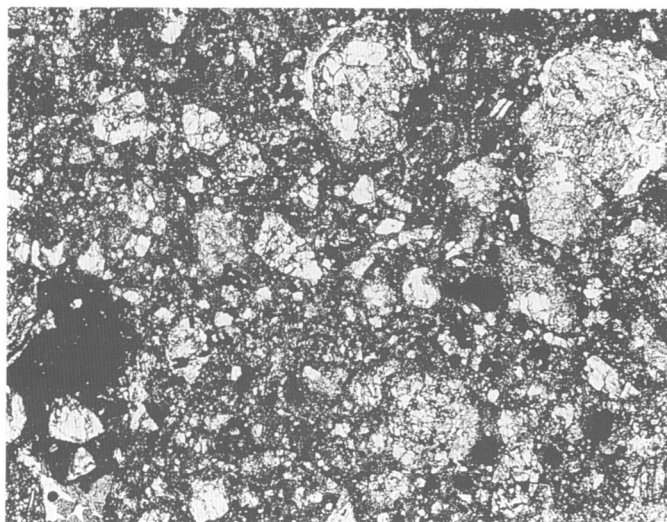


FIGURE 4-2.—Photomicrograph of the chondrite ALH85151. A mixture of chondrules, chondrule fragments, dark clasts, and mineral grains are dispersed throughout the dark matrix. Opaque grains are almost exclusively sulfide, with sparse chromite; metal is absent. Width of field is 2.3 mm.

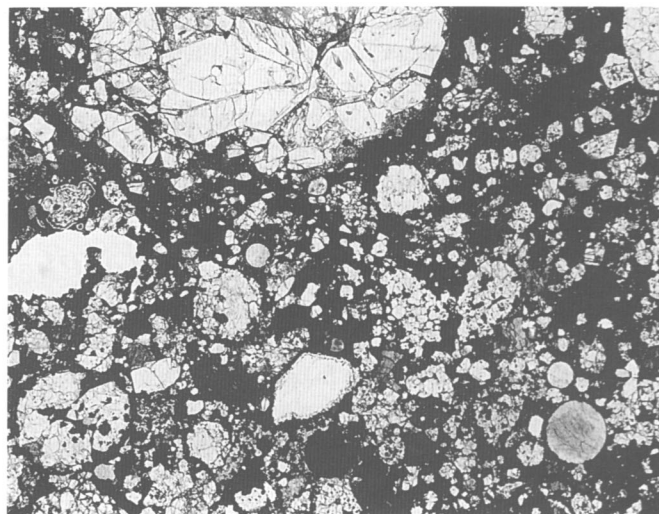


FIGURE 4-3.—Photomicrograph of the unique chondrite LEW85332. Abundant chondrules of a wide range of sizes, chondrule fragments, iron-nickel metal, sulfide, and mineral grains are scattered in the darker matrix. The tiny chondrule at lower left center is roughly 80 μm in diameter. At left is a small, irregularly-shaped, rimmed, hibonite-bearing refractory inclusion. Width of field is 2.3 mm.

The interior is medium-gray with white inclusions; oxidation is extensive in some areas. A thin section shows numerous chondrules (up to 1.2 mm across) and chondrule fragments in a fine-grained matrix. Most of the chondrules consist mainly of porphyritic and barred olivine; pyroxene is rare. Minor amounts of nickel-iron and sulfide are present, mainly as very small grains scattered through the matrix. Microprobe analyses give the following compositions: olivine, $\text{Fa}_{0.4-41}$, with a mean of Fa_{34} ; pyroxene, Fs_{6-30} .

Weisberg et al. (1989) report oxygen isotope data for ALH85151 that show it belongs to a previously unknown chondrite group that includes the meteorite Carlisle Lakes. Rubin and Kallemeyn (1989) give detailed petrologic and bulk chemical data that also demonstrate the unusual nature of this chondrite; those authors note the similarity of ALH85151 to Carlisle Lakes and, possibly, Y-75302.

LEW85332 (113.7 g).—Dark fusion crust covers all but one surface of this meteorite. The interior has a dark gray fine-grained matrix with a few light-colored inclusions. A thin section shows an aggregate of small chondrules (up to 1.2 mm across, but most are less than 0.5 mm), chondrule fragments, and irregular granular masses set in a translucent yellow-brown matrix. Chondrules are mainly porphyritic olivine and radial pyroxene/cryptocrystalline. Minor amounts of nickel-iron and sulfide are present, as small grains scattered through the matrix, and locally concentrated around chondrule rims. Including microprobe data from Rubin and Kallemeyn (1990), olivine has a wide composition range, Fa_{2-37} , with a mean of Fa_9 ; less abundant pyroxene has a composition range Fs_{1-30} .

Rubin and Kallemeyn (1990) report petrologic and bulk

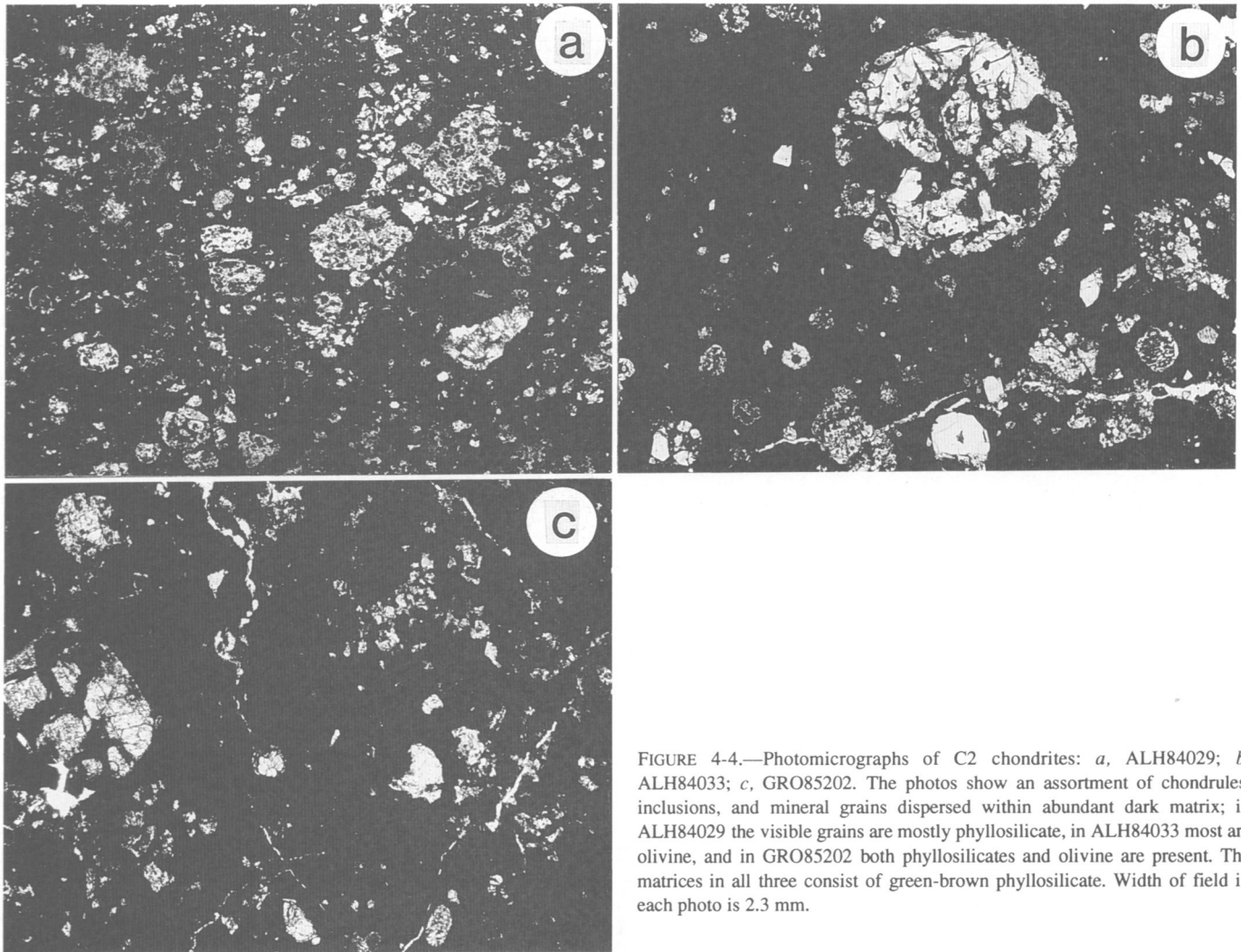


FIGURE 4-4.—Photomicrographs of C2 chondrites: *a*, ALH84029; *b*, ALH84033; *c*, GRO85202. The photos show an assortment of chondrules, inclusions, and mineral grains dispersed within abundant dark matrix; in ALH84029 the visible grains are mostly phyllosilicate, in ALH84033 most are olivine, and in GRO85202 both phyllosilicates and olivine are present. The matrices in all three consist of green-brown phyllosilicate. Width of field in each photo is 2.3 mm.

chemical data for LEW85332 that show it is probably a carbonaceous chondrite of a unique type.

CLASS C2

FIGURE 4-4

ALH84029, 84030, 84031, 84032, 84034, 84035, 84040, 84041, 84042, 84043, 84044, 84045, 84047, 84048, 84049, 84051, 85004, 85012 (total weight 542.5 g).—These are all small fragments, some with fusion crust, the largest of which (ALH84044) weighs 147.4 g. They were found close together on the SE edge of the Allan Hills Far Western Icefield, and this, together with their unique mineralogy (almost entirely phyllosilicate), indicates that they are likely paired (probably also with ALH83100, ALH83102, and ALH83106). The major component is a brown to black phyllosilicate matrix that encloses green to pale brown phyllosilicate pseudomorphs of chondrules, crystals, and inclusions. Calcite is abundant. Sporadic

primary olivine crystals (composition Fa_{0-2}) are preserved, although a few as iron-rich as Fa_{37} were found. Chondrules and inclusions range up to a little over 1 mm in diameter, and are completely altered to phyllosilicates. Chromite, pentlandite, and (?) magnetite are accessory. Gibson (1987) measured carbon abundances in ALH83100 (1.948%) and ALH84029 (1.863%). McSween (1987) determined matrix compositions in ALH83100 and ALH84034 and agreed that they are probably paired.

ALH84033, 84036, 84039, 84046, 84050, 84053, 84054, 84191 (total weight 139.3 g).—These small fragments (the largest, ALH84033, weighs 60.4 g), some with fusion crust, were collected at widely scattered locations on the Allan Hills Far Western Icefield; they are so similar in texture and mineralogy that they are tentatively paired. Unlike the ALH84029 group, these C2 carbonaceous chondrites contain abundant preserved primary phases. Chondrules up to nearly 2 mm in diameter, along with abundant and varied inclusion types, crystals, and crystal fragments, are dispersed in a black

matrix that is reddish brown on thin edges. Olivine is uniformly Fa_{0-2} among the grains analysed. Rare pyroxene is nearly pure $MgSiO_3$. Troilite, pentlandite, nickel-iron, chromite, and (?) magnetite are accessory phases. Many refractory inclusions are present, containing spinel, perovskite, and in a few cases blue-pleochroic hibonite.

Gibson (1987) determined the carbon content in ALH84033 to be 1.671%.

ALH85005, 85007, 85008, 85009, 85010, 85013, 85106 (total weight 326.5 g).—These specimens are very similar in texture and mineralogy and are tentatively paired. Most are fragments, some with fusion crust. The largest, ALH85013, is a completely crusted stone weighing 130.4 g. ALH85008, ALH85009, ALH85010, and ALH85011 were found close together at the NW end of Allan Hills Far Western Icefield. In thin section the meteorites are seen to consist largely of black opaque matrix, through which are scattered small (up to 0.2 mm) mineral grains and sparse chondrules and chondrule fragments. The chondrules and most of the mineral grains consist of olivine, usually close to Mg_2SiO_4 in composition but some are more iron-rich. Pyroxene is less common, and is close to $MgSiO_3$ in composition. A few grains of calcite were noted.

GRO85202 (27.2 g).—Thin fusion crust covers two sides of this stone; it is highly fractured, and disintegrated on chipping. A thin section shows a dark brown to black matrix with numerous mineral grains and aggregates and rare small chondrules. Most of the mineral grains and aggregates consist of an isotropic to weakly birefringent serpentine-like mineral. A few grains of olivine near Mg_2SiO_4 in composition were analysed; some grains of calcite were noted.

LEW85306, 85307, 85309, 85311, 85312 (total weight 293.5 g).—These specimens are very similar in texture and mineral compositions, and are tentatively paired. The largest, LEW85311, weighs 199.5 g. Frothy black fusion crust is present as patches on these stones. A thin evaporite deposit is present on LEW85309. The interiors show abundant light-colored clasts and chondrules set in a black fine-grained matrix. Some reddish-brown oxidation was noted. Thin sections show numerous mineral grains and aggregates and a few small (maximum diameter 0.6 mm) chondrules in a brown to black matrix. Most of the mineral grains are olivine, usually near Mg_2SiO_4 in composition, but some are more iron-rich. Pyroxene is less abundant, and is near $MgSiO_3$ in composition.

LEW86004, 86005, 86007, 86008, 86009 (total weight 20.5 g).—These specimens are so similar that they are tentatively paired. Some fusion crust remains on each of these stones. White evaporite deposit speckles the crust-free surfaces of LEW86005 and LEW86007. A brownish weathering rind extends 1–2 mm into the interior of LEW86004, LEW86008, and LEW86009. Unweathered interior matrix is jet black and contains abundant rounded and irregular inclusions. Thin sections show numerous small colorless grains (mainly olivine), irregular aggregates, and rare chondrules in an opaque to translucent brown matrix. Microprobe analyses of the

olivines show a composition range of Fa_{0-54} with a marked peak at Fa_{0-1} . A few grains of clinoenstatite were analysed, having a composition range of Fs_{0-7} .

CLASS C3

FIGURE 4-5

ALH84028 (735.9 g), 84037 (3.0 g).—These two meteorites are so similar that they can confidently be paired. Bubbly black fusion crust covers about 50% of ALH84028; the interior is gray with numerous 1–2 mm sized lighter inclusions, and shows a few oxidation halos. A thin section shows a variety of chondrules up to about 2 mm in diameter, together with clasts and inclusions up to about 4 mm in maximum dimension, in a pristine matrix consisting of abundant minute olivine plates with composition Fa_{45-50} , troilite, and awaruite. The chondrules are very well preserved, and many contain devitrified glass. The olivine in chondrules, and larger matrix grains, has a wide range of composition, Fa_{0-30} , but most are Fa_{0-10} . Pyroxene grains having a composition close to Wo_1En_{97} were analysed, although a wider range of compositions like that of olivine is presumably present. Fine-grained and “coarse-grained” refractory inclusions are present; one example found is a type A, irregular in shape, that contains gehlenitic melilite, spinel, and very Ti-rich fassaitic pyroxene. This is a C3V carbonaceous chondrite.

ALH85003 (50.1 g).—Thick patchy fusion crust covers approximately 70% of this meteorite. The interior is light gray and chondrules or clasts are not distinguishable in the granular matrix. A 1 mm thick weathering rind and small patches of rust are present. A thin section shows an aggregate of small chondrules (up to 0.9 mm diameter, but most are less than 0.6 mm), chondrule fragments, and irregular aggregates set in a translucent yellow-brown matrix. Chondrules are mainly granular or porphyritic olivine. Minor amounts of nickel-iron are present, as small grains scattered throughout the section. Microprobe analyses of olivine show a wide composition range, Fa_{1-56} , with a mean of Fa_{17} ; only a few grains of pyroxene were found, having a composition range of $Fs_{0.5-23}$. This meteorite is a C3 chondrite of the Ormans subtype; it is possibly paired with ALH82101 (they were found 2.5 km apart at the northern margin of the Allan Hills Far Western Icefield).

ALH85006 (49.0 g).—Fusion crust is present on only one surface of this coherent stone. The interior is made up of chondrules up to 2 mm in diameter and irregular white inclusions up to 3 mm long. A thin section shows a variety of chondrules (up to 2.5 mm across), chondrule fragments, and irregular clasts in a dark brown to black matrix. Fine-grained opaques are dispersed throughout the matrix, and rim some of the chondrules. The matrix consists largely of fine-grained iron-rich (Fa_{45-47}) olivine. Olivine in the chondrules and mineral fragments is usually near Mg_2SiO_4 in composition, but more iron-rich grains are also present. Pyroxene is much less

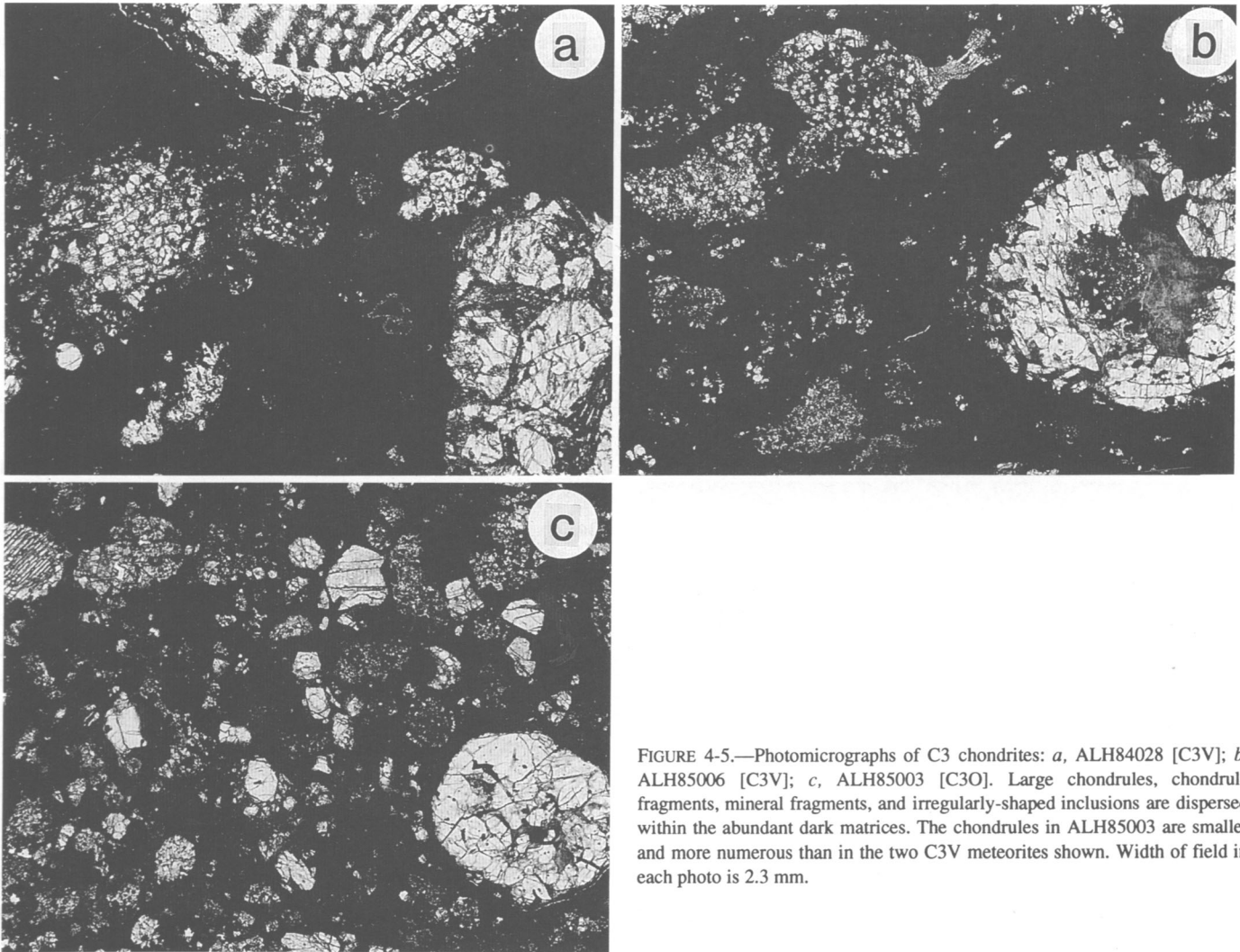


FIGURE 4-5.—Photomicrographs of C3 chondrites: *a*, ALH84028 [C3V]; *b*, ALH85006 [C3V]; *c*, ALH85003 [C3O]. Large chondrules, chondrule fragments, mineral fragments, and irregularly-shaped inclusions are dispersed within the abundant dark matrices. The chondrules in ALH85003 are smaller and more numerous than in the two C3V meteorites shown. Width of field in each photo is 2.3 mm.

abundant than olivine, and is close to MgSiO_3 in composition. The meteorite is a C3V chondrite.

LEW86006 (0.8g).—Forty percent of this small stone is covered with dull black fusion crust; dark gray matrix with some irregular white inclusions makes up the interior. The very small thin section (5×3 mm) shows several chondrules, up to 1.5 mm across, and some irregular granular aggregates in a very fine-grained translucent brown matrix. The chondrules consist mainly of olivine, some with polysynthetically-twinning clinopyroxene. Microprobe analyses give olivine compositions in the range Fa_{0-27} , with a mean of Fa_6 ; pyroxene compositions range from Fs_0 to Fs_5 . The matrix appears to consist largely of fine-grained iron-rich olivine (Fa_{40-50}). The meteorite is tentatively identified as a C3V chondrite.

CLASS C4

FIGURE 4-6

ALH84038 (12.3 g).—This fragment has black to reddish-

brown fusion crust on all but one surface; the interior is dark gray and fine-grained with no features visible. Thin section examination shows the meteorite to consist largely of finely granular olivine (grains up to 0.1 mm) with rare chondrules and chondrule fragments, and a little opaque material. Microprobe analyses, including data from Kallemeyn et al. (1991), give the following compositions: olivine, Fa_{25-30} (one grain was found with a composition of Fa_{39}), with a mean of Fa_{29} ; pyroxene (Fs_{26-28}); and plagioclase (An_{22-82}). The minor element and trace element data of Kallemeyn et al. (1991) support the original proposal that this meteorite might be paired with ALH82135. Kallemeyn et al. (1991) have proposed a new group of carbonaceous chondrites, CK (after Karoonda), within which ALH84038 is classified by them as CK4.

ALH85002 (437.7 g).—Most of the surface is covered with reddish-brown polygonally-fractured fusion crust. The interior is light gray with dark rounded inclusions as large as 1 mm and white irregular inclusions up to 3 mm long. Thin section examination reveals mostly fine-grained olivine (grains up to

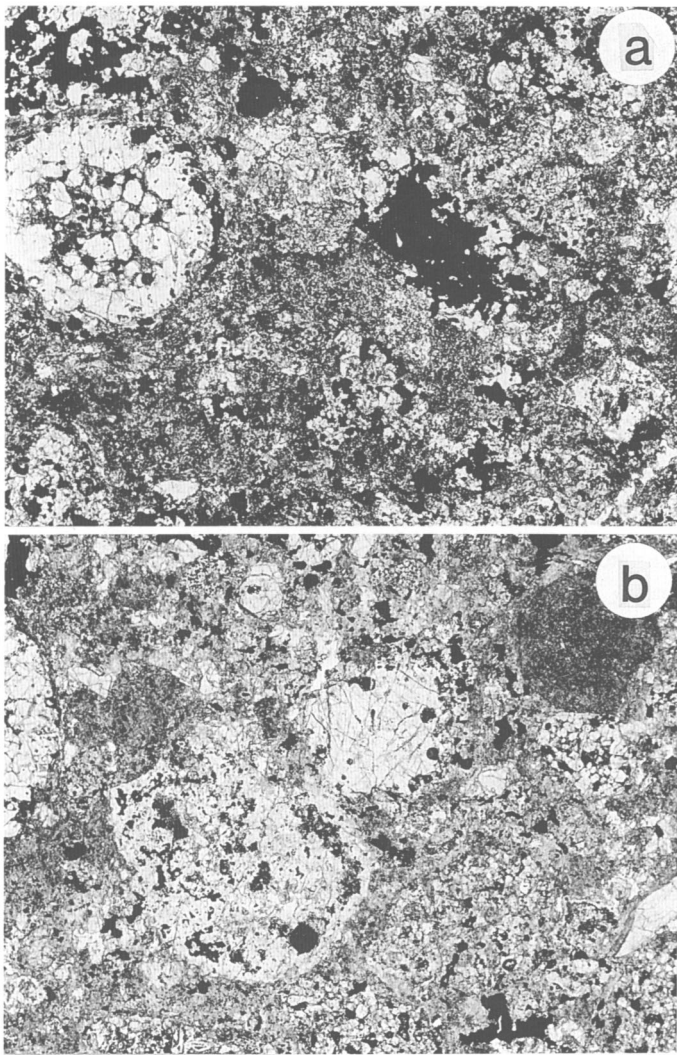


FIGURE 4-6.—Photomicrographs of C4 chondrites: *a*, ALH85002. Chondrules, chondrule fragments, magnetite, and sulfide are dispersed in the granular olivine-rich matrix. *b*, LEW86258. Chondrules, chondrule fragments, mineral grains, and some small irregular inclusions are visible in the granular olivine-rich matrix. Width of field in each photo is 2.3 mm.

0.1 mm), with a little pyroxene, plagioclase, and opaques (largely magnetite). A few chondrules, made up of coarser-grained olivine, are present. Microprobe analyses, including data from Kallemeyn et al. (1991), give the following compositions: olivine, Fa_{30} ; pyroxene, Fs_{23-29} ; plagioclase, An_{30-66} . Kallemeyn et al. (1991) give trace and minor element data for ALH85002, and they classify it as CK4.

LEW86258 (24.1 g).—This stone is gray and friable with black chondrules protruding from weathered surfaces; about 40% of the surface is covered with polygonally-fractured black fusion crust. A thin section shows a few chondrules in a matrix consisting largely of fine-grained olivine (grains up to 0.1 mm), with a little pyroxene, plagioclase, and opaques (almost entirely magnetite, with a little nickel-iron). Most chondrules are about

1 mm in diameter and consist of granular olivine; one large (2.5 mm) chondrule was found that consists of radiating plagioclase laths up to 0.8 mm long in a matrix of granular olivine and diopside. Microprobe analyses, including data from Kallemeyn et al. (1991), give the following compositions: olivine, Fa_{32} ; low-Ca pyroxene, Fs_{26} ; diopside, $Wo_{42}Fs_5$ with 4.8% Al_2O_3 , 1.9% TiO_2 ; plagioclase, An_{31-83} . Kallemeyn et al. (1991) give trace and minor element data for LEW86258, and they classify it as probable type CK4 (weathered).

ENSTATITE CHONDRITES

FIGURE 4-7

ALH84170 (39.2 g).—Fifty percent of this fragment is covered by extremely weathered fusion crust; the interior has a black matrix with numerous white to gray rounded and irregular inclusions. Seen in thin section, chondrules (0.3–2 mm) are abundant and consist of radiating or granular pyroxene, some with olivine. The matrix is made up of chondrule fragments and mineral grains, with a considerable amount of opaques (nickel-iron and sulfides). Weathering is extensive, with brown limonitic staining throughout. Microprobe analyses show many grains of olivine and pyroxene close to Mg_2SiO_4 and $MgSiO_3$ in composition, but some contain a considerable amount of iron. The nickel-iron contains 2.2%–3.0% Si. This meteorite is classified as type EH3.

ALH84188, 84200, 84206, 84220, 84235, 84250, 84254, 85159 (total weight 64.1 g).—Most of these small fragments, some of which are extremely weathered, were collected in a limited area of the Allan Hills Near Western Icefield. In thin section the chondrules and chondrule fragments are abundant but mostly small (ranging up to 0.6 mm across with only a few larger ones); they consist of fine-grained to coarsely granular pyroxene. The matrix consists of small pyroxene grains and opaques (mostly nickel-iron with some sulfides). Weathering is indicated by brown limonitic staining throughout the sections. Microprobe analyses give the following pyroxene compositions: $Fs_{0.6-4}$, with a mean of $Fs_{1.8}$. The nickel-iron contains 2.3% Si. These fragments are classified as type E4.

ALH85119 (20.6 g).—This stone, found near the NW end of the Allan Hills Far Western Icefield, is completely covered with frothy black fusion crust; evaporite deposit is present underneath the fusion crust in some areas. The interior is charcoal gray with dark chondrules; oxidation is extensive in some areas. A thin section shows a compact aggregate of chondrules, chondrule fragments, and irregular clasts up to 3 mm across, together with about 25% nickel-iron in grains up to 1.5 mm and minor troilite. A blue ~isotropic phase—possibly ringwoodite—is present as isolated sporadic grains in the matrix and as an interstitial phase (replacing glass?) within a few chondrules. Pyroxene is the predominant silicate; minor olivine occurs as small grains poikilolithically enclosed in pyroxene. Many of the pyroxene crystals are clouded with very

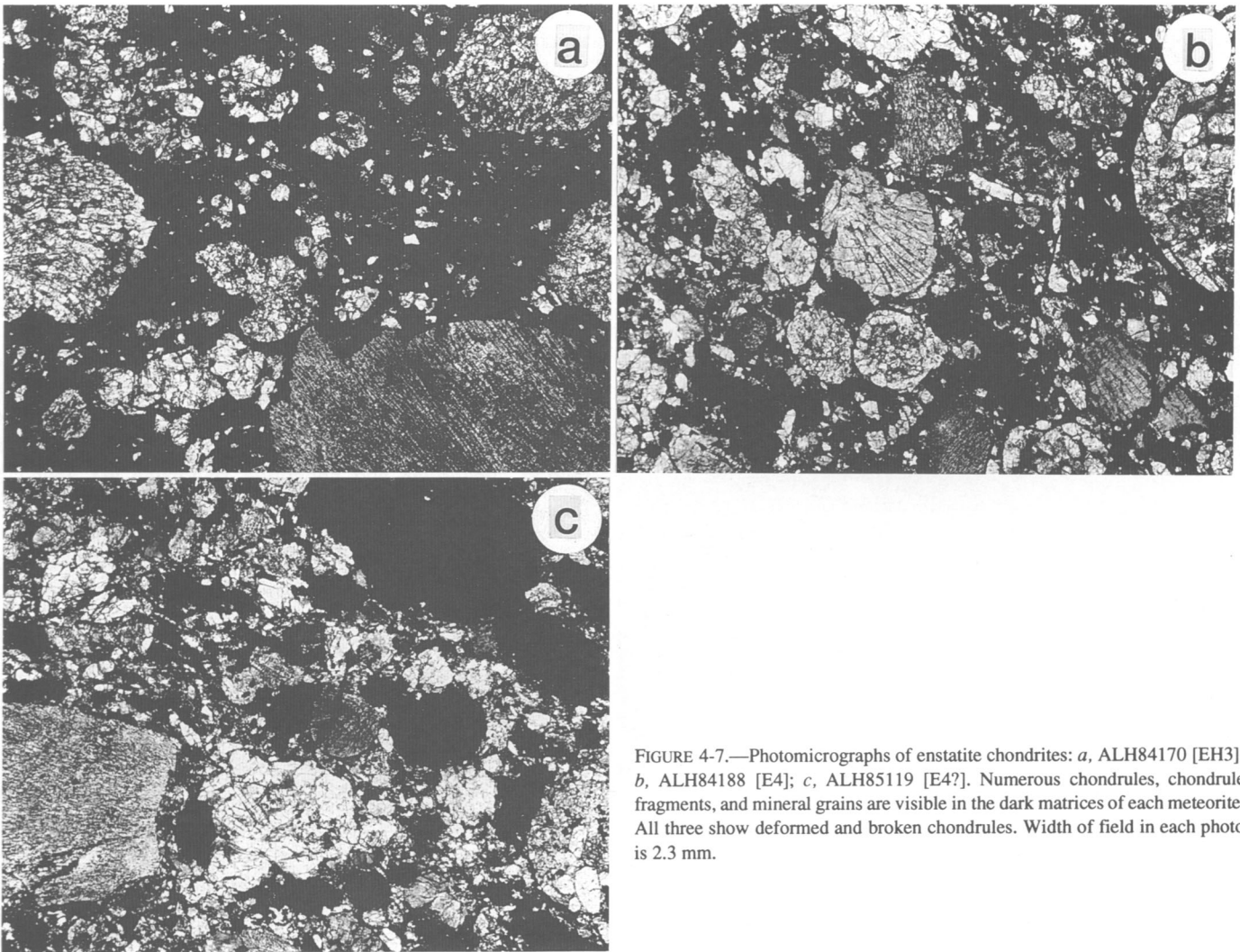


FIGURE 4-7.—Photomicrographs of enstatite chondrites: *a*, ALH84170 [EH3]; *b*, ALH84188 [E4]; *c*, ALH85119 [E4?]. Numerous chondrules, chondrule fragments, and mineral grains are visible in the dark matrices of each meteorite. All three show deformed and broken chondrules. Width of field in each photo is 2.3 mm.

fine-grained opaque material; in addition, many pyroxenes are intensely deformed and even granulated, suggesting—taken together with a clear directional fabric visible in the section and the possible presence of ringwoodite—that this meteorite has been severely shocked. Coarsely crystalline graphite occurs within some metal grains. Pyroxene compositions are $Fs_{0.3-12}$, mean $Fs_{2.4}$. The nickel-iron contains 0.4%–0.6% Si. This meteorite has been tentatively classified as an E4 chondrite in the *Antarctic Meteorite Newsletter*, but the silicon content of the metal is low for EH.

CLASS H3

FIGURE 4-8

ALH85121 (55.3 g).—Frothy brown and black fusion crust covers the top surface of the “mushroom cap” shaped stone, and thick (2 mm) viscous ropy fusion crust covers the lower (B) surface. The interior is moderately to heavily weathered, with a

weathering rind up to 5 mm thick; numerous clasts and chondrules are present. A thin section shows abundant chondrules and chondrule fragments up to 3 mm across, in a matrix of fine-grained olivine and pyroxene with moderate amounts of nickel-iron and troilite (locally rimming chondrules). Chondrule types include granular and porphyritic olivine and olivine-pyroxene, and radiating or cryptocrystalline pyroxene. Weathering is extensive, with limonitic staining and small areas of red-brown limonite throughout. Microprobe analyses show olivine and pyroxene with a considerable range in composition: olivine, Fa_{9-20} (the coefficient of variation, c.v., for FeO is 16); pyroxene, Fs_{3-31} . The meteorite is classified as an H3 chondrite (estimated H3.8).

LEW85383 (18.5 g).—This angular stone is completely covered with polished black fusion crust. The interior is heavily oxidized, masking any structure present. The section shows abundant chondrules and chondrule fragments, up to 1.5 mm across, in a minor amount of finely granular matrix containing considerable nickel-iron and lesser troilite. A variety of

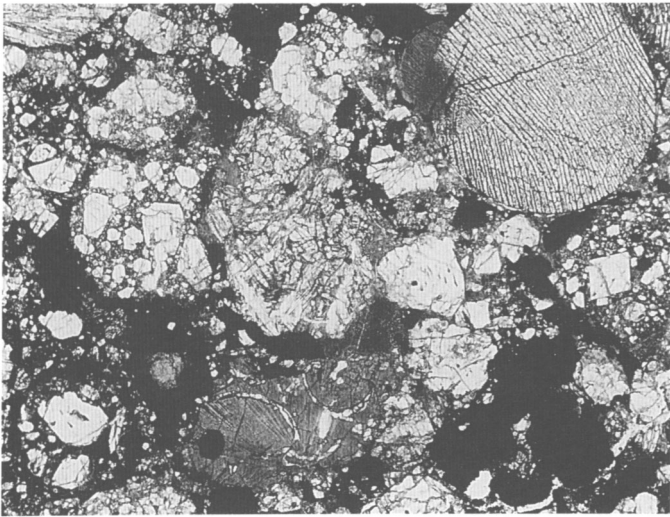


FIGURE 4-8.—Photomicrograph of the H3 chondrite ALH85121. Chondrules, chondrule fragments, and mineral grains are visible in a dark matrix. Part of the "matrix" is in fact dark limonite staining. Width of field is 2.3 mm.

chondrule types is present, mostly porphyritic and granular olivine and olivine-pyroxene, but some cryptocrystalline and radiating pyroxene chondrules also occur. Weathering is extensive, with brown limonitic staining throughout the section. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{6-23} with a mean of Fa_{17} (c.v. FeO is 26); pyroxene, Fs_{2-18} . The meteorite is classified as an H3 chondrite (estimated H3.7).

LEW86102 (21.8g), 86105 (6.4 g).—Shiny smooth brown/black fusion crust completely covers both of these specimens. The interiors consist of black matrix with abundant small weathered chondrules. Oxidation is scattered throughout the interiors with LEW86105 being the more weathered of the two samples.

Thin section examination shows that the two specimens are very similar and probably paired. Chondrules and chondrule fragments are abundant, ranging up to 2.1 mm across; most are porphyritic or granular olivine and olivine-pyroxene, but a few radiating or cryptocrystalline pyroxene chondrules were noted. They are surrounded by a dark finely granular groundmass containing some metal and a little sulfide, often as rims to chondrules; the metal is extensively altered to limonite. Microprobe analyses show olivine and pyroxene of highly variable composition; olivine, Fa_{1-50} (c.v. FeO is 70); pyroxene, Fs_{1-41} . The meteorites are classified as H3 chondrites (estimated H3.3).

CLASS L3

FIGURE 4-9

ALH84120 (129.0 g), 85045 (145.0 g).—Thirty percent of ALH84120 is covered with fusion crust; fractured brown fusion crust covers most of ALH85045. The interiors of these

unequilibrated chondrites are light to medium gray and show abundant chondrules (up to 3 mm across) and irregular inclusions. Sections show an aggregate of chondrules (0.3–2.4 mm across) and chondrule fragments in a fine-grained matrix of olivine and pyroxene with minor amounts of nickel-iron and troilite. A variety of chondrule types is present; one barred chondrule was found with transparent pale brown glass between the olivine bars. Most of the pyroxene is polysynthetically twinned clinobronzite. Minor weathering is indicated by brown limonitic staining around metal grains. Microprobe analyses gave the following compositions: olivine, Fa_{22-26} , mean Fa_{23} (c.v. FeO is 8); pyroxene, Fs_{6-22} . These L3 chondrites (estimated L3.9) are very similar and may be paired.

ALH84205 (25.2 g).—Fusion crust covers 60% of this stone. The interior is made up of light to medium gray matrix with abundant light and dark chondrules and inclusions. In thin section chondrules and chondrule fragments are abundant, ranging up to 2.1 mm across; most are granular olivine and olivine-pyroxene, but barred olivine and cryptocrystalline pyroxene chondrules are also present. Many have narrow black rims. Nickel-iron and troilite are present in small amounts. Microprobe analyses give the following compositions: olivine, Fa_{12-33} , with a mean of Fa_{19} (c.v. FeO is 27); pyroxene, Fs_{4-19} . The meteorite is classified as an L3.7 chondrite.

ALH85062 (167.3 g), 85155 (18.5 g).—These stones are partly covered with dull black fusion crust. The interiors show a gray matrix with abundant inclusions. Sections show a close-packed aggregate of chondrules and chondrule fragments (up to 2.1 mm across) in a dark finely granular matrix, which includes minor amounts of nickel-iron and troilite. A variety of chondrule types is present, including granular and porphyritic olivine and fine-grained pyroxene. Both olivine and pyroxene show a wide range in composition: olivine, Fa_{1-28} , mean Fa_{16} (c.v. FeO is 40); pyroxene, Fs_{3-20} . These meteorites are very similar and may be paired. They are classified as L3.5–3.6, and may belong to the ALHA77011 pairing group.

ALH85070 (12.9 g).—Fusion crust covers about 75% of this stone. The interior is light-gray and has abundant inclusions. Oxidation is light. The section shows abundant chondrules and chondrule fragments, up to 2 mm across, in a fine-grained matrix containing a few coarser grains of nickel-iron and troilite. A variety of chondrule types is present including granular and porphyritic olivine and olivine-pyroxene, barred olivine, and crypto-crystalline pyroxene. Much of the pyroxene is polysynthetically-twinned clinobronzite. Minor weathering is indicated by rusty halos around metal grains. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{4-25} with a mean of Fa_{18} (c.v. FeO is 38); pyroxene, Fs_{1-29} . The meteorite is classified as an L3 chondrite (estimated L3.6).

LEW85339 (28.8 g).—Polygonally fractured fusion crust completely covers this small specimen. The interior is light gray with chondrules and other inclusions measuring up to ~3 mm in diameter. One dark haloed inclusion (metallic?) is ~7

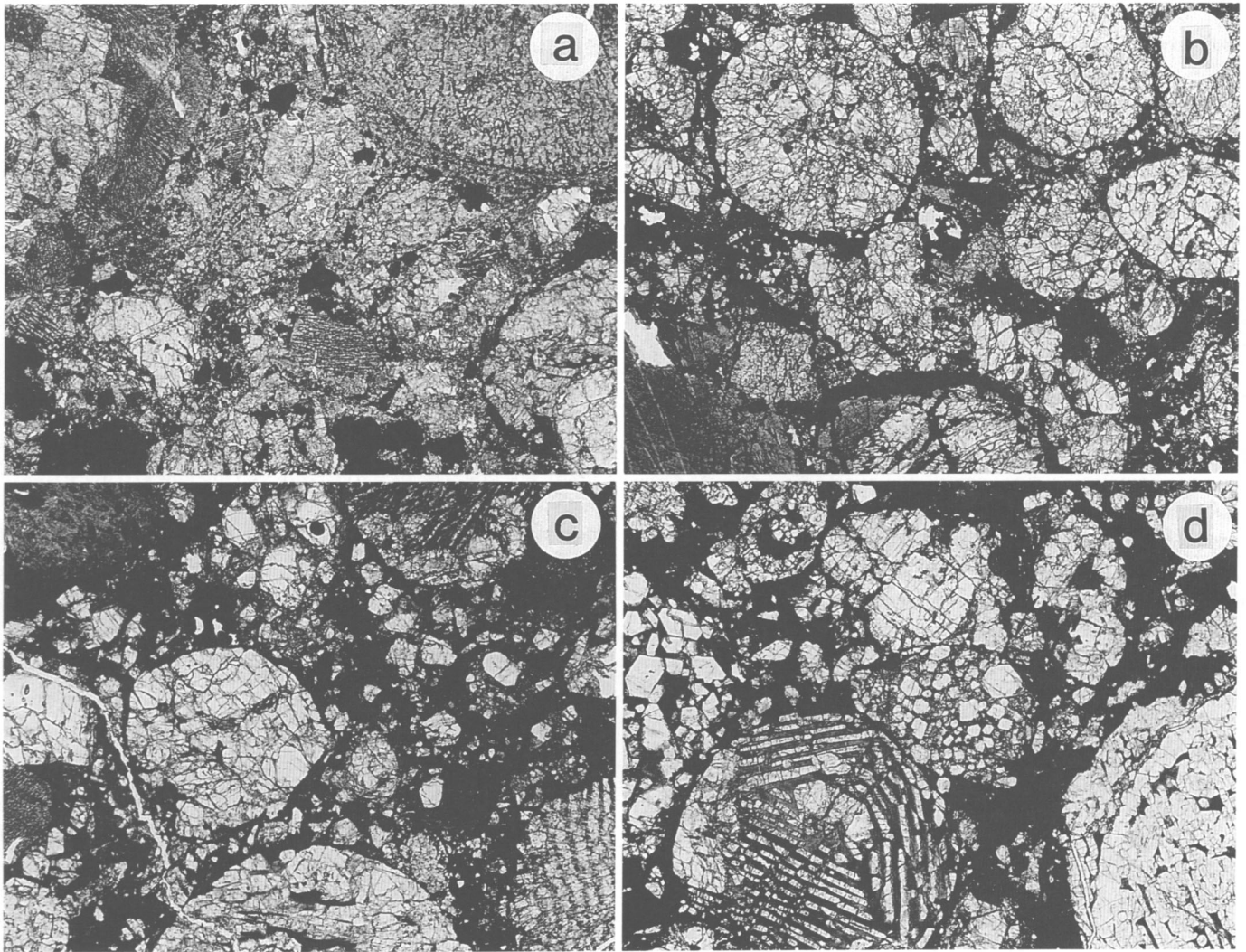


FIGURE 4-9.—Photomicrographs of L3 chondrites: *a*, ALH84120; *b*, ALH84205; *c*, LEW86018; *d*, LEW86127. Abundant chondrules, chondrule fragments, and mineral grains are visible in the photos; only a little matrix is actually present in any of these three meteorites, the dark regions in fact being mostly limonite weathering. Width of field in each photo is 2.3 mm.

mm across. In thin section, chondrules and chondrule fragments up to 2.1 mm across are closely-packed in a minimum amount of dark matrix that contains some troilite and a little nickel-iron. A variety of chondrule types is present, including granular and porphyritic olivine and olivine-pyroxene, barred olivine, and fine-grained radiating pyroxene. Considerable weathering is indicated by brown limonitic staining throughout the section. Microprobe analyses show olivine and pyroxene of variable composition: olivine, Fa_{1-30} , with a mean of Fa_{14} (c.v. FeO is 59); pyroxene, Fs_{3-13} . The meteorite is classified as an L3 chondrite (estimated L3.4).

LEW85396 (60.2 g), 85401 (3.9 g), 86018 (502.0 g), 86022 (351.7 g).—These stones are very similar and are possibly paired. They all retain some fusion crust, but are extensively weathered. Interiors are brown and show numerous chondrules

and inclusions up to 5 mm long. Thin sections show a close-packed mass of chondrules (up to 2.9 mm across), chondrule fragments, and irregular granular aggregates in a small amount of opaque matrix which includes minor amounts of nickel-iron and troilite. Most chondrules consist of granular or porphyritic olivine, some with polysynthetically-twinned clinopyroxene. Both olivine and pyroxene show a wide range in composition: olivine, Fa_{1-34} ; pyroxene, Fs_{1-31} . The meteorites are classified as L3.5 chondrites.

LEW85434 (19.4 g), 85437 (9.4 g).—Both specimens have red-brown interiors covered with weathered fusion crust. Light colored chondrules are visible in LEW85437.

Thin section examination shows that these two specimens are very similar and probably paired. Chondrules and chondrule fragments, up to 1.8 mm across, are closely-packed in a

small amount of dark matrix containing a little troilite and nickel-iron. Chondrule types include granular and porphyritic olivine and olivine-pyroxene, barred olivine, and fine-grained radiating pyroxene. Weathering is extensive, with brown limonitic staining pervading the sections. Olivine and pyroxene show a wide range in composition: olivine, Fa_{1-23} with a mean of Fa_{10} (c.v. FeO is 76); pyroxene, Fs_{2-11} . The meteorite is classed as an L3 chondrite (estimated L3.4).

LEW85452 (9.2 g).—Black fusion crust completely covers LEW85452. Macroscopically, the interior structure has been obscured by oxidation. The section shows a close-packed aggregate of chondrules and chondrule fragments, up to 2.4 mm across, in a finely granular matrix containing some troilite and nickel-iron. Chondrule types include granular and porphyritic olivine and olivine-pyroxene, and fine-grained to cryptocrystalline pyroxene. Olivine and pyroxene show a wide range in composition: olivine, Fa_{5-23} with a mean of Fa_{15} (c.v. FeO is 35); pyroxene, Fs_{2-18} . The meteorite is classed as an L3 chondrite (estimated L3.6).

LEW86021 (325.8 g).—This rounded stone is mostly covered with iridescent fusion crust; evaporite deposit is present on some surfaces. The interior is red-brown and heavily weathered. A section shows a close-packed mass of chondrules (up to 2.7 mm across), chondrule fragments, and irregular crystalline aggregates, together with minor amounts of nickel-iron and troilite. A variety of chondrule types is present, including granular and porphyritic olivine and olivine-pyroxene, barred olivine, and radiating pyroxene. Weathering is extensive, with limonitic staining and areas of brown limonite throughout. Microprobe analyses give the following compositions: olivine, Fa_{18-28} , mean Fa_{21} (c.v. FeO is 10); pyroxene, Fs_{4-17} . The meteorite is classified as an L3.9 chondrite.

LEW86127, 86134, 86144, 86158, 86207, 86246, 86270, 86307, 86367, 86408, 86417, 86436, 86505 (total weight 150.9 g).—All these small stones show light and dark chondrules and angular fragments in a darker, very coherent matrix. They are very similar in all respects and may be paired. Sections show a close-packed aggregate of chondrules and chondrule fragments, up to 3 mm across, in a minimum amount of fine-grained dark matrix that contains a little nickel-iron and troilite. Chondrule types include granular and porphyritic olivine and olivine-pyroxene, barred olivine, and radiating and cryptocrystalline pyroxene. Weathering is extensive, with brown limonitic staining throughout. Composition ranges are: olivine, Fa_{1-30} ; pyroxene, Fs_{1-24} . The meteorites are classified as L3.5 chondrites.

LEW86549 (50.1 g).—A gray interior is overlain by a black polygonally-fractured fusion crust that covers about 50% of the surface of this specimen. The section consists mainly of chondrules and chondrule fragments, with a minor amount of dark finely-granular matrix containing a little nickel-iron and troilite. The chondrules are relatively small, the largest found being 0.9 mm across; most are granular olivine and olivine-

pyroxene, but barred olivine and radiating pyroxene chondrules are also present. Weathering is extensive, with brown limonitic staining throughout the section. Olivine and pyroxene are variable in composition: olivine, Fa_{5-20} , with a mean of Fa_{15} (c.v. FeO is 28); pyroxene, Fs_{1-29} . This meteorite is classified as an L3 chondrite (estimated L3.7).

RKP86700 (424.1 g).—Brown fusion crust spotted with oxidation halos covers 90% of this stone. The interior is dark gray with black inclusions up to 2 mm across; oxidation is heavy along fractures. A thin section shows a close-packed mass of chondrules (0.6–2.4 mm across) and irregular aggregates. Some chondrules have dark rims consisting largely of fine-grained troilite. The sparse matrix is fine-grained, with a small amount of coarser nickel-iron and troilite scattered throughout. A notable variety of chondrule types is present; many are granular or porphyritic olivine and olivine-pyroxene with transparent to turbid interstitial glass. The pyroxene is polysynthetically-twinned clinobronzite. Brown limonitic staining pervades the section. Composition ranges are as follows: olivine, Fa_{17-27} , mean Fa_{23} (c.v. FeO is 9.3); pyroxene, Fs_{14-23} . The meteorite is an L3 chondrite (estimated L3.9); it resembles RKPA80256, and may be paired with it.

CLASS LL3

FIGURE 4-10

ALH84086 (234.0 g).—Fusion crust covers most of this chondrite. Abundant inclusions, both chondrules and clasts (one 0.7×0.9 cm), are present in the medium gray matrix. A section shows a close-packed aggregate of chondrules, chondrule fragments, and irregular inclusions up to 3 mm across, with a few grains of nickel-iron and sulfide and hardly any matrix. A considerable variety of chondrules is present, the commonest being porphyritic or granular olivine with or without polysynthetically twinned clinobronzite. Some chondrules have intergranular transparent pale brown glass; in others the glass is turbid and partly devitrified. Microprobe analyses, including data from Rubin (1990), show a moderate range in olivine composition (Fa_{25-29}) with a mean of Fa_{28} , and a wider range in pyroxene (Fs_{17-26}). The meteorite was originally classified as an LL3.9 chondrite; Rubin (1990) has suggested LL3.8.

ALH84126 (41.2 g).—This fragment retains four small patches of fusion crust. Numerous chondrules and inclusions show in relief on the brown weathered surface. A thin section shows a close-packed aggregate of chondrules, chondrule fragments, and angular clasts ranging up to 3 mm across. Many chondrules have dark rims. A variety of chondrule types is present, including porphyritic olivine, granular olivine and olivine-pyroxene, and radiating pyroxene. A few grains of troilite and nickel-iron are present. Mineral compositions are: olivine, Fa_{7-31} , mean Fa_{16} (c.v. FeO is 46); pyroxene, Fs_{3-24} , mean Fs_9 . The meteorite is classified as an LL3.5 chondrite.

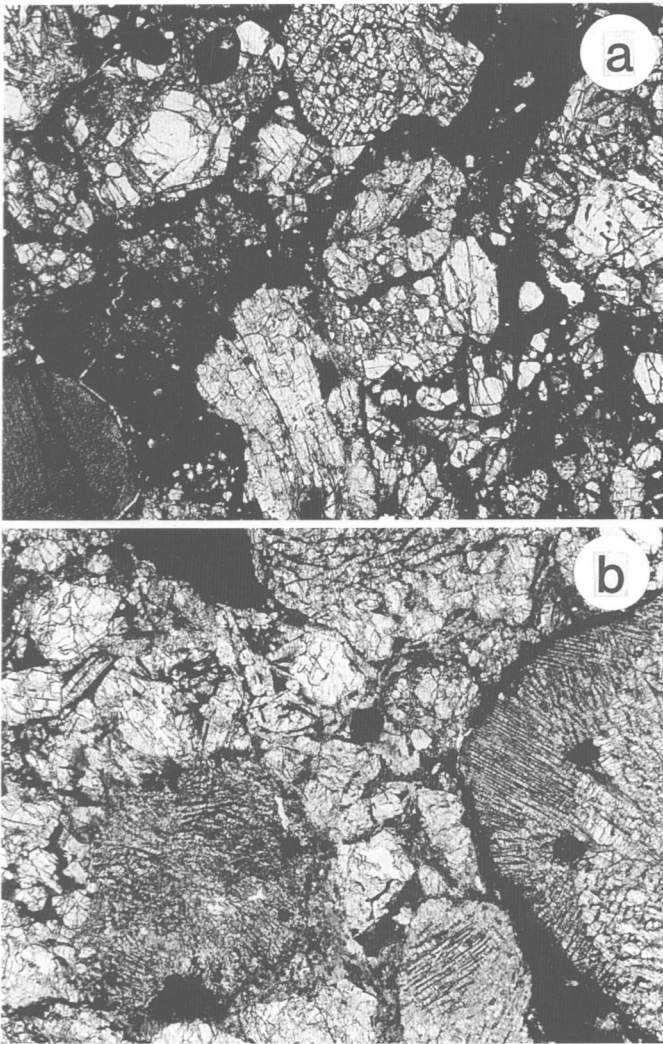


FIGURE 4-10.—Photomicrographs of LL3 chondrites: *a*, ALH84126; *b*, ALH84086. Numerous chondrules, chondrule fragments, and mineral grains are visible in very sparse dark matrices. Much of what appears to be dark matrix in ALH84126 is actually limonite staining. Opaque (iron-nickel metal and troilite) grains are visible in the photo of ALH84086. Width of field in each photo is 2.3 mm.

Achondrites

BRACHINA-LIKE AND UNGROUPED

FIGURE 4-11

ALH 84025 (4.6 g).—This small meteorite is largely covered with thick fusion crust. In composition it is essentially a dunite, consisting of large (up to 1.5 mm) polygonal olivine crystals that are uniformly Fe_{67-68} in composition, with lesser diopside ($Wo_{44}En_{46}$) and sparse polygonal chromite grains. Crisscrossing the meteorite are veins of troilite, within which are tiny globules of Ni-rich (about 30% Ni) metal. In many cases these sulfide veins are no more than trails of tiny sulfide grains that outline crystal boundaries and define (presumably) healed

fractures within crystals. Only the larger and more continuous veins contain metal. Neither the olivine nor the pyroxene show significant undulatory extinction. A well-defined fusion crust, 0.6 mm thick, encloses much of the area of the thin section, reflecting the small overall size of this meteorite. A very few fractures show slight limonitic staining, indicating only minor terrestrial weathering. This specimen most closely resembles the unique achondrite Brachina in texture and mineralogy, but unlike Brachina it is more coarsely crystalline and contains no plagioclase.

Prinz et al. (1986) made a comprehensive study of the mineralogy of ALH84025 and confirmed its close relationship to Brachina. Warren and Kallemeyn (1987) compared ALH84025 to Brachina and Chassigny, noting that in some respects it bears little resemblance to either. It has far lower contents of light REE, and also shows a small (barely significant) positive Eu anomaly, which neither Brachina nor Chassigny has. They interpret the texture and bulk composition of this meteorite to reflect an origin as an igneous cumulate. Ott et al. (1987) have measured the noble gases in ALH84025 and conclude that it is like Brachina and unlike Chassigny.

ALH84190 (7.9 g).—This small fragment probably fits on a corner of a larger meteorite that is angular and has an ablation flange. The section shows an aggregate of anhedral to subhedral grains, 0.06–0.5 mm across, of olivine and pyroxene, with about 15% of disseminated nickel-iron and minor amounts of plagioclase and troilite. The proportion of pyroxene to olivine is estimated as 4 : 1. Weathering is extensive, with veinlets and small areas of brown limonite throughout the section. Microprobe analyses gave the following compositions: olivine, Fa_4 ; plagioclase, An_{19} ; pyroxene, Wo_3Fs_6 (slightly variable, with one grain of diopside, $Wo_{43}Fs_3$, analysed). This ungrouped achondrite is essentially identical with ALHA81187; in mineral compositions and texture these meteorites closely resemble inclusions in iron meteorites, such as in Campo del Cielo (Wlotzka and Jarosewich, 1977).

EET84302 (59.6 g).—The exterior of this specimen is mostly covered with thin fusion crust. The section shows an anhedral granular aggregate (grain size 0.1–0.4 mm) consisting largely of olivine and orthopyroxene, with minor amounts of plagioclase, diopside, nickel-iron, and troilite. Weathering is extensive, with limonitic staining throughout the section. Microprobe analyses gave the following compositions: olivine, Fa_5 ; orthopyroxene, Wo_2Fs_8 ; diopside, $Wo_{42}Fs_3$; plagioclase, An_{23} .

ANGRITE

FIGURE 4-12

LEW86010 (6.9 g).—Greenish brown crystals are visible in relief on the polished black exterior surface of this tiny stone; some flow-like features are also visible. In thin section the rock

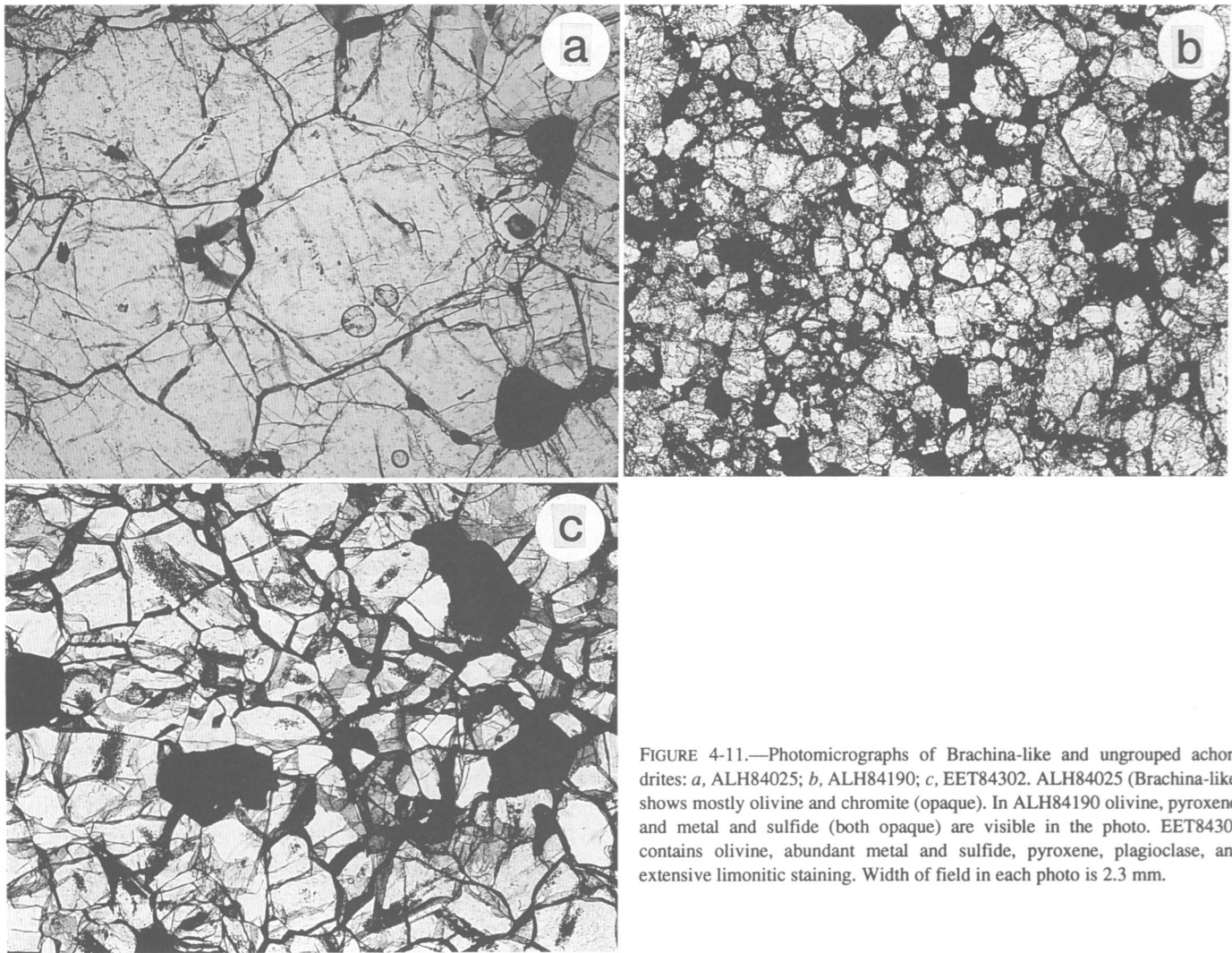


FIGURE 4-11.—Photomicrographs of Brachina-like and ungrouped achondrites: *a*, ALH84025; *b*, ALH84190; *c*, EET84302. ALH84025 (Brachina-like) shows mostly olivine and chromite (opaque). In ALH84190 olivine, pyroxene, and metal and sulfide (both opaque) are visible in the photo. EET84302 contains olivine, abundant metal and sulfide, pyroxene, plagioclase, and extensive limonitic staining. Width of field in each photo is 2.3 mm.

consists of a granular aggregate of subequal amounts of plagioclase, pyroxene, and olivine, with minor amounts of troilite, whitlockite, hercynite spinel, and rare merrillite. A striking feature is the strongly zoned, reddish-purple pleochroism of the pyroxene.

The pyroxene is a fassaite, with 10% Al_2O_3 and 2% TiO_2 . The olivine is Fa_{63} in composition and contains 1%–3% CaO; present within the olivines are optically-visible exsolution lamellae of kirschsteinite. The plagioclase is An_{100} in composition.

Correlated studies of the petrologic and trace element characteristics have been reported by McKay, Lindstrom, Le, and Yang (1988), McKay, Lindstrom, Yang, and Wagstaff (1988), and Crozaz and Lundberg (1988); Rb-Sr, Pb-Pb, and Ca and Ti isotopic properties are reported by Lugmair et al. (1989).

McKay and co-workers conclude that there is little doubt that LEW86010 is an igneous rock. The trace element studies of Crozaz and Lundberg (1988) support such a conclusion;

moreover, the lower REE abundances and higher Fe/Mg in LEW86010 relative to Angra Dos Reis (ADOR) makes it unlikely that these two rocks are co-magmatic.

Lugmair et al. (1989) found that the initial $^{87}\text{Sr}/^{86}\text{Sr}$ for LEW86010 is slightly higher than that of ADOR and slightly lower than that of the cumulate eucrite, Moore County. The Pb isotopic composition of LEW86010 proved to be severely contaminated by modern terrestrial lead; however, measurements on plagioclase yielded model ages of 4.536 b.y. relative to primordial lead. The aluminous composition of LEW86010 led to a proposal (Prinz et al., 1988) that it might somehow be related to Ca-Al-rich inclusions such as those found in carbonaceous chondrites; Lugmair et al. (1989) measured Ca and Ti isotopic ratios in the angrite and found no anomalies.

On the basis of zoning in the pyroxene and olivine, McKay, Lindstrom, Le, and Yang (1988) and McKay, Lindstrom, Yang, and Wagstaff (1988) concluded that LEW86010 cooled more rapidly than did ADOR.

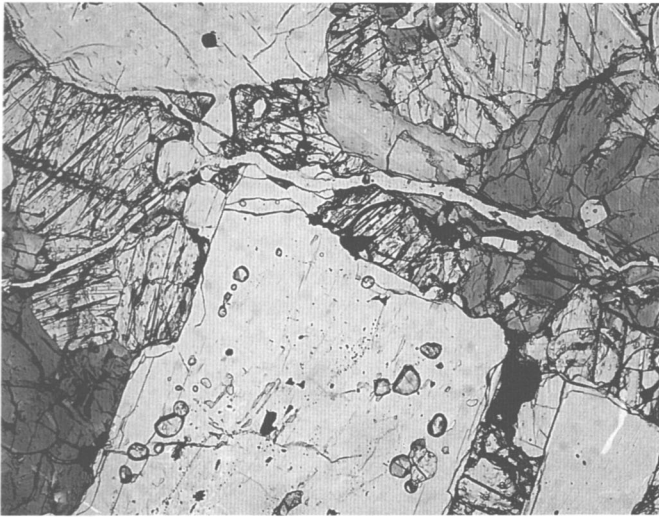


FIGURE 4-12.—Photomicrograph of the angrite LEW86010. Plagioclase (clear), olivine (clear with high relief), fassaitic pyroxene (grey), and sparse troilite are visible. Width of field is 2.3 mm.

AUBRITES

FIGURE 4-13

ALH84007–84024 (total weight 3.6 kg).—These 18 specimens were collected in the Middle Western Icefield over a distance of some 6 km. The largest specimen, ALH84007, weighs 705.6 g. All are fragments, some with minor amounts of yellowish to black fusion crust, and are almost certainly pieces of a single meteorite, along with ALH83009 and ALH83015. Macroscopically they are complex breccias of large white clasts up to 2 cm across, some dark inclusions up to 5 mm across, and occasional metal grains with rusty halos. Thin sections show that the meteorite is made up almost entirely of large (up to ~4 mm) intensely shocked enstatite crystals (essentially pure MgSiO_3 ; FeO less than 0.2%). The dusty brown matrix consists of granulated enstatite with minor forsterite (FeO 0.1%), diopside ($\text{Wo}_{41-44}\text{En}_{56-59}$), and plagioclase (An_9Or_3). Diopside occurs both as independent grains in the matrix and as rounded inclusions within enstatite. Sparse kamacite grains, up to 3 mm across, are invariably associated with a complex assemblage of phases that includes troilite, schreibersite, daubreelite, and alabandite.

Schwarz et al. (1986) have examined the chemistry of mineral separates from ALH84007, ALH84008, and ALH84011. The “enstatite” separates have V-shaped REE patterns with positive Eu anomalies, and appear fairly uniform in comparison with previous data on aubrites. Ryder and Murali (1987) have continued the work on these meteorites, and find that the REE patterns are influenced by several sulfide phases, which are the principal carriers of these elements. Random microprobe analyses of 55 enstatite grains in ALH84011 give the following: Al_2O_3 is fairly uniform, mostly in the range 0.06%–0.08%; CaO 0.22%–0.30%; FeO variable,

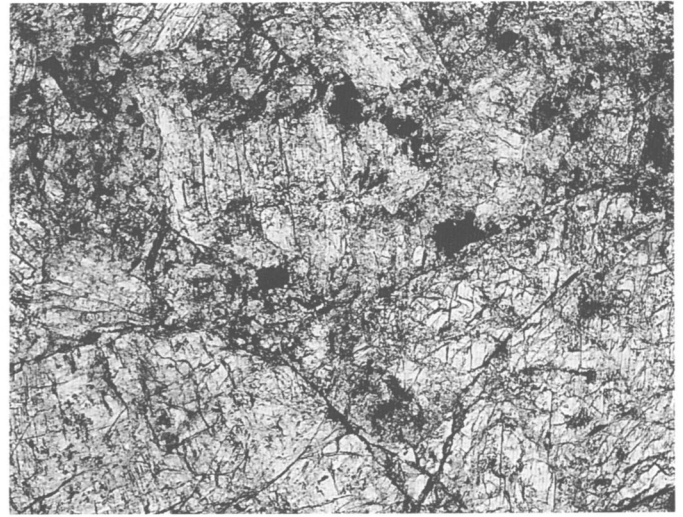


FIGURE 4-13.—Photomicrograph of the aubrite ALH84007. Most of the photo is occupied by large deformed enstatite crystals, with scattered opaque sulfides. Width of field is 2.3 mm.

with most less than 0.03%; Na_2O and TiO_2 both less than 0.01%; Cr_2O_3 less than 0.015%.

DIOGENITES

FIGURE 4-14

ALH84001 (1930.9 g).—Much of this rectangular shaped meteorite is covered with dull black fusion crust. Remnants of flow marks are visible on two surfaces. Areas not covered by fusion crust have a greenish-gray color and a blocky texture. Cleavage planes are obvious on some large crystals and the stone has a shocked appearance. Small areas of oxidation are present, and small fractures are numerous.

A thin section shows orthopyroxene ($\text{Wo}_3\text{Fs}_{27}$) crystals up to 5 mm long forming a polygonal-granular mosaic. Despite the fact that the pyroxene contains 1.5% CaO, no exsolution lamellae were observed. Veins of intensely granulated pyroxene cross cut the section. Other minerals include minor chromite and irregular patches of maskelynite ($\text{An}_{35-39}\text{Or}_{3-4}$). The section does not show iron-oxide staining but does contain patches of brown Fe-rich carbonate, $(\text{Fe}_{29}\text{Mg}_{60}\text{Ca}_{11})\text{CO}_3$. Although this diogenite contains granulated areas, it does not appear to be a breccia.

ALH85015 (3.2 g).—This small fragment is partly covered with black fusion crust, shiny in some places and dull in others. Part of the area devoid of fusion crust is highly polished. A weathering rind extends 2 mm into the interior, which is medium gray in color with white and dark clasts. The thin section consists almost entirely of orthopyroxene clasts, up to 3 mm across, in a groundmass of comminuted orthopyroxene, accessory plagioclase and opaques, and traces of olivine. The pyroxene is fairly uniform in composition, Fs_{25} , with CaO 0.8%–1.5%, MnO 0.45%–0.67%, Al_2O_3 0.32%–0.66%, and

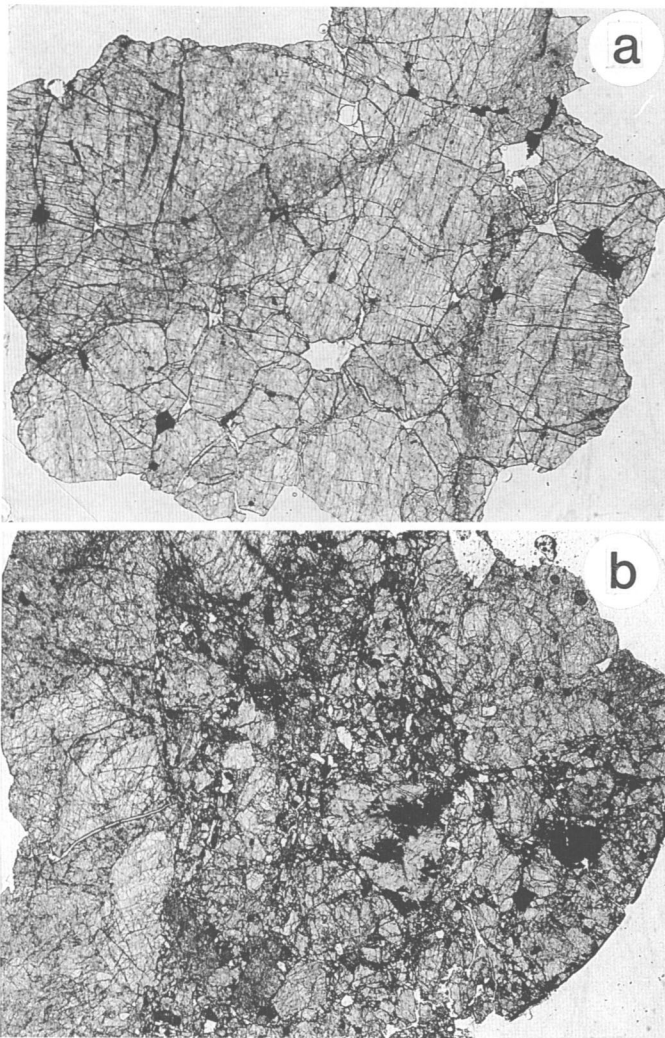


FIGURE 4-14.—Photomicrographs of diogenites: *a*, ALH84001. The photo shows the largely undeformed character of this meteorite, except for some narrow granulated zones crossing the section. Clear maskelynite and opaque chromite are accessory to the predominant orthopyroxene. *b*, ALH85015. In contrast with ALH84001, this meteorite is highly brecciated. Orthopyroxene-rich clasts are prominent in a comminuted matrix of pyroxene, plagioclase, minor olivine, and opaques. Width of field in each photo is 1 cm.

TiO₂ 0.05%–0.17%. The plagioclase composition is An_{84–95}. One grain of olivine, Fa₃₉, was analysed.

EUCRITES

FIGURE 4-15

ALH85001 (212.3 g).—This meteorite is an oriented stone covered by a shiny black fusion crust with thick flow lines. Areas devoid of fusion crust have weathered to a brownish-gray color. A discontinuous weathering rind, up to 4 mm thick, was exposed when the stone was chipped. The interior is made up of abundant laths of chalky plagioclase in a light gray matrix. The thin section shows angular fragments of orthopyroxene

and plagioclase, up to 2.4 mm across, in a comminuted groundmass of these minerals. Some of the pyroxene has lamellae and blebs of exsolved augite. A large gabbroic clast, 6 mm across with individual grains up to 3 mm, was found in one section. Trace amounts of nickel-iron and troilite are present in the groundmass. Microprobe analyses show that pyroxene compositions are remarkably uniform, Wo₂Fs₃₂, with a few more calcic grains, up to Wo₈ (possibly incipient augite exsolution). Plagioclase composition is also fairly uniform, An_{92–94}. The meteorite is a monomict eucrite with unusually magnesian pyroxene, similar to that in the Binda eucrite.

Mittlefehldt and Lindstrom (1988) have provided REE data on this meteorite.

LEW85300 (210.3 g), 85302 (114.5 g), 85303 (408.0 g).—These three specimens of a complex polymict eucrite are clearly paired. Thin shiny fusion crust with flow marks coat most of the top of LEW85300; the bottom surface has some fusion crust but most of this face is a fracture surface which appears to have been moderately polished. Fusion crust appears as dull patches on LEW85302 and LEW85303. Several large semi-rounded polymineralic clasts (as large as 2 × 2 cm) have sharply defined edges and are set in a black matrix.

Thin sections show numerous clasts with diverse textures and mineralogy set in a dark matrix with numerous comminuted grains of pyroxene and plagioclase. Some clasts have gabbroic or basaltic textures, others are breccias, and one is identified as a C3 chondrite. Microprobe analyses of section LEW85300,14 give pyroxene compositions clustering around Wo₃Fs₆₀, ranging to Wo₄₃Fs₂₆, with a mean (n = 15) of Wo₁₂Fs₅₂; two grains were found having the composition Wo₃Fs₃₃. The plagioclase composition is An_{84–93}.

The C3 chondrite clast consists largely of fine-grained olivine, with a composition of Fa_{1–44}; one grain each of clinoenstatite (Fs₅₉) and spinel (FeO 0.8%) were found.

A detailed account of clasts in these meteorites has been provided by Kozul and Hewins (1988). Mittlefehldt and Lindstrom (1988) have provided REE and other trace element data on some clasts from these meteorites.

LEW85305 (40.8 g).—This cuboidal stone is completely covered with shiny fusion crust showing flow lines. It has been described in detail by Delaney (1987), as follows: “Lewis Cliff 85305 is a granular fine grained eucrite ... containing pigeonite and augite with homogeneous plagioclase (An_{88,9}Or_{0,63}) in roughly equal proportions. A SiO₂ polymorph is the most abundant minor phase with troilite, metal and intimately intergrown ilmenite and Ti-bearing chromite. The pyroxene has a relict subophitic texture with a grain size of about 500–1000 μm, but the present pyroxene is very fine grained equant grains (50–100 μm) developed by granulation and recrystallization of the earlier texture. Plagioclase does not show the same comminution effects. Both the augite and the pigeonite have well-defined exsolution lamellae and are unzoned. Unlike that in most eucrites, the plagioclase in 85305 ... is also unzoned. The SiO₂ mineral in 85305 occurs in a distinctive textural

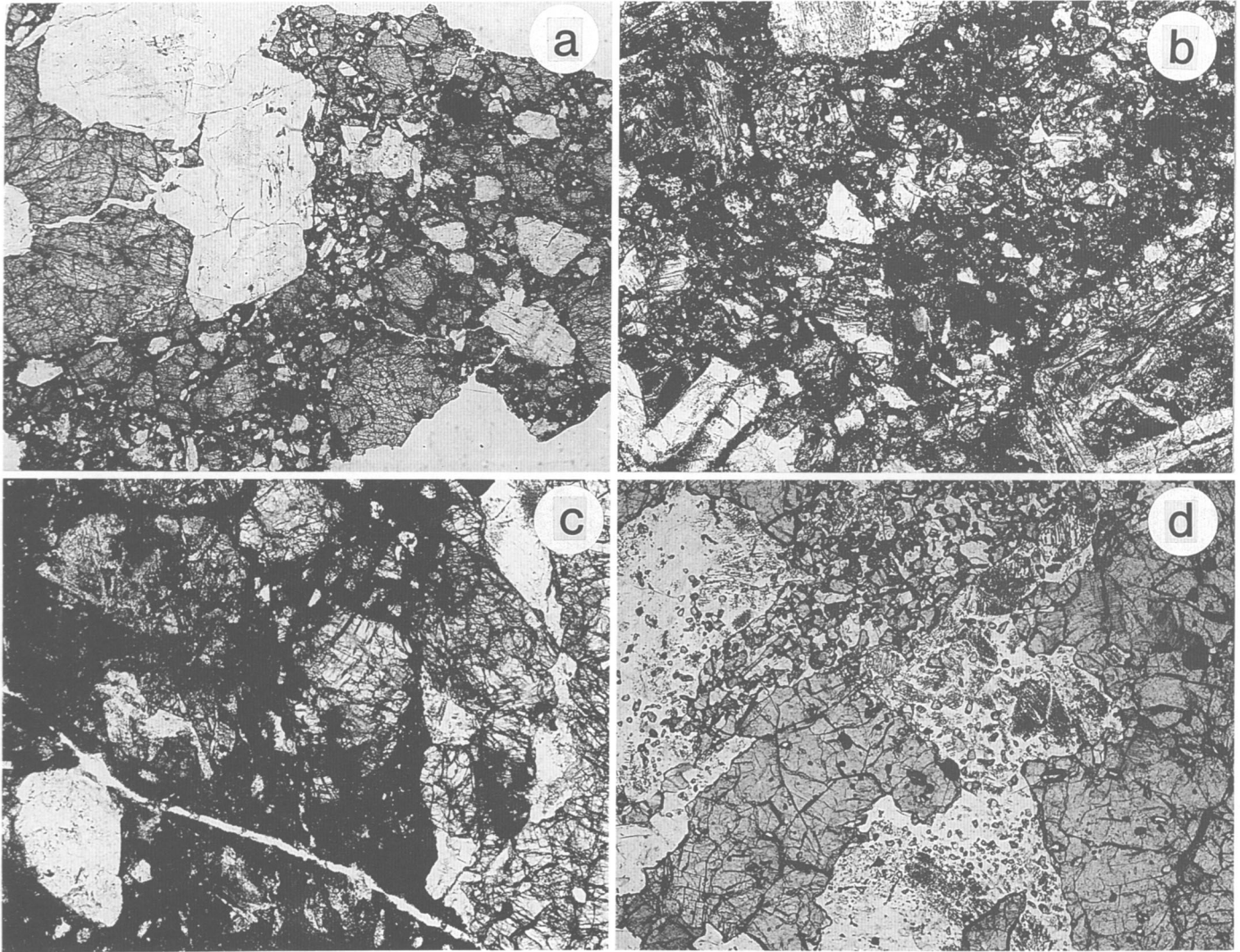


FIGURE 4-15.—Photomicrographs of eucrites: *a*, ALH85001. The photo shows a large gabbroic clast (upper left) enclosed in a granulated matrix of pyroxene (grey) and feldspar (light). *b*, LEW86001. The photo shows diverse-textured clasts in a granulated matrix. *c*, LEW85300. The photo shows several clast types enclosed in the dark granulated matrix. *d*, LEW85305. Fine- to coarse-grained pyroxene (grey) and plagioclase are prominent in the photo of this unbrecciated eucrite. Width of field in *a* is 1 cm; in all others, 2.3 mm.

setting as fairly large poikilitic grains with abundant small inclusions of both pyroxenes and tends to form secondary veins or “pools” through the thin section.”

In its texture and the lack of compositional zoning in its constituent phases, LEW85305 resembles the Ibitira eucrite (Steele and Smith, 1976); however, the mineral compositions are different.

Mittlefehldt and Lindstrom (1988) report that this meteorite has a relatively flat REE distribution pattern at about 7–9× ordinary chondrites.

LEW85353 (24.5 g).—This small stone has retained most of its thin fusion crust. Weathering has removed some crust and left a pitted surface. The interior is light gray and has a basaltic texture. A thin section shows a fine-grained aggregate (grains

0.1–0.4 mm) of pale brown pyroxene and colorless plagioclase, with a few opaque grains. Minor weathering is indicated by brown limonitic staining around the opaques. Plagioclase is fairly uniform in composition, averaging An_{88} . Pyroxene is largely hypersthene with a mean composition of Wo_2Fs_{60} ; accessory augite ($Wo_{48}Fs_{22}$) has exsolution lamellae of hypersthene.

LEW86001 (290.6 g).—Dull black fusion crust covers 80% of this stone. Large vugs, typical of Antarctic eucrites, are abundant. Interior surfaces have a light gray color and show numerous clasts up to 0.5 cm across; some oxidation is present. A thin section shows a groundmass of comminuted pyroxene and plagioclase (grains up to 0.5 mm), with numerous clasts up to 3 mm. The clasts consist of pyroxene and plagioclase, with

a variety of textures from fine-grained granular to ophitic to gabbroic. A small amount of opaques is present. Microprobe analyses show pyroxene compositions clustered around Wo_2Fs_{56} but ranging to $Wo_{44}Fs_{22}$, with a fairly uniform En content. The plagioclase composition is An_{76-88} .

Mittlefehldt and Lindstrom (1988) report that this meteorite is relatively enriched in REE (10–20× ordinary chondrites), and shows a LREE enriched pattern with a negative Eu anomaly.

LEW86002 (32.6 g).—This oblong stone is mostly covered with thin black fusion crust. Thin section examination reveals an ophitic intergrowth of pyroxene and plagioclase (plagioclase laths up to 0.7 mm long). Pyroxene ranges in composition from Wo_3Fs_{61} to $Wo_{37}Fs_{31}$, with fairly uniform En content. The plagioclase composition is An_{90} .

LEW86003 (1.6 g).—This small stone is mostly covered with dull black fusion crust. Ninety percent of the interior is light gray in color with minor black inclusions; the remainder is jet black with minor inclusions and is more oxidized than the lighter material. The contact between the two areas is sharp. Most of the thin section is an ophitic intergrowth of pyroxene and plagioclase, the plagioclase laths being up to 0.9 mm long. One end of the section is sharply bounded by an area of subophitic to gabbroic clasts, up to 1.8 mm across, in a dark brown glassy matrix. Mineral compositions are similar throughout. Pyroxene compositions range from Wo_2Fs_{64} to $Wo_{43}Fs_{27}$, with fairly uniform En contents. Plagioclase compositions are An_{87-91} .

HOWARDITES

FIGURE 4-16

LEW85313 (191.2 g).—Dull fusion crust covers most of this meteorite except where large pieces have been plucked out, giving the appearance of a piece of Swiss cheese. A brownish-gray weathering rind extends from less than 1 mm to greater than 1 cm into the interior. The massive gray matrix contains rounded and irregular inclusions ranging in color from white to black. Some oxidation halos are present. This meteorite was originally classified as a diogenite on the basis of a non-representative section (LEW85313,5), which was a large orthopyroxene clast. Berkley (1988) has shown that it is actually a howardite. It is a microbreccia of pyroxene clasts (orthopyroxene with minor clinopyroxene) and eucrite clasts, up to 0.9 mm across, in a comminuted groundmass of pyroxene grains, with minor plagioclase and accessory opaques (troilite and nickel-iron). Microprobe analyses give the following pyroxene composition range: $Wo_{1-10}Fs_{15-64}En_{34-85}$, with a mean of Wo_8Fs_{33} (one grain of ferroaugite, $Wo_{37}Fs_{38}$, was analyzed). The plagioclase composition range is An_{78-94} . Two grains of a silica polymorph, probably tridymite, were found during reconnaissance examination.

LEW85441 (10.9 g).—Half of the surface of this meteorite is

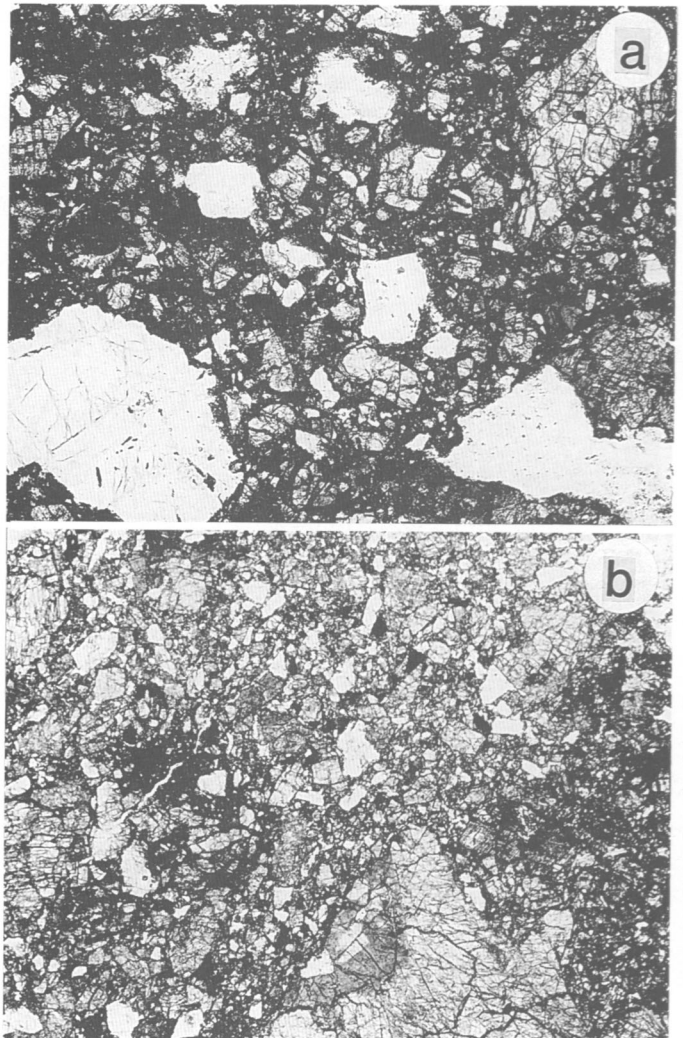


FIGURE 4-16.—Photomicrographs of howardites: *a*, LEW85441; *b*, LEW85313. Both photographs show heterogeneous aggregates of basaltic, gabbroic, and diogenitic clasts in comminuted matrices. Width of field in each photo is 2.3 mm.

covered with dull frothy fusion crust. Areas devoid of fusion crust are brownish-gray and show numerous clasts. Some oxidation halos are present. The section has a cataclastic texture, with angular fragments of pyroxene and plagioclase up to 2 mm across in a comminuted groundmass of the same minerals. The pyroxene is mainly hypersthene, but ranges widely in composition: $Wo_{1-10}Fs_{25-48}En_{34-74}$, with a mean of Wo_3Fs_{28} . Plagioclase composition is An_{92-96} . This meteorite is very similar to LEW85313 and is possibly paired with it.

UREILITES

FIGURE 4-17

ALH84136 (83.5 g).—This specimen is entirely covered with flaky black fusion crust. The interior is dark gray and

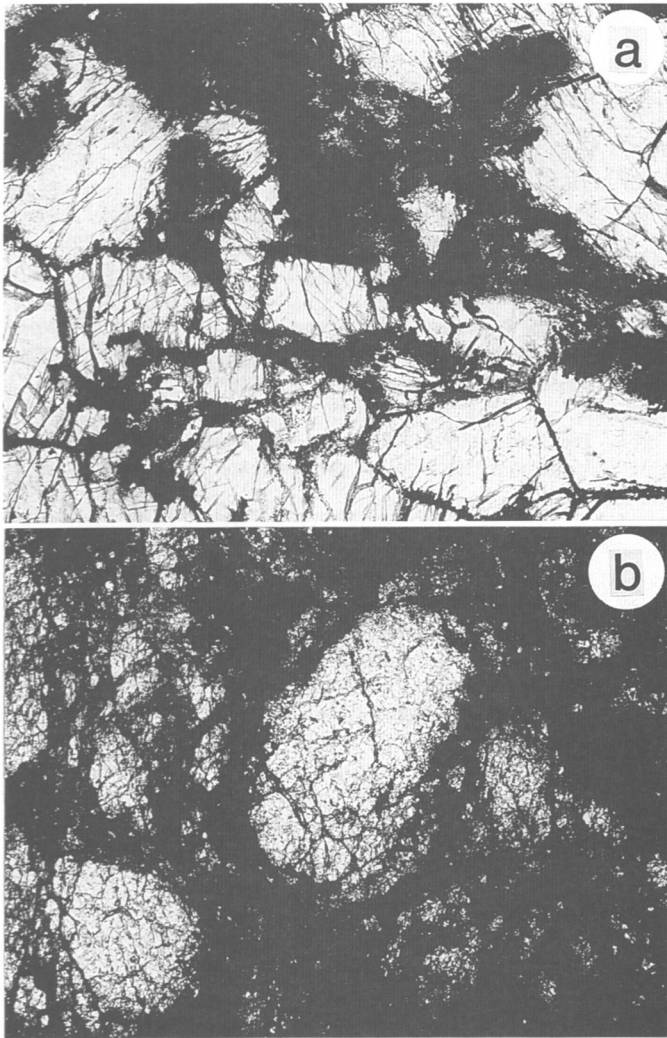


FIGURE 4-17.—Photomicrographs of ureilites: *a*, LEW85238. Olivine and pyroxene crystals are surrounded by dark, mostly carbonaceous material that also includes minor metal and troilite. *b*, LEW86216. The rounded olivine clasts have been transformed into fine-grained olivine mosaics, enclosed in a dark granulated matrix. Width of field in each photo is 2.3 mm.

granular with crystals as large as 2 mm in a red-brown matrix. A thin section shows an aggregate of anhedral to subhedral grains (0.6–2.4 mm across) of olivine and pyroxene, with about 10% of opaque material, in part disseminated throughout and in part concentrated along grain boundaries. Olivine grains are gray due to submicroscopic opaque inclusions, whereas pyroxene grains are clear but are extremely fractured. Microprobe analyses give the following compositions: olivine, somewhat variable, Fa_{0-5} , mean Fa_3 ; pyroxene, essentially uniform, Wo_5Fs_3 ; one grain of endiopsidite, $Wo_{34}Fs_{2.5}$, was analysed. This meteorite is so similar in all respects to ALH82106 and ALH82130 that it can be confidently paired with them; they were all found within 2–3 km of each other on the Allan Hills Far Western Icefield. This pairing is also supported by oxygen isotope data (Clayton and Mayeda, 1988).

LEW85328 (106.8 g).—The meteorite is covered by black fusion crust, frothy in places and with well-defined ablation marks. A thin section shows an aggregate of anhedral to subhedral grains (0.3–2.4 mm across) of olivine and pyroxene, in the approximate proportions of 2 : 1. Individual grains are rimmed by carbonaceous material. Trace amounts of finely-divided nickel-iron and troilite are present, mainly along grain boundaries. Microprobe analyses indicate that the olivine is uniform in composition, (Fa_{20}), with notably high CaO content (0.3%). The pyroxene is pigeonite with a composition of Wo_9Fs_{17} . This meteorite is notably unshocked compared to most ureilites.

LEW85440 (43.8 g).—Thin black fusion crust with greenish-gray streaks cover 60% of this stone. A thin section shows an equigranular aggregate of rounded to subhedral olivine and pyroxene grains, 0.3–0.6 mm across. The grains are rimmed with black carbonaceous material, which also contains trace amounts of nickel-iron (partly weathered to brown limonite) and troilite. Microprobe analyses show olivine and pyroxene of uniform composition: olivine Fa_9 (CaO 0.3%); pyroxene, Wo_5Fs_8 . Takeda et al. (1988) have made a detailed study of this meteorite and report one grain of augite, $Wo_{36}Fs_5$. Clayton and Mayeda (1988) have determined the oxygen isotopic composition.

LEW86216 (6.5 g).—This small stone has black frothy fusion crust on most surfaces. It is extremely weathered, and much of the thin section is obscured by brown limonite. It shows rounded olivine grains, up to 3 mm across, in a finer-grained, probably comminuted matrix of olivine with minor pyroxene. The probable presence of accessory diamond is indicated by difficulties in cutting and polishing, and by brightly fluorescent particles in an electron beam. The meteorite is heavily shocked, the large olivines being converted into a mosaic of tiny grains averaging 0.05 mm across. Microprobe analyses show an olivine composition range of Fa_{12-18} , with a mean of Fa_{17} (CaO 0.2%–0.4%); pyroxene compositions are in the range $Wo_{1-10}Fs_{12-18}$.

MESOSIDERITES

FIGURE 4-18

LEW86210 (9.2 g).—This is a reddish-brown weathered pebble with a high content of metal. Thin section examination reveals a granular aggregate of about 50% nickel-iron and 50% silicates. Pyroxene is the predominant silicate, with lesser amounts of plagioclase, as clastic grains up to 1.5 mm in maximum dimension in a matrix of metal and comminuted silicates. Minor weathering is indicated by small areas of brown limonite. Microprobe analyses show pyroxene in the composition range $Wo_{2-8}Fs_{24-61}$; most grains are Fs_{24-31} , with a mean of Wo_4Fs_{29} . The plagioclase composition is An_{89-92} . One grain of olivine, Fa_{45} , was analysed.

QUE86900 (1532.3 g).—This meteorite, from the Queen

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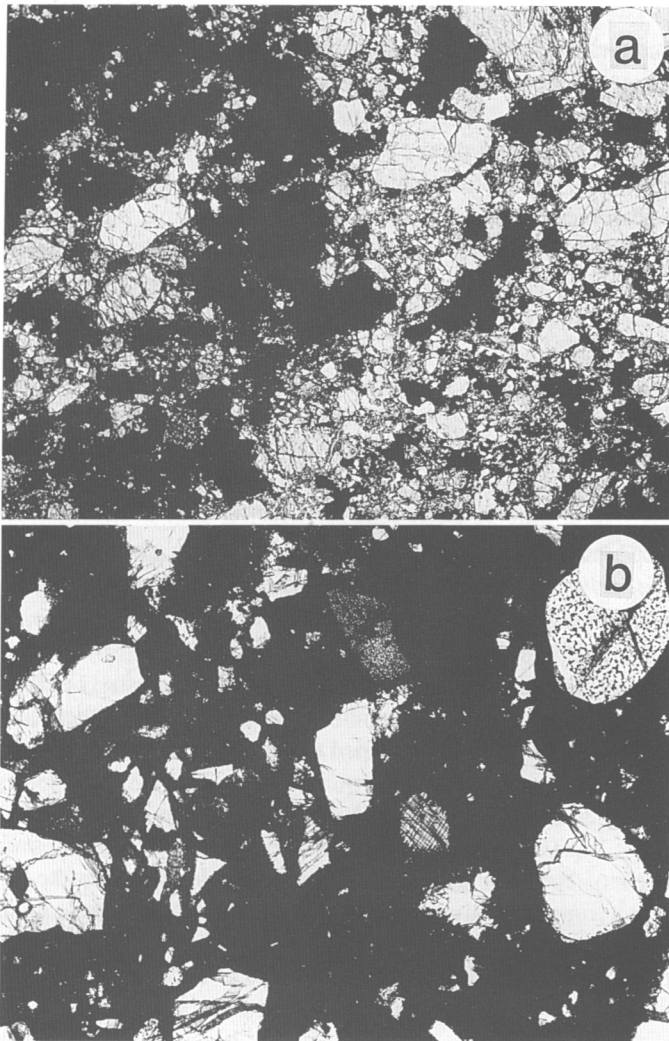


FIGURE 4-18.—Photomicrographs of mesosiderites: a, LEW86210; b, QUE86900. Both photographs show clasts of orthopyroxene and plagioclase enclosed in metal matrices. The metal in QUE86900 is heavily weathered. Width of field in each photo is 2.3 mm.

Alexandra Range, has isolated blebs of dull black fusion crust on about 10% of the surface, the remainder being weathered red-brown. Shallow regmaglypts are present. Large green platy pyroxene crystals are abundant, the largest being 1.5 cm long. Cleaving the stone revealed an interior with numerous platy and dark rounded inclusions in a highly weathered, red-brown, metal-rich matrix. A thin section shows plagioclase and pyroxene clasts, up to 1.5 mm across, in an opaque matrix of nickel-iron and troilite; the nickel-iron is extensively weathered to limonite. Most of the pyroxene is hypersthene, but some pigeonite is present; the composition ranges are $Wo_{1-11}Fs_{21-64}En_{31-78}$, with a mean of Wo_3Fs_{33} . Most plagioclase compositions are in the range An_{90-96} , but a few more sodic grains were analysed.

Mittlefehldt (1988) has measured the REE distribution in a gabbroic clast from this meteorite.

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5. Descriptions of Iron Meteorites

Roy S. Clarke, Jr.

This section provides brief descriptions of four octahedrites, a group IAB silicate-rich specimen, and three anomalous meteorites. The descriptions are based on material prepared previously for the *Antarctic Meteorite Newsletter* and on recently published data. The specimens considered are listed with their weights and classifications in Table 5-1.

Octahedrites

ALH84165 (94.7 g).—This is an aerodynamically shaped specimen ($4.3 \times 3.3 \times 1.5$ cm) from the Allan Hills (Figure 5-1). Distinct anterior and posterior surfaces are present, both covered with thin coatings of reddish brown secondary iron oxides. The anterior surface is smoother than the posterior and has a uniform radius of curvature over most of its area. The posterior radius of curvature is uniform and larger than that of the anterior surface. The anterior radius does, however, decrease markedly approaching the join of the two surfaces. Anterior surface ablation-melt has accumulated on the posterior side of the join, resulting in an approximately 1 mm flange around the specimen (Figure 5-1, *bottom*). Delicate streamers of fusion crust remain on the edges of the anterior surface recording the flow of melt away from the stagnation point at the center the surface. The axis of oriented flight was perpendicular to the surface as shown in Figure 5-1, *top*, at the stagnation point.

A median slice perpendicular to both the plane of the flange and the long axis of the specimen was taken to the left of the

small depression in Figure 5-1, *bottom*, providing an area of approximately 3 cm^2 for metallographic examination. The anterior edge of the slice is essentially free of fusion crust, but a heat-altered zone of kamacite transformed to α_2 penetrates 1.5 to 2 mm into the body of the specimen. The posterior edge has a continuous fusion crust accumulation 0.2 to 0.3 mm thick, and the kamacite along this edge has also been penetrated to a depth of 1.5 to 2 mm by α_2 structure. At the flange intersections, fusion crust accumulation is as thick as 1.5 mm.

Taenite lamellae, taenite-plessite areas, and cellular plessite areas are present in a well developed Widmanstätten pattern. The few opportunities for band width measurements suggest a value of about 1 mm, and the bulk Ni value is 7.76 wt% (Jarosewich, 1990). Grain boundary schreibersite is present, as is schreibersite associated with taenite. Kamacite is mottled and contains a pronounced ϵ -structure and occasional remnant Neumann bands. These observations suggest a chemical Group IIIAB classification, as has been established by Wasson et al. (1989).

GRO85201 (1401 g).—This specimen ($13 \times 8 \times 3.5$ cm) from Grosvenor Mountains was even more dramatically shaped by aerodynamic forces than ALH84165. It is roughly the shape and size of an extended and slightly curved adult human hand with closed fingers and thumb (Figure 5-2). The convex surface was the anterior surface during stable oriented flight (Figure 5-2, *top*). A distinct stagnation point may be seen in the center of this surface, from which streamers of melt flowed to a circumferential lip that separates the anterior and posterior surfaces (Figure 5-2, *bottom*). The anterior surface is dark and has a reddish cast due to terrestrial oxidation. There are distinct patches of black fusion crust and areas of bare, shiny metal

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FIGURE 5-1.—ALH84165 is an aerodynamically shaped individual covered with a thin coating of secondary iron oxides. (*Top*) Looking down on the anterior surface. The plane of the photograph is perpendicular to the orientation of the individual during atmospheric passage. The long axis is 4.3 cm. (*Bottom*) Specimen rotated 180° around the long axis and photographed from an oblique angle to show the accumulation of fusion crust forming the flange separating anterior and posterior surfaces.

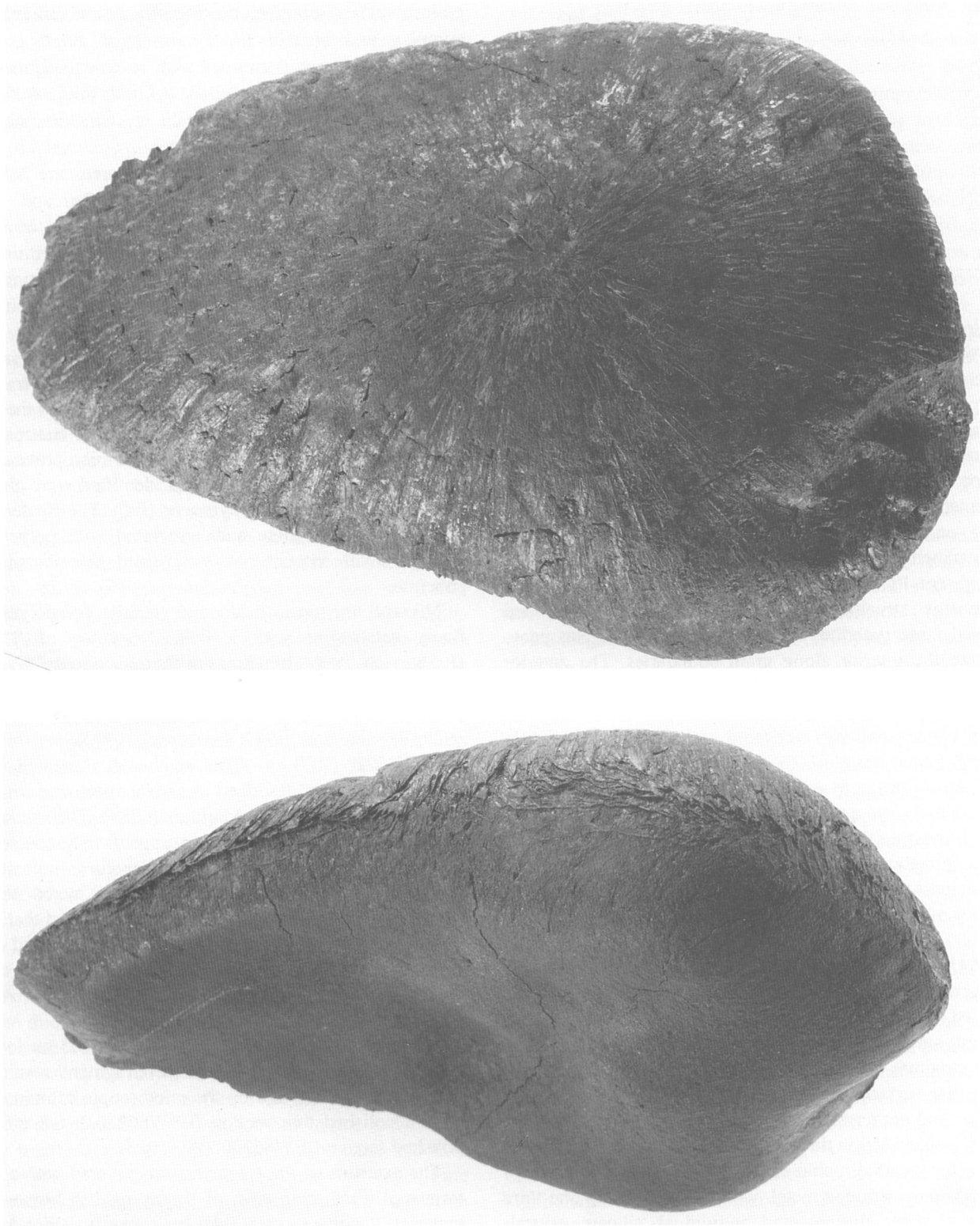


FIGURE 5-2.—GRO85201 is an unusually well preserved oriented individual. (*Top*) Looking down on the anterior surface. The plane of the photograph is perpendicular to the orientation of the individual during stable atmospheric flight. The stagnation point is in the center of the photograph. It is from this point that delicate streamers of melt flowed radially to the edge of the surface. The long axis is 13 cm. (*Bottom*) Specimen rotated about 60° around the long axis in (*Top*), showing the posterior surface and the accumulation of melt at the edge of the anterior surface.

TABLE 5-1.—Antarctic iron meteorites, 1984–1986.

Sample number	Weight (g)	Classification
ALH84165	94.7	IIIAB, Om
GRO85201	1401	IIIAB, Om
EET84300	72.7	IAB, Off
LEW86220	25.0	Silicate-rich IAB
LEW86540	21.0	IIICD, Off
ALH84233	13.6	Ungr, Anom
LEW85369	6.3	Ungr, Anom
LEW86211	163	Ungr, Sulfide-rich

associated with the metal streamers. The posterior surface is darker, also has a slight reddish cast, and has a uniform matte appearance. The specimen appears to have had a long terrestrial residence, but its delicate ablation-produced markings are remarkably well preserved.

A slice, perpendicular to both the surface illustrated in Figure 5-2, *top*, and the long axis of the specimen, was removed approximately one-third of the way from the small end, yielding an 11 cm² surface for examination. A regular Widmanstätten pattern with kamacite band widths of 0.8 to 1.5 mm is present. Plessite areas and centers of taenite bands have a martensitic structure. Grain boundary schreibersite and occasional large rhabdites are present. Weathering has penetrated into the interior along grain boundaries. The anterior edge has a rim of terrestrial oxide generally less than 0.1 mm thick and containing a few areas of remnant fusion crust. The posterior edge is uniformly covered with layered and slightly weathered fusion crust 1.0 to 1.5 mm thick. Interior to both edges is an α_2 structure typical of heat-altered zones. This α_2 structure blends into a much coarser martensite structure that is present throughout the kamacite in the section. These observations, combined with a bulk Ni value of 8.59 wt% (Jarosewich, 1990), suggest that the specimen is cosmically heat-altered and a member of group IIIAB as has been established by Wasson (1990).

EET84300 (72.7 g).—This irregularly shaped specimen (3.5 × 3 × 2 cm) from Elephant Moraine is severely weathered and is covered with a reddish brown coating of secondary oxides containing small amounts of adhering soil material. After the internal structure of the meteorite had been examined, it was realized that surface silicates on one part of the surface are meteoritic and not terrestrial silicates.

An off-center section through the specimen provided an area of 4 cm² for metallographic examination. About two-thirds of this area is uninterrupted metal, while the remaining one-third contains silicate clusters and individual silicate crystals dispersed in metal. These silicate associations comprise about 5% of the total area. The metal is polycrystalline, containing three cm-size areas of finest octahedrite structure with band widths around 0.1 mm. These three large areas are separated by two comparatively thin bands of kamacite containing median

grain boundary schreibersite. The silicate-rich areas are more complex and contain smaller areas of finest octahedrite structure. The slice is rimmed with an essentially continuous band of secondary oxides about 0.2 mm thick. A few small metal areas near the rim contain α_2 structure, its deepest penetration being less than 0.5 mm.

Dominant features within the metal areas are a Widmanstätten pattern of taenite, cellular plessite, and kamacite lamellae. Schreibersite is found at junctions of kamacite lamellae, at centers of kamacite lamellae, and within plessite areas. A number of graphite inclusions are present, ranging in size from a few hundredths of a mm to 0.5 mm. Tiny inclusions of daubreelite were tentatively identified.

Angular silicates occur as clusters of grains and as individual grains within metal. They range from transparent to translucent, and from water-clear to slightly colored. Some of the coloring is probably due to weathering. A 0.5 mm transparent and slightly green crystal proved on electron microprobe examination to be diopside. Other silicates identified were plagioclase (An₁₂), olivine (Fa₁), and pyroxene (Fs₆). The cluster silicates are coarsely crystalline and associated with polycrystalline troilite, small amounts of metal, and schreibersite and/or cohenite.

This specimen is a silicate- and graphite-rich polycrystalline finest octahedrite with a bulk Ni value of 9.71 wt% (Jarosewich, 1990). It belongs to chemical group IAB (Wasson et al., 1989) and is distinct from IAB meteorite EET83333 on the basis of both structure and chemical composition (Clarke, 1989; Wasson et al., 1989; Jarosewich, 1990).

LEW86220 (25.0 g).—This weathered, elongated pebble (4 × 1 × 1.5 cm), was described as an iron meteorite with silicate inclusions by Mason and Martinez (1988). Their macroscopic description noted that the interior “appears to be coarse-grained silicate minerals, some green, some yellow—all stained by oxidation.” The microscopic description noted that most silicate grains are in the 0.3–1.2 mm range, and that they are olivine and pyroxene with minor plagioclase and limonite veining. “Microprobe analyses give the following compositions: olivine, Fa₇; pyroxene, Wo₂Fs₆; plagioclase, An₁₅; one grain of diopside, Wo₄₃Fs₄, was analyzed.”

Additional information given here is based on low power microscopic examination of specimen fragments resulting from section preparation, and on the microscopic examination of a second polished thin section (LEW86220,2; 0.8 cm²) and a polished section LEW86220,3; 0.9 cm²).

The exteriors of the fragments are covered with a polished terrestrial weathering crust of patchy reddish brown to black material. Positive evidence for melt crust was not found, but some of the black material appears to represent the surface expression of heat-altered silicates. Two small surface areas in the mm-size range have a jade-green hue, while a third such surface area was at an edge, revealing both exterior and interior surfaces. Its interior expression was that of cleavage surfaces of

coarse, transparent green crystals, undoubtedly the diopside mentioned above. Approximately 10 such areas were seen on broken surfaces, one of which was 2.5 mm long. A crude estimate based on two sawn surfaces and the two polished section surfaces indicate that 30%–40% of the surface area consists of irregularly distributed metal.

Polished section and polished thin section examination revealed no melt crust, but there is a well developed heat-altered zone. Several areas along silicate edges have 20–50 μm rims of dendritic magnetite precipitated during the ablative, high temperature vitrification of the silicates, indicating that very little material has been lost from this surface. Sulfide veining and kamacite transformed to α_2 penetrate approximately one mm into the specimen. Weathering veins penetrate into the interior of the specimen, particularly along the edges of metal areas; and areas of metal transformed to oxide are prominent near exterior surfaces.

The metal is predominantly kamacite, with occasional well developed Neumann bands. Several taenite-plessite areas associated with schreibersite are present within kamacite. On the basis of optical examination alone, the association observed is kamacite in contact with a very thin border of “clear taenite 1” ($\sim 1 \mu\text{m}$), followed by a region of equal thickness of “cloudy zone,” followed by a comparatively broad area of “clear taenite 2,” and finally transformation into a coarse martensite which occupies most of the area of the structure. This thin border with kamacite is probably tetrataenite, but the optical anisotropy needed for confirmation can not be seen on such a thin rim. Troilite is irregularly distributed, much less abundant than metal, and mainly occurs as single crystals. Several small chromites were also recognized.

The information available suggests that this specimen passed through at least part of the atmosphere as an individual and that it is a silicate-rich area from a group IAB iron meteorite.

LEW86540 (21.0 g).—This aerodynamically shaped, tektite-like specimen is a slightly out-of-round ($2.2 \times 2.4 \text{ cm}$) disk (1.1 cm thick), with a small segment (2–3 mm wide, 2 mm deep) missing from its edge. Anterior and posterior surfaces intersect at a sharp edge which undulates only slightly from a plane. Maximum thickness is approximately at the center of the disk. The two surfaces are smooth, and they have essentially uniform radii of curvature, the radius of the anterior surface being 2–3 cm and that of the posterior surface 6–8 cm.

Surfaces are predominantly reddish-brown due to weathering, have small black patches or remnant fusion crust, and have several patches of iridescent coloring near the edge. Fine streamers of fusion crust ($\sim 0.1 \text{ mm}$) radiate from the stagnation point at the center of the anterior surface to the edge, with a very small accumulation of fusion crust at the edge. Indications of a very fine Widmanstätten pattern stand in relief in several areas of the posterior surface and can be seen under low magnification. Wasson (1990) has classified the meteorite as a finest octahedrite of chemical group IIICD. He reports bulk

values of 18.7 wt% Ni and 0.59 wt% Co.

A slice perpendicular to the plane defined by the edge of the specimen, and slightly to one side of the center of the disk, provided a surface area of 2 cm^2 for metallographic examination. The edge of this section corresponding to the anterior surface has a 10 to 100 μm thick rim of terrestrial weathering products. Remnant fusion crust is present within it and is partially invaded by terrestrial oxides. On the posterior edge, similar fusion crust/terrestrial oxide associations extend along about two-thirds of its length. A layered fusion crust accumulation 120 μm thick has collected at an intersection of anterior and posterior surfaces. Throughout the entire section, kamacite has been heat-altered to α_2 . Widths of kamacite lamellae range from 15 to 40 μm , their lengths being 10 to 100 times their widths. Schreibersites within 800 μm of the anterior surface have been heat-altered and survive in the form of quenched eutectic melts. Within 800 μm of the posterior surface, both eutectic melts and schreibersites melted at their edges are observed. Schreibersites are small (in the 50 to 100 μm range), numerous, and found within kamacite lamellae or at lamellae junctions. A small number of electron microprobe analyses indicate that schreibersite Ni contents range from 46 to 50 wt%. Taenite-bordered martensitic plessite occupies 60% or more of the surface area, and its Ni content is 18 to 19 wt%, in good agreement with Wasson's (1990) bulk Ni value.

Ungrouped Meteorites

ALH84233 (13.6 g).—This reddish-brown and rounded specimen ($2 \times 1.5 \times 1 \text{ cm}$) has a protrusion on one side giving it a shape suggestive of a teardrop, suggesting atmospheric ablation was an important shape-forming process. Several very small areas of remnant fusion crust were tentatively identified, but fusion crust has mainly been obliterated by weathering. One side of the specimen has been more severely weathered, suggesting it was the underside while exposed on the surface.

A median slice through the long axis of the specimen provided an area of approximately 1.5 cm^2 for metallographic examination. Much of the edge of the specimen has been penetrated by 0.1 mm of terrestrial weathering, and in a few areas both remnant fusion crust and weathering products were observed. The metal appears to have been single crystal kamacite with an occasional subgrain boundary that has been transformed throughout by atmospheric heating to a coarse martensite or α_2 structure. Its bulk Ni value as determined by electron microprobe is somewhat greater than 6 wt%. No significant troilite or schreibersite was observed in the metal.

At the base of the elongation where it joins the main body of the specimen, there is a 1 mm^2 area of weathered silicate material. Its external edge has been melted by atmospheric ablation and contains small bodies of troilite and kamacite. On the basis of a small number of microprobe analyses, the silicates seem to be uniform in composition. Olivine (Fa_{20}),

pyroxene (Fs_{17}), and plagioclase ($\text{Ab}_{83}\text{An}_{12}\text{Or}_4$) are present. Prinz et al. (1991) have recently given more detailed information on the silicates.

The data given here does not place this meteorite into one of the recognized structural or chemical classification categories. On the basis of trace element data on the metal, Wasson (1990) has found this to be an ungrouped meteorite.

LEW85369 (6.3 g).—This specimen from Lewis Cliff is small ($1.5 \times 1.5 \times 0.8$ cm), irregularly shaped, pitted, weathered, and covered with a reddish-brown coating of secondary oxides.

A median section through the specimen provided an area of 0.8 cm^2 for metallographic examination. The surface is comprised of about 8 roughly equidimensional metal grains in the 1 to 3 mm^2 size range. Two of these grains have a martensite structure that contains martensite subgrains bordered by thin, irregular bands of kamacite. The large kamacite grains appear to be single crystal kamacite free of inclusions. Individual kamacite grains react differently to nital etchant, some becoming very dark on only brief exposure. Preliminary electron microprobe analysis indicates that the kamacite contains slightly more than one weight percent Si. Terrestrial weathering has penetrated into the center of the sample along kamacite/kamacite grain boundaries and along cleavages. The external surface of the slice is bordered for the most part by about a 0.1 mm rim of terrestrial weathering products. Small areas of remnant fusion crust remain within and under the weathering products. Interior to this and around most of the exterior surface is a heat-altered zone, up to 1.5 mm thick at one point. The two thickest areas of heat-altered zone are at opposite ends of the section along its long axis, suggesting that this may have been an oriented individual during atmospheric passage.

The data given here are insufficient to place this meteorite into one of the recognized classification categories. On the basis of trace element data, Wasson (1990) has found it to be an ungrouped meteorite with compositional similarities to the Horse Creek iron meteorite and to metal nodules from the Mount Egerton stony iron meteorite.

LEW86211 (163.1 g), 86498 (134.2 g).—These two specimens of $4.5 \times 4 \times 4$ cm and $5 \times 3 \times 3$ cm respectively are distinct from all other meteorites in appearance and physical properties and are obviously paired.

This macroscopic description is based on a 72.6 g piece of LEW86211, $4.1 \times 2.9 \times 2.8$ cm, broken from the larger mass during processing. Two-thirds of its surface area is original exterior and the remainder is interior surface. The exterior is a weathered fusion crust, predominantly brown with suggestions of red and yellow, containing occasional patches of retained black fusion crust. There are areas of iridescent coloring, and while smooth to the touch, the surface has an unusual roughness and angularity of appearance when viewed with low

magnification. The areas of interior surface have a hackly appearance and a predominately yellow color that varies from pale yellow to bronze yellow. Under magnification ($\times 20$) the yellow material is seen to be present as globules, as fracture surfaces and crystal faces, and as fine filaments. A few small areas appear to be vugs coated with a drusy material. Whether these vug fillings are indigenous or a weathering phenomenon is not clear, but they may well prove to be indigenous. A few small areas of silicate are present as is an occasional chromite.

Metallographic examination was performed on a 6 cm^2 polished and etched slice removed from the piece described above. A thin heat altered zone is present and can be recognized along edges of both the troilite and metal areas, as well as along edges of the occasional silicate-rich area. The matrix is coarsely crystalline troilite that contains globular metal, with metal and troilite present in roughly equal amounts (40% to 60% troilite depending on the particular subarea selected). This structure suggests an eutectic intergrowth. Troilite crystals are in the mm-size range and are cracked on a one-tenth mm scale. A typical metal globule is 0.3×0.6 mm, although particles larger or much smaller are also present. A martensitic pattern develops on the metal with etching, with centers of these regions containing 8–9 wt% Ni and their edges as high as 20 wt% Ni. Schreibersite was not identified, but preliminary electron microprobe analyses indicated an unusually high phosphorus content within the martensite (0.5 to 0.6 wt%). This is suggestive of an unusually high cooling rate.

The occasional silicate-rich areas are fine-grained, some of these areas are vesicular, and weathering veins have penetrated into some of them. Prinz et al. (1991) have described these associations as highly reduced and consisting of olivine, orthopyroxene, and clinopyroxene with no feldspathic components. Oxygen isotope data establishes it as distinct from other meteorites, and the authors suggest that it is most similar to the low-Ni extreme of the IIE meteorites. Wasson (1990) has classified LEW86211 as an ungrouped meteorite compositionally similar to, but in significant ways different from, low-Ni IIE meteorites.

Discussion

This group of eight meteorites illustrates the unusual distribution of Antarctic iron meteorite types as compared to types recovered elsewhere. An unusually high proportion of ungrouped or anomalous meteorites is observed (Clarke, 1986; Wasson, 1990). Group IIIAB irons are the most abundant among non-Antarctic meteorites, but ALH84165 and GRO85201 are the only two IIIABs so far recovered by ANSMET expeditions. Both the great distance separating their recovery sites and observed chemical differences (Wasson et al., 1989; Wasson, 1990) suggest that they represent separate falls.

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6. Terrestrial Ages of Victoria Land Meteorites Derived from Cosmic-Ray-Produced Radionuclides

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Since 1979, Battelle, Pacific Northwest Laboratories (Battelle-Northwest) has continued to assay Antarctic meteorites for the cosmic-ray-produced radionuclide, ^{26}Al ($t_{1/2} \sim 720,000$ years). This nuclide is assayed rapidly and nondestructively by multiparameter gamma-ray spectroscopy. These measurements have been intended to provide a basis for estimation of the terrestrial residence time of meteorites that have been collected on the Antarctic ice sheet. While the ^{26}Al method alone cannot provide a completely reliable terrestrial age for individual samples, ^{26}Al data can be used to evaluate trends for large groups of samples and provide useful guidance for selecting samples for more detailed study by other methods. Other investigators have performed analyses for several other cosmic-ray-produced radionuclides on some of these same samples.

In addition to ^{26}Al , the isotopes studied and tabulated in this article include ^{53}Mn ($t_{1/2} = 3.7$ million years), ^{10}Be ($t_{1/2} = 1.5$ million years), ^{36}Cl ($t_{1/2} = 300,000$ years), and ^{14}C ($t_{1/2} = 5730$ years). Very sophisticated and labor intensive techniques that involve complicated physical and chemical separations are used for those analyses. Manganese-53 is measured by neutron activation while ^{14}C , ^{10}Be , and ^{36}Cl are measured by accelerator mass spectrometry.

Previous issues of *Smithsonian Contributions to the Earth Sciences* have reviewed the status of cosmogenic radionuclide research on Antarctic meteorites (Evans and Rancitelli, 1980; Evans, Reeves, and Rancitelli, 1982; Nishiizumi, 1984). This article updates that information but expands the data base considerably with the addition of previously unreported information on 214 meteorites. The Battelle-Northwest pro-

gram has measured ^{26}Al in 422 Victoria Land meteorites (Evans, Rancitelli, and Reeves, 1979; Evans and Reeves, 1987), and these data are tabulated in this article, together with published data on four other radionuclides. The tabulation includes 22 ^{10}Be , 79 ^{53}Mn , 54 ^{36}Cl , and 15 ^{14}C measurements. Only information on samples studied in the Battelle-Northwest program is considered here; the tabulation is thus not completely comprehensive. Multiple measurements on the same meteorite have also been excluded in the interest of simplicity. Our information is representative, although the total data base on cosmogenic radionuclides available in the published literature is somewhat larger than that presented. A more complete review of all available data for Antarctic as well as non-Antarctic meteorite finds and falls has recently been compiled and published by Nishiizumi (1987).

Several factors influence the interpretation of cosmogenic radionuclide data when calculating a terrestrial age. Ideally we may assume that cosmic ray interactions in the meteorite preatmospheric main mass produce long-lived radionuclides at a known and constant rate. If the cosmic ray exposure time is long, compared to the half-life of the isotope of interest, the meteorite will fall to earth with a constant saturated activity that will then decay exponentially. The amount of decay provides a measure of the residence time of the meteorite on earth. Saturation activities for ^{26}Al were calculated by Evans and Reeves (1987) to be 59 and 55 dpm/kg for L and H chondrites, respectively. The expected saturation activity of ureilites is given by Wilkening et al. (1973) as 58 ± 4 dpm/kg. The calculations were based on the production rate data of Fuse and Anders (1969). Similarly, the corresponding saturation activities for ^{53}Mn , ^{10}Be , ^{36}Cl , and ^{14}C are 414, 20, 22.8, and 60 dpm/kg respectively, according to the evaluation of Reedy, Arnold, and Lal (1983).

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Several factors may modify the activity of cosmogenic radionuclides found at the time of fall. For example, shielding may reduce the production rate for either abnormally large or unusually small preatmospheric bodies. That effect is more significant for low-energy products such as ^{26}Al , ^{53}Mn , or ^{14}C and less important for high-energy products such as ^{36}Cl . Another factor affecting production is that meteorites may occasionally experience unusual irradiation histories (e.g., solar cosmic ray effects that produce elevated activity). Low-energy products such as ^{26}Al and ^{53}Mn can be affected by a solar component particularly in very small objects. Finally, and most importantly, the cosmic ray exposure period in space following breakup from the parent body may not be long enough to reach radioactive saturation for the isotope of interest. That effect is quite significant for ^{53}Mn or ^{10}Be and is of occasional significance for ^{26}Al . The half-life of ^{36}Cl is sufficiently short that the isotope is almost always found at the saturation value. Chlorine-36 is thus clearly the isotope of choice for the time scale of interest in Antarctica.

In this work, we consider terrestrial ages derived from ^{36}Cl to be the most reliable. Other cosmic ray produced radioisotopes with appropriate half-lives for terrestrial age determination include ^{81}Kr ($t_{1/2} = 210,000$ years), ^{59}Ni ($t_{1/2} = 76,000$ years), and ^{41}Ca ($t_{1/2} = 100,000$). A few ^{81}Kr based ages have been included in this work although the data were not included in the table in the interest of conserving space. For more details see Freundel et al. (1986). ^{81}Kr data are relatively scarce at this time as the nuclide is generally present in low abundances in meteorites and is difficult to measure. Interpretation of ^{81}Kr data is complicated since the production rate of the isotope is sensitive to trace element chemistry. ^{59}Ni and ^{41}Ca data are also rather scarce. Interpretation of data for those isotopes is complicated by neutron capture effects which are typically very size dependent. Terrestrial ages can also be derived with some degree of assurance by combining ^{26}Al and ^{53}Mn data. The longer lived ^{53}Mn is used to estimate exposure age, and the shorter lived ^{26}Al is used to estimate terrestrial age. A convergent solution to a common pair of terrestrial and exposure ages can be obtained by numerical solution to the pair of simultaneous radioactive saturation and decay equations after only a few iterations.

Table 6-1 summarizes a large body of cosmogenic radionuclide data measured on Antarctic meteorites allocated from the U.S. collection. With only five exceptions, all terrestrial ages given in the last column of Table 6-1 were calculated or recalculated specifically for this tabulation. The terrestrial age estimate for the lunar meteorite, ALHA81005, was taken from the work of Nishiizumi, Reedy, and Arnold (1988). Terrestrial age estimates for ALHA77005 (shergottite), ALHA78132 (eucrite), ALHA79017 (eucrite), and EETA79005 (eucrite) were taken from the age calculations of Freundel et al. (1986) based on their ^{81}Kr measurements. ^{36}Cl data were used whenever available to produce firm estimates of terrestrial age; those data are shown as numbers with a one standard deviation

error. The ^{36}Cl method is capable of measuring terrestrial ages greater than approximately 70,000 to 90,000 years. In a few cases, ^{14}C data were used for an age calculation, although most meteorites have been found to be older than the greatest age measurable with ^{14}C (30,000 to 50,000 years). Ages shown in the table as approximate are based on a combination of ^{26}Al and ^{53}Mn data. In most cases where comparison is possible, the two methods agree reasonably well; however, the ^{36}Cl method is clearly more accurate and capable of resolving shorter ages. The remaining terrestrial age estimates in Table 6-1 are based only on ^{26}Al and should be used with great caution. Those ages are intended as conservative limits based on worst-case arithmetic propagation of 1 sigma errors in both the measured and the expected value. That procedure will, in most cases, significantly overestimate the terrestrial age. A minimum upper limit of 200,000 years was assumed for terrestrial ages based on ^{26}Al alone. That number is somewhat arbitrarily based on the authors' best judgement as to the minimum amount of decay resolvable by ^{26}Al data alone.

The samples in Table 6-1 have a wide range of terrestrial ages, with a few specimens having sufficiently short terrestrial ages that they still contain detectable ^{14}C , while a number of samples measured for ^{36}Cl have ages of nearly 1 million years; the oldest sample measured to date is ALHA78153 ($970,000 \pm 100,000$ years). The 970,000 year terrestrial age for ALHA78153 shown in Table 6-1 is derived from ^{36}Cl data; however, a nearly identical age estimate can be obtained from the ^{26}Al data as well. A number of other samples have been found recently that have similarly low ^{26}Al contents and may have terrestrial ages up to 1 million years. Currently available evidence continues to suggest that approximately 1 million years is the approximate age cutoff for the residence time in the Allan Hills region. There are not enough measurements available now to draw firm conclusions about the other regions sampled; however, Nishiizumi (1984) has suggested that the Allan Hills meteorites have a wider range of terrestrial ages and are generally older than other Victoria Land and Yamato meteorites. The distribution of ages and the age cutoff represent important constraints for models of ice movement, meteorite accumulation, and destruction of meteorites by weathering in the Victoria Land region.

Figure 6-1 shows the distribution of ^{26}Al contents for the Antarctic meteorites collected in the Victoria Land region compared with the equivalent treatment for a selection of falls and finds collected worldwide outside Antarctica. For this purpose we have assumed that the terrestrial ages of chondrites outside the Antarctic are, in general, short compared with the half-life of ^{26}Al (i.e., less than 100,000 years). The worldwide data include 135 samples taken from a variety of sources (Evans, Reeves, Rancitelli, and Bogard, 1982; Cressy, 1976; Cameron and Top, 1974; Heyman and Anders, 1967). Approximately one-third of the data originated in our laboratory. The frequency distribution of worldwide data (solid bars) has been renormalized on the figure to give the same integrated

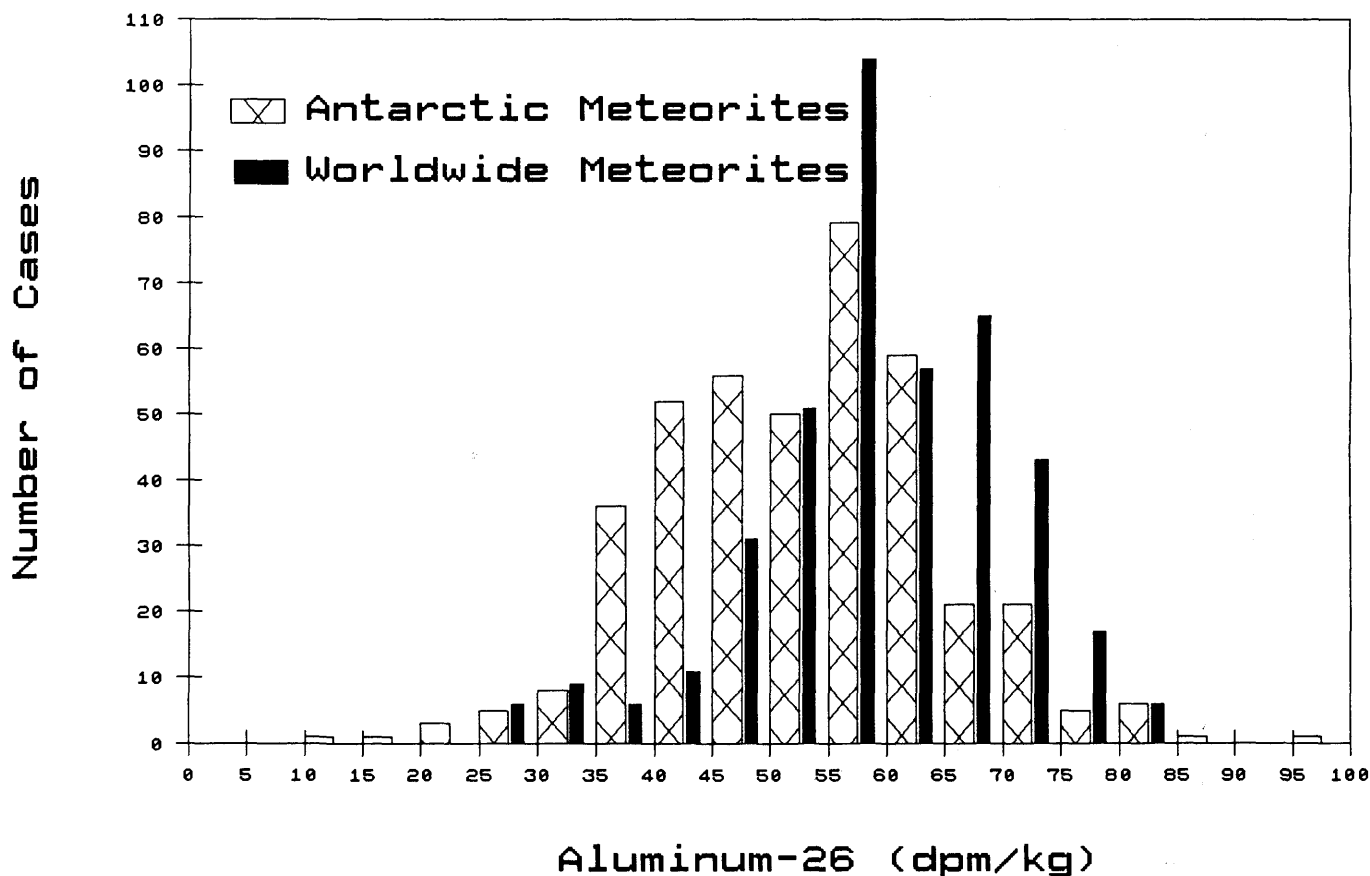


FIGURE 6-1.—Distribution of ²⁶Al contents of ordinary chondrite finds from the Victoria Land region of Antarctica (crosshatched bars) as compared with the distribution worldwide for both falls and finds (solid bars). The frequency distribution of worldwide data has been adjusted to have the same integrated area as for Antarctic specimens. All data are normalized to an L chondrite composition using the saturation values computed from the production rates of Fuse and Anders (1969), and nominal chondritic compositions. No correction was made for exposure age. Worldwide data were taken from a variety of sources (Evans, Reeves, Rancitelli, and Bogard, 1982; Cressy, 1976; Cameron and Top, 1974; Heyman and Anders, 1967).

area as the Antarctic data (crosshatched bars). Only ordinary chondrites (H, L, and LL) are included. The data for H chondrites were multiplied by a factor of 1.07 to correct for the expected differences in production rates caused by compositional differences (Fuse and Anders, 1969). The Antarctic data show a definite shift to lower values. The shift is evident in the excess of samples with ²⁶Al contents between 35 and 50 dpm/kg as well as a corresponding depletion above 65 dpm/kg. Interpretation of the excess of samples with low values is somewhat complicated by the inclusion of a number of paired specimens which may be associated with showers; however, the low values are associated with a wide range of meteorite

types and cannot be attributed strictly to shower effects. It thus appears from a strictly statistical basis that the average age of the collection is a significant fraction of the half-life of ²⁶Al. This observation is consistent with other observations based on more direct methods of terrestrial age determination (i.e., ³⁶Cl or ⁸¹Kr dating) as discussed above.

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TABLE 6-1.—Activity and terrestrial age estimates for Victoria Land meteorites¹.

Specimen number	Class	Activity ²					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
Allan Hills							
ALHA76004	LL3	58 ± 6					< 280
ALHA76005	Eu	89 ± 9	22.8 ± 0.8	402 ± 37		< 1.0	> 34, < 340
ALHA76006	H6	51 ± 5		456 ± 33		< 1.7	> 32, < 200
ALHA76007	L6	45 ± 4		336 ± 26		< 1.2	> 34, ~ 250
ALHA76008	H6	11 ± 1	3.9 ± 0.5	22 ± 3	9.4 ± 1.0	< 1.7	100 ± 70
ALHA77001	L6	52 ± 5		422 ± 13	20.1 ± 1.2		< 140
ALHA77002	L5	30 ± 3		255 ± 8	4.6 ± 1.1		690 ± 170
ALHA77003	C3	45 ± 5	19 ± 2	317 ± 13	18.4 ± 1.2	0.62 ± 0.06	90 ± 80
ALHA77004	H4	52 ± 5		326 ± 13	15.2 ± 0.5	0.65 ± 0.02	180 ± 70
ALHA77005	Sher	55 ± 2	14 ± 0.7	270 ± 15	4.6 ± 0.9		190 ± 70
ALHA77007	H5	36 ± 2*					< 640
ALHA77008	L6	49 ± 3*					< 410
ALHA77009	H4	32 ± 2		352 ± 19	10.7 ± 0.2		330 ± 60
ALHA77010	H4	49 ± 3					< 340
ALHA77011	L3	39 ± 4		162 ± 9			~ 330
ALHA77012	H5	78 ± 3					< 200
ALHA77013	L3	44 ± 5*					< 580
ALHA77014	H5	55 ± 3					< 200
ALHA77015	L3	36 ± 4	14.4 ± 1.2	162 ± 8			~ 430
ALHA77016	H5	51 ± 5*					< 330
ALHA77017	H5	53 ± 5*					< 280
ALHA77018	H5	58 ± 7*					< 220
ALHA77019	L6	51 ± 4*					< 380
ALHA77021	H5	63 ± 7*					< 200
ALHA77023	H5	78 ± 9*					< 200
ALHA77025	H5	54 ± 5					< 280
ALHA77026	H5	17 ± 9*					< 2,300
ALHA77042	H5	53 ± 10*					< 400
ALHA77047	L3	50 ± 6*					< 450
ALHA77050	L3	36 ± 4*					< 780
ALHA77052	L3	42 ± 3*					< 580
ALHA77060	LL5	38 ± 3*					< 690
ALHA77062	H5	47 ± 5					< 430
ALHA77071	H5	55 ± 6					< 280
ALHA77078	H5	67 ± 8*					< 200
ALHA77081	H?	42 ± 4					< 550
ALHA77084	H5	53 ± 7*					< 340
ALHA77085	H5	37 ± 4*					< 690
ALHA77086	H5	58 ± 6					< 220
ALHA77087	H5	41 ± 10*					< 750
ALHA77088	H5	55 ± 6*					< 280
ALHA77092	H5	44 ± 7*					< 580
ALHA77111	H6	20 ± 7*					< 1640
ALHA77112	H5	29 ± 15*					< 1640
ALHA77114	H5	47 ± 9*					< 530
ALHA77115	L3	48 ± 3		173 ± 9			~ 130
ALHA77117	L5	45 ± 17*					< 840
ALHA77118	H5	53 ± 5					< 320
ALHA77124	H5	70 ± 7					< 200
ALHA77126	H5	48 ± 14*					< 400
ALHA77130	H5	51 ± 8*					< 400
ALHA77131	H6	92 ± 11*					< 200
ALHA77132	H5	42 ± 2*					< 500
ALHA77139	H5	53 ± 6*					< 300

¹Average saturated activity: ²⁶Al 59 ± 9 (L), 55 ± (H); ⁵³Mn: 414 ± 50; ¹⁰Be: 20 ± 2; ³⁶Cl: 22.8 ± 3.1; ¹⁴C: 60.²Activity: ²⁶Al, ¹⁴C: dpm/kg meteorite; ⁵³Mn: dpm/kg (Fe+1/3Ni); ³⁶Cl: dpm/kg metal.

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
ALHA77140	L3	40 ± 4		178 ± 10			~ 330
ALHA77143	H5	57 ± 9*					< 280
ALHA77144	H6	56 ± 6					< 260
ALHA77149	H6	52 ± 9*					< 400
ALHA77150	L6	71 ± 3*					< 200
ALHA77157	H6	52 ± 3*					< 280
ALHA77160	L3	50 ± 7*					< 480
ALHA77162	L6	50 ± 15*					< 300
ALHA77163	L3	57 ± 9*					< 610
ALHA77164	L3	44 ± 5		156 ± 8			< 200
ALHA77165	L3	46 ± 8*					< 1,440
ALHA77166	L3	35 ± 2*					< 750
ALHA77167	L3	37 ± 2		137 ± 7			< 350
ALHA77168	H5	52 ± 13*					< 500
ALHA77171	H5	58 ± 13*					< 350
ALHA77173	H5	59 ± 15*					< 370
ALHA77174	H5	25 ± 12*					< 1,640
ALHA77175	L3	24 ± 14*					< 2,000
ALHA77176	L3	48 ± 7*					< 530
ALHA77177	H5	54 ± 3					< 260
ALHA77180	L6	56 ± 2*		350 ± 18			< 240
ALHA77181	H5	44 ± 9*					< 610
ALHA77182	H5	41 ± 4		297 ± 16			< 550
ALHA77183	H6	38 ± 2*					< 605
ALHA77184	H5	48 ± 2*					< 360
ALHA77185	L3	45 ± 11*					< 360
ALHA77186	H5	59 ± 3*					< 200
ALHA77187	H5	66 ± 7*					< 200
ALHA77188	H5	61 ± 2*					< 200
ALHA77190	H4	51 ± 3					< 320
ALHA77191	H4	56 ± 4					< 240
ALHA77192	H4	55 ± 6					< 300
ALHA77197	L3	45 ± 11*					< 360
ALHA77208	H4	52 ± 3					< 300
ALHA77209	H6	52 ± 8*					< 370
ALHA77211	L3	60 ± 12*					< 480
ALHA77214	L3	56 ± 6	15 ± 1	151 ± 6	17.0 ± 8	0.35 ± 0.03	130 ± 80
ALHA77215	L3	36 ± 4					< 780
ALHA77216	L3	40 ± 3	21 ± 1	402 ± 17			< 630
ALHA77217	L3	38 ± 3		377 ± 15			< 690
ALHA77221	H4	57 ± 2*					< 200
ALHA77223	H4	56 ± 2*					< 200
ALHA77224	H4	51 ± 3					< 320
ALHA77225	H4	51 ± 3					< 320
ALHA77230	L4	51 ± 3		362 ± 15			~ 130
ALHA77232	H4	54 ± 3					< 260
ALHA77233	H4	47 ± 3					< 410
ALHA77240	H5	71 ± 11*					< 200
ALHA77241	L3	35 ± 2*					< 750
ALHA77242	H5	47 ± 6*					< 450
ALHA77244	L3	40 ± 7*					< 750
ALHA77245	H5	40 ± 5*					< 610
ALHA77246	H6	67 ± 4*					< 200
ALHA77247	H5	59 ± 8*					< 220
ALHA77248	H6	27 ± 3*					< 1,000
ALHA77249	L3	37 ± 2		181 ± 9	14.9 ± 0.5		180 ± 70
ALHA77251	L6	52 ± 7*					< 430
ALHA77252	L3	42 ± 2*					

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
ALHA77253	H5	56 ± 9*					< 300
ALHA77254	L5	53 ± 2*					< 300
ALHA77258	H6	29 ± 2	20 ± 1	434 ± 18	12.2 ± 0.4		270 ± 70
ALHA77259	H5	49 ± 2					< 340
ALHA77260	L3	37 ± 2		150 ± 8			~ 380
ALHA77261	L6	36 ± 4	22.7 ± 1.4	302 ± 13	11.1 ± 0.6		310 ± 80
ALHA77262	H4	47 ± 5		327 ± 13	21.7 ± 2.0		< 100
ALHA77266	H5	42 ± 2*					< 500
ALHA77267	L5	61 ± 4*					< 200
ALHA77268	H5	51 ± 2*		319 ± 17	18.3 ± 0.4		100 ± 70
ALHA77269	L6	49 ± 3					< 410
ALHA77270	L6	40 ± 3		494 ± 20	6.7 ± 0.1		530 ± 60
ALHA77271	H6	39 ± 2		283 ± 15	19.4 ± 0.8		< 140
ALHA77272	L6	35 ± 4	18 ± 2	213 ± 11	6.6 ± 0.3	< 0.5	540 ± 80
ALHA77273	L6	31 ± 2		224 ± 11	6.2 ± 0.3		560 ± 80
ALHA77274	H5	53 ± 2					< 200
ALHA77275	H5	43 ± 8*					< 610
ALHA77277	L6	55 ± 2					< 220
ALHA77278	LL3	28 ± 3		264 ± 11	10.9 ± 0.7		320 ± 80
ALHA77279	H5	39 ± 2*					< 580
ALHA77280	L6	44 ± 2		325 ± 16	12.2 ± 0.3		270 ± 70
ALHA77281	L6	42 ± 2*		503 ± 27			~ 330
ALHA77282	L6	49 ± 3		384 ± 17	12.1 ± 0.4	1.07 ± 0.24	270 ± 70
ALHA77284	L6	45 ± 5					< 550
ALHA77285	H6	38 ± 4	16.8 ± 0.8	394 ± 16	13.6 ± 0.5		220 ± 70
ALHA77286	H4	54 ± 4					< 260
ALHA77287	H5	57 ± 2					< 200
ALHA77288	H6	45 ± 3					< 480
ALHA77293	L6	66 ± 5*					< 200
ALHA77294	H5	61 ± 4		433 ± 17	20.8 ± 0.6	1.6 ± 0.3	< 30 ± 2
ALHA77295	EH4	57 ± 4*					< 250
ALHA77296	L6	67 ± 4					< 220
ALHA77297	L6	70 ± 7	25.0 ± 0.9	428 ± 17	19.6 ± 0.2	< 0.6	< 130
ALHA77299	H3	43 ± 4		317 ± 19	18.9 ± 0.8		< 160
ALHA77300	H5	54 ± 4					< 260
ALHA77301	L6	41 ± 6*					< 690
ALHA77303	L3	45 ± 5*					< 550
ALHA77304	L4	50 ± 3		211 ± 9			~ 130
ALHA78001	H5	50 ± 4					< 340
ALHA78003	L6	59 ± 4					< 220
ALHA78004	H5	49 ± 8*					< 530
ALHA78005	H5	56 ± 11*					< 350
ALHA78012	H5	68 ± 9*					< 200
ALHA78015	LL3	48 ± 8*					< 550
ALHA78027	H5	78 ± 8*					< 200
ALHA78038	L3	36 ± 3		170 ± 9			< 430
ALHA78039	L6	42 ± 3					< 580
ALHA78040	Eu	93 ± 5		428 ± 19			< 200
ALHA78041	L3	38 ± 3					< 690
ALHA78042	L6	45 ± 2					< 480
ALHA78043	L6	38 ± 3	19.4 ± 0.7	457 ± 22	7.3 ± 0.3		490 ± 70
ALHA78044	L4	51 ± 4					< 380
ALHA78045	L6	34 ± 3		276 ± 18	4.0 ± 0.2		750 ± 80
ALHA78046	L3	46 ± 5					< 530
ALHA78047	H5	33 ± 1*					< 720
ALHA78048	L6	59 ± 5					< 240
ALHA78049	H5	52 ± 3					< 300
ALHA78050	L6	44 ± 3					< 530

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
ALHA78051	H4	38 ± 3					< 530
ALHA78052	H5	56 ± 4					< 630
ALHA78053	H4	56 ± 3					< 220
ALHA78063	LL6	48 ± 7*					< 530
ALHA78074	L6	66 ± 3					< 200
ALHA78075	H5	49 ± 3					< 360
ALHA78076	H6	52 ± 4		427 ± 18	16.9 ± 0.5		130 ± 70
ALHA78077	H4	42 ± 3					< 530
ALHA78078	L6	49 ± 3					< 410
ALHA78080	H5	75 ± 7*					< 200
ALHA78082	LL6	49 ± 5*					< 450
ALHA78085	H5	50 ± 2*					< 320
ALHA78101	L6	48 ± 3*					< 430
ALHA78102	H5	35 ± 3		323 ± 17	14.0 ± 0.6		210 ± 70
ALHA78103	L6	58 ± 3		453 ± 24	10.7 ± 1.2		330 ± 110
ALHA78104	L6	53 ± 3		366 ± 19	20.1 ± 1.7		< 150
ALHA78105	L6	61 ± 7		462 ± 21	12.5 ± 0.3		260 ± 70
ALHA78106	L6	44 ± 4					< 550
ALHA78107	H5	54 ± 3					< 260
ALHA78108	H5	55 ± 3*					< 260
ALHA78109	LL5	46 ± 3		444 ± 28	12.4 ± 0.5		260 ± 70
ALHA78110	H5	58 ± 3					< 200
ALHA78111	H5	53 ± 3*					< 280
ALHA78112	L6	42 ± 3	21 ± 2	347 ± 16	13.4 ± 0.5		230 ± 70
ALHA78114	L6	38 ± 2	14 ± 2	360 ± 14	7.8 ± 0.3		460 ± 70
ALHA78115	H6	43 ± 3	16 ± 2	334 ± 14	21.6 ± 0.6		< 90
ALHA78116	H5	36 ± 2*					< 660
ALHA78119	L3	42 ± 3*					< 580
ALHA78120	H4	47 ± 7*					< 470
ALHA78121	H5	56 ± 6*					< 240
ALHA78124	H6	54 ± 8*					< 330
ALHA78126	L6	45 ± 3					< 500
ALHA78127	L6	46 ± 3*					< 480
ALHA78128	H5	34 ± 2			15.2 ± 0.4		180 ± 70
ALHA78129	H5	59 ± 3*					< 200
ALHA78130	L6	51 ± 4	18 ± 2	380 ± 15	20.7 ± 0.5		< 110
ALHA78131	L6	40 ± 3		402 ± 19	9.3 ± 0.4		390 ± 70
ALHA78132	Eu	68 ± 4					120 ± 50
ALHA78133	L6	50 ± 6*					< 450
ALHA78134	H4	61 ± 3		258 ± 14	22.9 ± 1.6		< 90
ALHA78135	H6	52 ± 6*					< 330
ALHA78136	H5	64 ± 8*					< 200
ALHA78137	H6	58 ± 6*					< 200
ALHA78141	H5	75 ± 8*					< 200
ALHA78142	L5	60 ± 11*					< 340
ALHA78145	H6	63 ± 11*					< 200
ALHA78147	H5/6	56 ± 10*					< 330
ALHA78149	L3	72 ± 7*					< 200
ALHA78153	LL6	22 ± 1			2.44 ± 0.25		970 ± 100
ALHA78157	H4	43 ± 10*					< 670
ALHA78159	H5	53 ± 6*					< 300
ALHA78162	L3	36 ± 9*					< 960
ALHA78164	H5	72 ± 9*					< 200
ALHA78170	H3	48 ± 4					< 410
ALHA78173	H5	64 ± 5					< 200
ALHA78190	H5	67 ± 6					< 200
ALHA78194	H5	74 ± 5					< 200
ALHA78235	L3	38 ± 5					< 750

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
ALHA78251	L6	56 ± 6					< 320
ALHA79002	H6	34 ± 2					< 720
ALHA79007	L6	71 ± 4					< 200
ALHA79012	H5	52 ± 3					< 300
ALHA79013	H5	59 ± 3					< 200
ALHA79016	H6	50 ± 3					< 340
ALHA79017	Eu	97 ± 3	23.8 ± 0.8	530 ± 75			< 120 ± 50
ALHA79018	L6	58 ± 3					< 220
ALHA79025	H5	53 ± 3					< 300
ALHA79026	H5	60 ± 4					< 200
ALHA79027	L6	42 ± 3					< 580
ALHA79029	H5	49 ± 3					< 380
ALHA79033	L6	72 ± 4					< 200
ALHA79039	H4	42 ± 2					< 500
ALHA79045	L3	44 ± 3					< 530
ALHA79046	H5	50 ± 3*					< 340
ALHA79053	H5	60 ± 3*					< 200
ALHA80102	Eu	83 ± 5		526 ± 27			< 300
ALHA80103	L6	57 ± 3		465 ± 70			< 100
ALHA80105	L6	58 ± 3		443 ± 31			< 100
ALHA80106	H4	52 ± 3					< 320
ALHA80107	L6	59 ± 3					< 200
ALHA80108	L6	62 ± 4					< 200
ALHA80110	L6	65 ± 4					< 200
ALHA80112	L6	59 ± 3					< 200
ALHA80113	L6	57 ± 3					< 240
ALHA80114	L6	62 ± 3					< 200
ALHA80115	L6	56 ± 3					< 260
ALHA80116	L6	60 ± 2*					< 200
ALHA80117	L6	62 ± 3*					< 200
ALHA80125	L6	58 ± 4					< 240
ALHA80128	H4	59 ± 4					< 200
ALHA80129	H5	56 ± 3		289 ± 20			< 100
ALHA80132	H5	58 ± 3		281 ± 21			< 200
ALHA81005	Ano	46 ± 3	4.1 ± 0.5	173 ± 12	8.8 ± 0.4		200–400
ALHA81017	L5	54 ± 2*					< 280
ALHA81019	H5	41 ± 2*					< 530
ALHA81020	H5	54 ± 3					< 230
ALHA81022	H4	44 ± 2*					< 450
ALHA81024	L3	40 ± 2*					< 610
ALHA81025	L3	45 ± 3*					< 500
ALHA81026	L6	63 ± 3*					< 200
ALHA81029	L6	39 ± 2*					< 630
ALHA81031	L3	30 ± 1*					< 890
ALHA81032	L3	45 ± 2*					< 480
ALHA81038	H6	35 ± 2*					< 690
ALHA81039	H5	56 ± 2*					< 200
ALHA81040	L4	65 ± 3*					< 200
ALHA81041	H4	52 ± 2*					< 280
ALHA81042	H5	50 ± 2*					< 320
ALHA81043	H4	56 ± 3*					< 220
ALHA81044	H4	53 ± 2*					< 260
ALHA81048	H4	58 ± 3*					< 200
ALHA81064	H5	59 ± 3*					< 200
ALHA81094	H6	58 ± 3*					< 200
ALHA81099	L6	80 ± 4*					< 200
ALHA81100	H5	49 ± 2*					< 340
ALHA81101	URE	35 ± 2*					< 750

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
ALHA81102	H6	36 ± 2*					< 660
ALHA81103	H6	49 ± 2*					< 340
ALHA81104	H4	57 ± 2*					< 200
ALHA81105	H4	54 ± 3*					< 260
ALHA81107	L6	70 ± 3					< 200
ALHA81111	H6	38 ± 2*					< 610
ALHA81112	H6	39 ± 2*					< 580
ALHA81113	H5	61 ± 3*					< 200
ALHA81115	H5	40 ± 2*					< 550
ALHA81119	L4	36 ± 2*					< 660
ALHA81161	H5	54 ± 2*					< 240
ALHA81183	H5	53 ± 3*					< 280
ALHA81247	L6	44 ± 2*					< 500
ALHA81251	LL3	45 ± 2*					< 480
ALHA81260	E6	33 ± 2*					< 720
ALHA81295	H5	52 ± 2*					< 280
ALH82102	H5	39 ± 2			21.7 ± 0.9		< 100
ALH82104	L5	62 ± 2*					< 200
ALH82105	L6	45 ± 2*					< 480
ALH82106	URE	63 ± 6*					< 200
ALH82118	L6	59 ± 3*					< 200
ALH82122	H5	44 ± 2*					< 450
ALH82125	L6	36 ± 2*					< 720
ALH82126	H4	54 ± 2*					< 240
ALH82130	URE	62 ± 5*					< 200
ALH83001	L4	40 ± 1*					< 560
ALH83002	L5	28 ± 1*					< 960
ALH83003	H5	39 ± 2*					< 580
ALH83004	L6	53 ± 2*					< 300
ALH83005	H5	34 ± 2*					< 720
ALH83006	H5	53 ± 2*					< 260
ALH83007	L3	58 ± 2*					< 200
ALH83008	L3	38 ± 2*					< 660
ALH83010	L3	50 ± 2*					< 360
ALH83011	L5	44 ± 2*					< 500
ALH83013	H6	58 ± 3*					< 200
ALH83067	L6	42 ± 2*					< 550
ALH83070	LL6	62 ± 3*					< 200
ALH84057	L6	42 ± 2*					< 500
ALH84059	H4	43 ± 2*					< 480
ALH84060	H5	59 ± 2*					< 200
ALH84061	L6	46 ± 2*					< 450
ALH84062	L6	46 ± 2*					< 450
ALH84063	L5	54 ± 2*					< 260
ALH84066	L6	73 ± 3*					< 200
ALH84067	H5	54 ± 2*					< 240
ALH84068	H5	46 ± 2*					< 450
ALH84069	H5	40 ± 2*					< 550
ALH84070	L6	52 ± 4*					< 360
ALH84071	H6	45 ± 1*					< 410
ALH84072	L6	41 ± 2*					< 580
ALH84073	H5	34 ± 1*					< 690
ALH84074	H5	33 ± 1*					< 720
ALH84075	H5	49 ± 2*					< 340
ALH84076	H5	64 ± 3*					< 200
ALH84077	H5	45 ± 2*					< 430
ALH84078	H5	65 ± 3*					< 200
ALH84079	L6	65 ± 3*					< 200

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
ALH84080	L6	26 ± 1*					< 1040
ALH84081	LL6	46 ± 2*					< 450
ALH84082	H6	40 ± 2*					< 550
ALH84083	H6	38 ± 2*					< 610
ALH84084	H4	59 ± 2*					< 200
ALH84085	H5	49 ± 2*					< 340
ALH84086	LL3	56 ± 2*					< 200
ALH84087	L6	69 ± 3*					< 200
ALH84088	H5	60 ± 3*					< 200
ALH84089	H5	49 ± 2*					< 340
ALH84090	L6	40 ± 2*					< 610
ALH84091	H5	50 ± 2*					< 320
ALH84092	L6	63 ± 3*					< 200
ALH84093	H6	69 ± 4*					< 200
ALH84094	H5	54 ± 3*					< 260
ALH84095	L6	33 ± 2*					< 820
ALH84096	C4	70 ± 4*					< 200
ALH84097	L6	63 ± 4*					< 200
ALH84098	H5	65 ± 3*					< 200
Bates Nunatak							
BTNA78001	L6	65 ± 4					< 200
BTNA78004	LL6	49 ± 3		361 ± 22	19.5 ± 0.4		< 130
BTNA78005	H6	40 ± 2					< 550
Elephant Moraine							
EETA79001	Sher	23 ± 3	4.7 ± 0.2	65 ± 15	8.1 ± 0.6		< 60
EETA79003	L6	47 ± 3		333 ± 12	16.8 ± 2.2		< 250
EETA79005	Eu	63 ± 3					180 ± 30
EETA79007	H5	47 ± 3					< 430
EETA79010	L6	67 ± 4					< 200
EETA79011	Eu	79 ± 6	11.0 ± 0.6				< 430
Meteorite Hills							
META78001	H4	53 ± 3		429 ± 17	20.5 ± 0.8		< 130
META78002	L6	47 ± 3		237 ± 19	21.4 ± 0.5		< 90
META78003	L6	50 ± 3					< 380
META78004	L6	49 ± 4					< 430
META78005	L6	44 ± 3		302 ± 16	20.4 ± 0.4		< 110
META78006	H6	60 ± 4		519 ± 28	20.9 ± 0.5		< 100
META78009	H5	68 ± 4					< 200
META78010	H5	56 ± 3		484 ± 25	21.8 ± 0.5		< 80
META78011	H5	39 ± 3					< 600
META78013	H6	61 ± 4					< 200
META78014	H5	68 ± 4					< 200
META78015	L5	42 ± 5					< 630
META78018	H5	58 ± 4					< 200
META78019	H6	108 ± 6			10.0 ± 2.0		< 100
META78021	L6	52 ± 12					< 550
META78023	H6	54 ± 5					< 340
META78025	H6	33 ± 2					< 750
META78027	H6	69 ± 6					< 200
META78028	L6	56 ± 3		301 ± 19	21.3 ± 0.6	1.01 ± 0.03	32 ± 1
Mount Baldr							
MBRA76001	H6	73 ± 4		397 ± 34		1.19 ± 0.30	31 ± 3
Outpost Nunatak							
OTTA80301	H3	82 ± 3					< 200

TABLE 6-1.—Continued.

Specimen number	Class	Activity					Terrestrial age × 1000 y
		²⁶ Al (7.2 × 10 ⁵ y)	¹⁰ Be (1.5 × 10 ⁶ y)	⁵³ Mn (3.7 × 10 ⁶ y)	³⁶ Cl (3.0 × 10 ⁵ y)	¹⁴ C (5730 y)	
Reckling Peak							
RKPA78001	L6	49 ± 3				< 400	
RKPA78003	L6	50 ± 3		363 ± 16		< 130	
RKPA78004	H4	39 ± 2			19.8 ± 0.4	< 580	
RKPA78005	H5	65 ± 5				< 200	
RKPA79001	L6	58 ± 4		280 ± 1	24.0 ± 0.6	< 70	
RKPA79002	L6	60 ± 3				< 200	
RKPA79003	H6	59 ± 4				< 200	
RKPA79004	H5	45 ± 3				< 480	
RKPA79009	H6	47 ± 2				< 380	
RKPA79013	L5	56 ± 4				< 280	
RKPA80201	H6	52 ± 3	18.1 ± 0.6	292 ± 15	21.6 ± 0.3	< 80	
RKPA80202	L6	53 ± 3				< 320	
RKPA80209	L5	44 ± 2				< 500	
RKPA80216	L4	71 ± 5				< 200	
RKPA80219	L6	60 ± 2				< 200	
RKPA80222	LL6	61 ± 4				< 200	
RKPA80223	H5	54 ± 2				< 240	
RKPA80231	H6	62 ± 4		205 ± 11	22.7 ± 0.5	< 80	
RKPA80232	H4	62 ± 4				< 200	
RKPA80233	H5	67 ± 4				< 200	
RKPA80234	LL5	58 ± 3				< 200	
RKPA80235	LL6	55 ± 3				< 200	
RKPA80237	H4	46 ± 3				< 450	
RKPA80251	H5	49 ± 4				< 380	
RKPA80254	H6	60 ± 2				< 200	
RKPA80256	L3	62 ± 4				< 200	
RKPA80262	H6	40 ± 4				< 610	
RKPA80264	L6	48 ± 2				< 410	
RKPA80267	H4	44 ± 2				< 450	

References:

- Column 1 (²⁶Al): Evans et al., 1979, 1980, 1982, 1987; Tuniz et al., 1983; Evans, Wacker, and Reeves, herein (data marked with asterisks is previously unpublished).
- Column 2 (¹⁰Be): Moniot et al., 1982; Nishiizumi, Arnold, Imamura, Inoue, and Honda, 1982; Nishiizumi, Arnold, Klein, and Middleton, 1982; Nishiizumi, Klein, Middleton, Elmore, Kubiak, and Arnold, 1986; Nishiizumi, Elmore, Kubik, Bonani, Suter, Wolfli, and Arnold, 1986; Tuniz et al., 1983; Vogt et al., 1986.
- Column 3 (⁵³Mn): Imamura et al., 1979; Nishiizumi et al., 1979, 1981, 1983; Nishiizumi, Klein, Middleton, Elmore, Kubiak, and Arnold, 1986; Nishiizumi, Elmore, Kubik, Bonani, Suter, Wolfli, and Arnold, 1986; Nishiizumi, 1987; Nishiizumi, Reedy, and Arnold, 1988; Goswami and Nishiizumi, 1983.
- Column 4 (³⁶Cl): Nishiizumi et al., 1979, 1981, 1983; Nishiizumi, Klein, Middleton, Elmore, Kubiak, and Arnold, 1986; Nishiizumi, Elmore, Kubik, Bonani, Suter, Wolfli, and Arnold, 1986; Nishiizumi, 1987; Nishiizumi, Reedy, and Arnold, 1988.
- Column 5 (¹⁴C): Fireman, 1979, 1980, 1983; Fireman and Norris, 1981; Andrews et al., 1982.
- Column 6 (age): Evans, Wacker, and Reeves, herein; Nishiizumi, Reedy, and Arnold, 1988; Freundel et al., 1986.

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7. Natural Thermoluminescence Levels and the Recovery Location of Antarctic Meteorites

Fouad A. Hasan, Roberta Score, Benjamin M. Myers, Hazel Sears, William A. Cassidy, and Derek W.G. Sears

In this article, the levels of natural thermoluminescence in 379 Antarctic meteorites are reported; 86 samples were from the 1985 collection at the Allan Hills site, 88 were collected in the Lewis Cliff region during the 1985–1986 season and 165 were collected at the Lewis Cliff sites during the 1986–1987 field season. An additional four samples came from the Allan Hills site in 1986, and 36 came from six other ice fields. The distributions of natural thermoluminescence data for the 1985 Allan Hills and 1986 Lewis Cliff collections are similar, with peaks in the histograms at 32–63 krad with values ranging between <1 krad and 327 ± 3 krad. On the basis of a study of 23 meteorites of known ^{26}Al content, the natural TL data for these two collections seem consistent with the majority of the meteorites having terrestrial ages of $150,000 \pm 100,000$ years, while a smaller fraction fall in the $400,000 \pm 200,000$ year range. On the other hand, samples from the 1985 Lewis Cliff collections show a greater proportion of samples with natural thermoluminescence in the 5–20 krad range, consistent with the majority having ages in the order of $400,000 \pm 200,000$ years. The difference within the samples collected at Lewis Cliff is related to collection site, the meteorites collected at Meteorite Moraine having a peak at 50–63 krad, with relatively little spread in natural TL, while the meteorites collected on the Lewis Cliff Ice Tongue include a larger proportion with natural TL in the 5–20 krad range. There seems to be a trend in natural TL with location on the Lewis Cliff Ice Tongue, with natural TL levels tending to be higher in the northern part of the Tongue compared with the southern part, but it is not clear if this is an effect of concentration mechanism or a few major

pairings. 14% of the 379 samples have low natural TL (<5 krad), which can be attributed to recent heating (close solar passage, shock, or atmospheric heating). Three meteorites have extremely high natural TL strongly suggestive of high radiation doses or low temperatures in space (these are ALH85033, LEW85448, and LEW86286), while a further 18 have natural TL values in excess of 100 krad and possibly experienced high extraterrestrial radiation doses or low temperatures.

Introduction

The mineralogical and petrographic surveys made on Antarctic meteorites as part of their initial description identify meteorites which are members of rare or previously unknown classes. However, they do not generally identify members of well-populated classes which have experienced unusual histories, such as particularly long or short terrestrial ages, unusual orbits, or other events resulting in anomalous thermal or radiation histories. To some degree, ^{26}Al measurements provide such information. Natural thermoluminescence (TL) measurements provide data which is complementary to the information available using cosmogenic isotopes and other techniques, and can help in the identification of meteorites with interesting and unusual histories. They can also provide an indication of relative terrestrial ages, and TL measurements can be useful in identifying fragments of a single meteorite (i.e., pairing). The natural thermoluminescence of meteorites was recently reviewed by Sears and Hasan (1986) and Sears (1988).

Thermoluminescence is a measure of the number of excited state electrons in a suitable crystalline lattice. In the chondritic meteorites the lattice is usually feldspar, but it can, on occasion, be various calcic minerals, forsterite, enstatite, quartz, or other trace constituents. The means of excitation is the passage of ionizing radiations, and natural thermoluminescence measurements have successfully been applied to radiation dosimetry and pottery dating for many years; in both cases the TL level is

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used to determine the absorbed dose. In meteorites, because of the larger dose rates and longer time scales involved, the number of excited electrons is determined by an equilibrium between the rate of excitation and de-excitation, the de-excitation being a thermally controlled process. Simple theoretical treatments yield the following relationship between natural TL level (k), dose rate (R) and temperature (T , in $^{\circ}\text{K}$):

$$k = \frac{k_m}{1 + \frac{s}{aR} e^{\frac{-E}{kT}}}$$

where the other parameters are factors describing the TL process: s , the Arrhenius factor; k is Boltzmann's constant; E is the difference in energy of the excited state electrons and the conduction band; a is the rate constant for excitation of electrons; k_m is the maximum TL that can be induced (e.g., Sears, 1988). Any event in the history of a meteorite which involves a change in radiation dose and temperature will affect natural TL levels to some extent.

The calculated black-body temperature for a meteorite at 1 a.u. is 240 K (assuming plausible values for size and albedo) and dose rates are in the order of 1 rad/year. On earth, temperatures and dose rates are probably around 293 and 1 mrad/year, respectively. A relationship between natural TL and terrestrial age is therefore to be expected as the equilibrium TL level falls from its extraterrestrial value to its terrestrial value (Sears and Mills, 1974; Melcher, 1981a; McKeever, 1982). Thus, taking $s = 2 \times 10^{13}/\text{sec}$, $E = 1.43 \text{ eV}$ (McKeever, 1982), this simple treatment suggests that at temperatures observed in the central U.S. (say 15°C) natural TL levels decay by a factor of 20 in about 5×10^4 years, while at Antarctic temperatures (say -5°C) the TL fades by a factor of about 20 in 3×10^6 years. This relationship between natural TL and terrestrial age is borne out, to some degree quantitatively, by studies in which natural TL levels are compared with terrestrial ages determined by cosmogenic isotopes (Sears and Durrani, 1980; Hasan et al., 1987, see below). It is the case, however, that a small proportion of meteorites have low levels of natural TL which cannot be attributed to large terrestrial ages, and these must have experienced a recent heating event sufficient to lower their natural TL.

At a perihelion of 0.722 a.u. (the smallest perihelion observed for bright fireballs falling into the Prairie Network camera system), the black body temperature is 236°K . The Lost City meteorite had an orbit with a perihelion of 0.967 a.u., at which distance the black body temperature is 275°K . Substitution of these temperature values into the above equation shows that a factor of 100 difference in natural TL level could result from these differences in perihelion (McKeever and Sears, 1980; Melcher, 1981b).

Of course, there are other means by which the meteorite could have been heated, such as shock-heating. The temperatures involved do not have to be high, but it is necessary for the heating to have occurred sufficiently recently that the equilibrium has not had time to re-establish itself. This time period is

unclear, but theoretical treatments seem to indicate time periods in the order of 10^5 years. Another major heating event is passage through the atmosphere, but the effects are limited to the outermost centimeter or less (Vaz, 1971; Sears, 1975; Melcher, 1979). In addition, a factor of two variation in natural TL levels due to gradients in the cosmogenic dose rate throughout meteorites has been reported (Vaz, 1971; Sears, 1975; Lalou et al., 1970).

Many of these factors appear to have been involved in determining the natural thermoluminescence levels in 23 Antarctic meteorites of known ^{26}Al activity discussed by Hasan et al. (1987). In Figure 7-1 the earlier data have been replotted using our current methods of natural TL data reduction (see below) and normalizing the ^{26}Al activity to Si, the major target for ^{26}Al production. (These changes result in a slightly improved correlation coefficient, 0.69 compared to 0.62 in the paper by Hasan et al. (1987). While 17 meteorites lie on or near a regression line, six plot well below the line and have presumably suffered recent heating. Two of the six are shock-blackened L6 chondrites (RKPA79001 and RKPA80202, which may be paired), and the heat associated with the shock event may have lowered their natural TL. Two others, which also are paired, have rather high ^{26}Al activities; this situation is analogous to that for Malakal which is known to have experienced an unusual thermal and radiation history (Cressy and Rancitelli, 1974; Melcher, 1981a,b). These matters were discussed by Hasan et al. (1987). Based on our interpretations of Figure 7-1, we may assume that natural TL values of significantly less than ~ 5 krad imply recent heating, while values greater than this seem to be reflecting differences in history analogous to those responsible for the ^{26}Al range, predominantly differences in terrestrial age (and, on occasion, low cosmic ray exposure age). We can get some feel, albeit very approximate, of the terrestrial ages involved from a compilation of terrestrial ages by Nishiizumi (1984); five of the meteorites in the natural TL- ^{26}Al "cluster," between 30–80 krad and 250–350 dpm/kg Si, have a mean terrestrial age of $150,000 \pm 100,000$ years, while six meteorites in the "cluster" corresponding to 10–30 krad and 150–250 dpm/kg Si have a mean terrestrial age $400,000 \pm 200,000$ years. These individuals and their terrestrial ages are listed in table 2 of Hasan et al. (1987). ALHA78008 has an unusual radiation history. Its low ^{26}Al activity (and presumably its low natural thermoluminescence relative to other meteorites involved in the regression line) reflects low cosmic ray exposure, rather than simply a particularly large terrestrial age (Nishiizumi et al., 1979).

In the present paper, we report natural TL data for 379 Antarctic meteorite fragments, we present histograms for most of them (separated into various find sites), and we discuss some possible interpretations of these data.

Experimental Procedures

Our data are listed in Table 7-1. Most of the data were gathered by Fouad Hasan, while data for 27 samples were

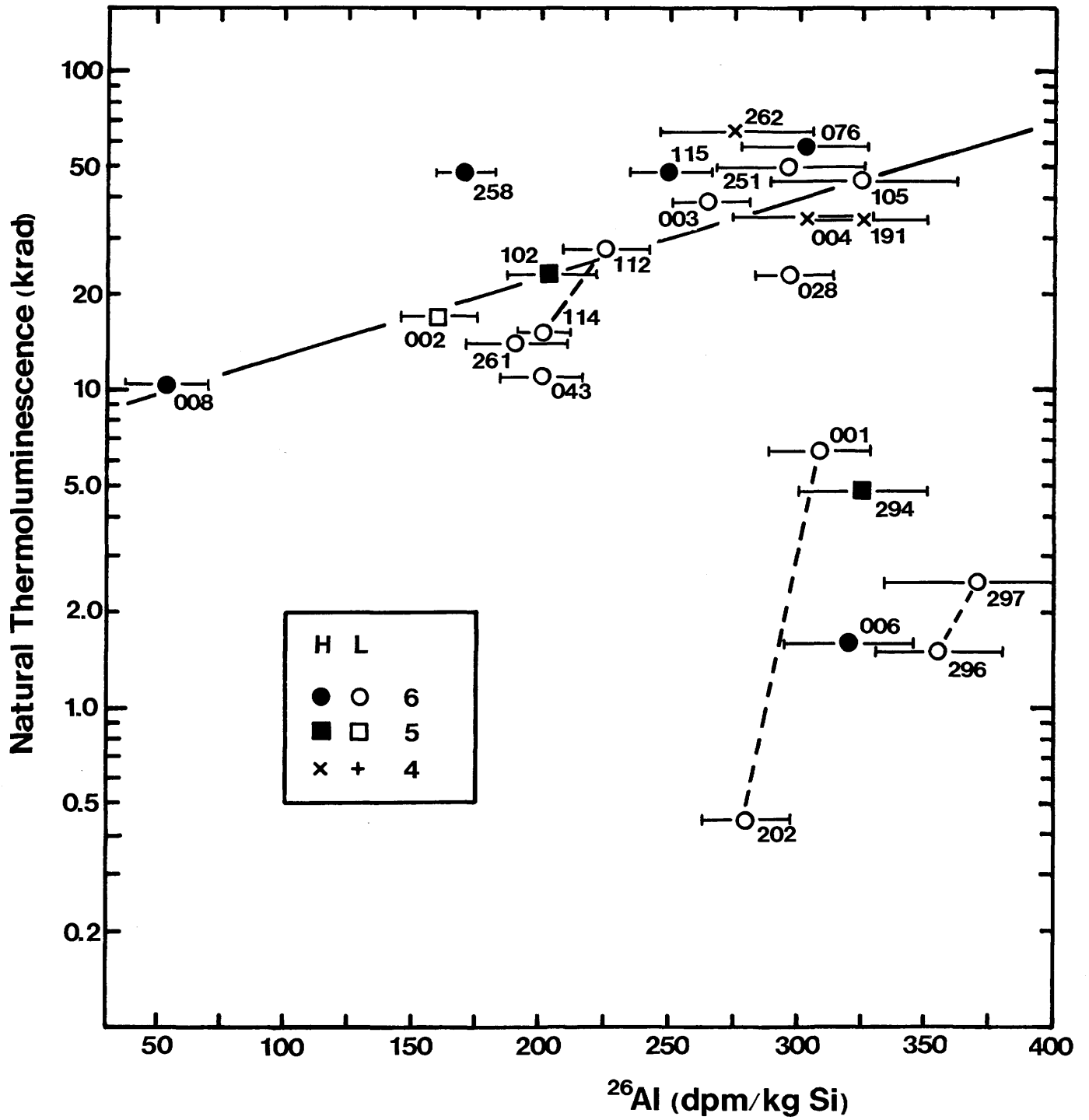


FIGURE 7-1.—Plot of natural thermoluminescence against ^{26}Al activity for 23 Antarctic meteorites. (The samples are from collections made between 1976 and 1981 at Allan Hills, Meteorite Hills, and Reckling Peak and may be identified from table 2 in Hasan et al., 1987.) The data are from Hasan et al. (1987), and references therein, but the TL data have been converted to doses using the method of Hasan et al. (1989) and the Al-26 activities have been calculated relative to Si assuming 17.2% Si for H chondrites and 18.9% Si for L chondrites. The solid line is a regression line through 17 meteorites and has the equation $\text{Log}(\text{Natural TL}) = 0.00250 \text{ }^{26}\text{Al} + 0.8610$, and correlation coefficient 0.69. The broken lines connect samples for which there is evidence for pairing (Scott, 1984).

TABLE 7-1.—Natural thermoluminescence data for Antarctic meteorites. These data supersede previous TL data (October 1987, April 1988, and February 1989 data sets). The quoted uncertainties are the standard deviations shown by replicate measurement of a single aliquot.

Specimen number	Natural TL (krad at 250° C)	Specimen number	Natural TL (krad at 250° C)	Specimen number	Natural TL (krad at 250° C)
ALH85016	40 ± 3	ALH85112	48.0 ± 0.5	GRO85211	39 ± 1
ALH85017	3.6 ± 0.6	ALH85114	8.92 ± 0.07	GRO85212	74 ± 1
ALH85018	33.9 ± 0.6	ALH85115	10 ± 1	GRO85213	105 ± 1
ALH85020	39 ± 2	ALH85118	38.0 ± 0.3	GRO85214	74 ± 2
ALH85023	55 ± 1	ALH85119	- -	GRO85215	0.80 ± 0.04
ALH85026	36 ± 2	ALH85120	10.1 ± 0.1	GRO85216	12.5 ± 0.1
ALH85027	67 ± 4	ALH85122	1.9 ± 0.4	GRO85218	5.6 ± 0.2
ALH85028	18 ± 1	ALH85123	74 ± 2	LEW85301	0.41 ± 0.03
ALH85029	28.2 ± 0.9	ALH85124	6.9 ± 0.3	LEW85303	31 ± 2
ALH85030	29 ± 1	ALH85125	10.1 ± 0.1	LEW85305	0.036 ± 0.005
ALH85031	0.9 ± 0.4	ALH85127	1.5 ± 0.2	LEW85306	- -
ALH85033	258 ± 3	ALH85128	4.3 ± 0.1	LEW85313	4.4 ± 0.04
ALH85034	40 ± 3	ALH85129	36 ± 2	LEW85314	35.8 ± 0.5
ALH85035	6.0 ± 0.1	ALH85131	32.2 ± 0.5	LEW85315	22.5 ± 0.6
ALH85037	6.2 ± 0.4	ALH85132	13 ± 1	LEW85316	52 ± 2
ALH85038	27.2 ± 0.3	ALH85133	57 ± 4	LEW85317	35.8 ± 0.2
ALH85039	26.6 ± 0.3	ALH85135	43.6 ± 0.5	LEW85318	12.2 ± 0.1
ALH85040	40.5 ± 0.2	ALH85136	20 ± 1	LEW85319	7.3 ± 0.1
ALH85041	17.8 ± 0.6	ALH85137	2.0 ± 0.3	LEW85321	41.8 ± 0.8
ALH85042	48 ± 1	ALH85141	21.5 ± 0.4	LEW85322	41 ± 1
ALH85043	107 ± 11	ALH85142	26.2 ± 0.2	LEW85323	6.6 ± 0.1
ALH85044	20.2 ± 0.3	ALH85143	5.7 ± 0.1	LEW85324	32 ± 3
ALH85045	63 ± 2	ALH85144	96 ± 2	LEW85325	20 ± 1
ALH85048	15.1 ± 0.4	ALH85146	59 ± 2	LEW85327	0.37 ± 0.05
ALH85052	2.1 ± 0.5	ALH85151	155 ± 2	LEW85329	26 ± 1
ALH85054	7.7 ± 0.6	ALH85152	88 ± 2	LEW85330	12.4 ± 0.3
ALH85056	2.5 ± 0.1	ALH85155	104 ± 17	LEW85331	47 ± 2
ALH85059	50 ± 4	ALH85156	8.8 ± 0.2	LEW85333	52 ± 2
ALH85062	59 ± 6	ALH86600	25.4 ± 0.5	LEW85334	26.2 ± 0.5
ALH85063	9.0 ± 0.2	ALH86601	4 ± 0.4	LEW85335	6.9 ± 0.1
ALH85065	35.4 ± 0.3	ALH86602	10.0 ± 0.2	LEW85336	82 ± 4
ALH85066	77 ± 2	ALH86603	80 ± 2	LEW85337	10.2 ± 0.4
ALH85070	104 ± 2	BOW85800	43 ± 3	LEW85338	25.6 ± 0.6
ALH85071	5.3 ± 0.1	DOM85501	4.0 ± 0.5	LEW85340	27.1 ± 0.8
ALH85073	74.2 ± 0.8	DOM85502	34 ± 2	LEW85341	14 ± 1
ALH85075	45.9 ± 0.7	DOM85503	36.3 ± 0.8	LEW85343	40 ± 1
ALH85076	16.9 ± 0.4	DOM85504	52 ± 1	LEW85345	43 ± 3
ALH85077	8.3 ± 0.2	DOM85505	14.6 ± 0.3	LEW85346	50 ± 5
ALH85079	92 ± 1	DOM85506	56 ± 1	LEW85347	52 ± 5
ALH85080	57 ± 5	DOM85508	20.6 ± 0.7	LEW85348	19.5 ± 0.6
ALH85082	14.7 ± 0.4	DOM85509	54.1 ± 0.7	LEW85350	10.0 ± 0.2
ALH85083	52 ± 5	DOM85510	63 ± 2	LEW85351	6.4 ± 0.2
ALH85084	45 ± 2	EET86800	2.7 ± 0.1	LEW85352	6.6 ± 0.3
ALH85086	54 ± 4	EET86801	7.7 ± 0.1	LEW85353	0.5 ± 0.2
ALH85087	34 ± 2	EET86802	29 ± 1	LEW85354	1.9 ± 0.4
ALH85090	80 ± 4	GEO85700	9.9 ± 0.2	LEW85356	14 ± 1
ALH85091	24 ± 2	GEO85701	72 ± 2	LEW85357	6.4 ± 0.2
ALH85094	96 ± 2	GRO85203	110 ± 4	LEW85359	24 ± 1
ALH85097	93 ± 2	GRO85204	43 ± 2	LEW85360	0.16 ± 0.01
ALH85098	5.6 ± 0.2	GRO85205	25.8 ± 0.3	LEW85362	8.0 ± 0.3
ALH85100	57 ± 2	GRO85207	77.3 ± 0.4	LEW85368	0.32 ± 0.02
ALH85102	1.7 ± 0.2	GRO85208	71.8 ± 0.2	LEW85371	24 ± 3
ALH85103	58 ± 1	GRO85209	18 ± 6	LEW85373	20 ± 3
ALH85104	0.56 ± 0.09	GRO85210	23.2 ± 0.3	LEW85379	14.4 ± 0.3
ALH85105	60 ± 1			LEW85380	6.9 ± 0.1
ALH85107	19.1 ± 0.6			LEW85381	7.8 ± 0.3
ALH85108	2 ± 1			LEW85383	34 ± 2
ALH85110	148 ± 2				

TABLE 7-1.—Continued.

Specimen number	Natural TL (krad at 250° C)	Specimen number	Natural TL (krad at 250° C)	Specimen number	Natural TL (krad at 250° C)
LEW85384	48 ± 0.5	LEW86035	96.0 ± 0.2	LEW86199	27.6 ± 0.2
LEW85385	8.2 ± 0.1	LEW86037	79 ± 1	LEW86203	16 ± 3
LEW85386	0.090 ± 0.004	LEW86039	5 ± 2	LEW86204	9.7 ± 0.1
LEW85398	14 ± 1	LEW86040	139 ± 5	LEW86206	96 ± 1
LEW85402	31.0 ± 0.9	LEW86041	2.34 ± 0.08	LEW86207	8 ± 1
LEW85403	18.2 ± 0.4	LEW86043	24.8 ± 0.3	LEW86211	6 ± 1
LEW85404	35 ± 1	LEW86044	21.9 ± 0.9	LEW86213	13 ± 2
LEW85405	5.9 ± 0.2	LEW86047	32.2 ± 0.8	LEW86215	9.0 ± 0.9
LEW85406	22 ± 0.4	LEW86050	136 ± 14	LEW86225	42.5 ± 0.7
LEW85413	7.9 ± 0.2	LEW86053	52 ± 5	LEW86226	64 ± 2
LEW85418	10.1 ± 0.2	LEW86055	37.1 ± 0.5	LEW86228	55.8 ± 0.9
LEW85420	96 ± 4	LEW86056	11 ± 0.6	LEW86232	62 ± 4
LEW85423	31.8 ± 0.2	LEW86057	77 ± 6	LEW86238	59 ± 9
LEW85426	6.5 ± 0.1	LEW86060	1.4 ± 0.07	LEW86241	20 ± 1
LEW85427	77 ± 4	LEW86070	58 ± 1	LEW86249	17 ± 1
LEW85428	13.6 ± 0.4	LEW86072	60.5 ± 0.6	LEW86250	45 ± 2
LEW85429	54 ± 1	LEW86073	47 ± 4	LEW86251	55.8 ± 0.7
LEW85433	93 ± 1	LEW86074	47 ± 1	LEW86252	155 ± 19
LEW85441	0.60 ± 0.01	LEW86076	42.7 ± 0.9	LEW86255	60.7 ± 0.6
LEW85443	46 ± 1	LEW86077	101 ± 6	LEW86258	4 ± 2
LEW85445	25.4 ± 0.5	LEW86078	107 ± 4	LEW86266	24.2 ± 0.6
LEW85446	48 ± 1	LEW86079	66.7 ± 0.4	LEW86268	16 ± 1
LEW85448	206 ± 5	LEW86081	93 ± 1	LEW86273	31 ± 1
LEW85449	6.2 ± 0.4	LEW86083	36 ± 2	LEW86282	89 ± 0.2
LEW85450	3.2 ± 0.6	LEW86084	29 ± 1	LEW86286	327 ± 3
LEW85451	0.88 ± 0.02	LEW86085	19 ± 1	LEW86295	5.7 ± 0.3
LEW85454	1.76 ± 0.01	LEW86086	93 ± 2	LEW86302	1.7 ± 0.1
LEW85455	3.4 ± 0.3	LEW86088	54.9 ± 0.4	LEW86305	33 ± 1
LEW85456	62.5 ± 0.6	LEW86089	4.7 ± 0.3	LEW86311	53 ± 1
LEW85457	1.63 ± 0.03	LEW86090	6.9 ± 0.1	LEW86312	19.5 ± 0.1
LEW85458	33 ± 0.06	LEW86091	12.7 ± 0.1	LEW86314	74 ± 2
LEW85459	1.7 ± 0.1	LEW86096	76 ± 1	LEW86317	68 ± 2
LEW85460	11.24 ± 0.5	LEW86098	2.9 ± 0.1	LEW86327	19.6 ± 0.1
LEW85461	77 ± 2	LEW86099	9.7 ± 0.4	LEW86337	53 ± 2
LEW85463	1.5 ± 0.1	LEW86101	6 ± 1	LEW86340	96 ± 8
LEW85464	12.5 ± 0.3	LEW86104	27.2 ± 0.2	LEW86344	19.4 ± 0.7
LEW85465	5.3 ± 0.2	LEW86107	40 ± 2	LEW86349	84 ± 2
LEW85472	24.2 ± 0.7	LEW86110	53.2 ± 0.5	LEW86350	3 ± 1
LEW86001	28 ± 4	LEW86111	59 ± 28	LEW86352	20.4 ± 0.1
LEW86002	13 ± 3	LEW86115	52.5 ± 0.7	LEW86354	25.0 ± 0.3
LEW86011	157 ± 1	LEW86118	3.6 ± 0.65	LEW86360	57 ± 1
LEW86012	50.8 ± 0.9	LEW86119	1.7 ± 0.08	LEW86364	29.7 ± 0.3
LEW86013	93 ± 2	LEW86120	22.9 ± 0.9	LEW86366	44 ± 1
LEW86014	93 ± 2	LEW86123	21 ± 3	LEW86367	8 ± 2
LEW86015	122 ± 6	LEW86134	- -	LEW86368	96 ± 4
LEW86016	8.2 ± 0.3	LEW86135	88 ± 4	LEW86371	28.4 ± 0.8
LEW86017	17 ± 1	LEW86138	196 ± 22	LEW86376	9.9 ± 0.6
LEW86018	- -	LEW86152	107 ± 2	LEW86380	45 ± 9
LEW86019	114.8 ± 0.7	LEW86160	10.2 ± 0.2	LEW86382	3.76 ± 0.07
LEW86020	37.0 ± 0.2	LEW86161	69 ± 2	LEW86385	50 ± 1
LEW86021	36 ± 2	LEW86163	10 ± 3	LEW86388	67 ± 2
LEW86022	- -	LEW86164	13.1 ± 0.5	LEW86393	21.7 ± 0.4
LEW86023	32 ± 3	LEW86165	50.6 ± 0.7	LEW86395	22.5 ± 0.1
LEW86024	21.9 ± 0.1	LEW86166	2.3 ± 0.2	LEW86396	2.6 ± 0.2
LEW86025	0.9 ± 0.1	LEW86168	96 ± 2	LEW86397	25.9 ± 0.3
LEW86026	64 ± 2	LEW86174	93 ± 4	LEW86407	16.5 ± 0.1
LEW86028	38 ± 2	LEW86181	16 ± 1	LEW86418	0.85 ± 0.07
LEW86030	75 ± 0.6	LEW86183	22.3 ± 0.6	LEW86438	88 ± 2
LEW86031	127 ± 2	LEW86186	17.9 ± 0.3	LEW86442	28.7 ± 0.6
LEW86033	62 ± 2	LEW86195	16.0 ± 0.5	LEW86451	52 ± 2

TABLE 7-1.—Continued.

Specimen number	Natural TL (krad at 250° C)	Specimen number	Natural TL (krad at 250° C)	Specimen number	Natural TL (krad at 250° C)
LEW86463	30 ± 4	LEW86490	58.5 ± 0.2	LEW86544	18.9 ± 0.3
LEW86465	39.6 ± 0.7	LEW86499	13.5 ± 0.5	LEW86546	57 ± 2
LEW86466	47 ± 1	LEW86500	38 ± 1	LEW86549	52 ± 4
LEW86470	21.3 ± 0.4	LEW86503	28.4 ± 0.3	QUE86900	16 ± 7
LEW86471	5 ± 0.6	LEW86514	63.0 ± 0.8	RKP86700	9 ± 1
LEW86472	42.7 ± 0.3	LEW86515	54 ± 1	RKP86701	37.8 ± 0.8
LEW86473	87.1 ± 0.2	LEW86522	0.9 ± 0.2	RKP86702	12 ± 1
LEW86479	80 ± 10	LEW86525	7.3 ± 0.1	RKP86703	10.2 ± 0.4
LEW86485	28 ± 0.9	LEW86528	27 ± 0.3	RKP86704	38 ± 2
LEW86489	30.0 ± 0.9	LEW86534	14.4 ± 0.4	RKP86705	13.7 ± 0.4

gathered by Roberta Score. Over the eighteen month period during which the data were gathered, which is also the first eighteen months of the project, our techniques and procedures were constantly improved and, therefore, the data vary in quality. The procedures are essentially those described by Hasan et al. (1987), but improvements concerned primarily the criteria for the selection of samples and subsequent storage conditions. Initially, samples were taken randomly. Later, an attempt was made to take samples at least 1 cm from any obvious fusion crust. Most recently, sampling was restricted to those meteorites in which it was possible to take samples at least 1 cm away from all existing surfaces. This restricts the measurements to samples >20g. Samples in the present data base were sent from JSC to the TL laboratory at Arkansas through the United States mail. In the future, samples will be hand-carried to avoid the danger of accidental heating in transit.

We also have developed a means of standardizing our reporting procedure, so that a single datum for each meteorite is reported. The natural TL signal must be normalized to remove the major effects of meteorite-to-meteorite differences in TL sensitivity due to sample heterogeneity, shock, and metamorphism. There are two commonly used means of doing this, and the relative advantages and disadvantages of each were discussed by McKeever and Sears (1980). Here we use a composite method described by Hasan et al. (1989). It is important to note that (1) these new data replace *both* measures of natural TL in earlier versions of our data (*Antarctic Meteoric Newsletter*, 11(1), 11(2)); and (2) the uncertainties quoted refer only to the standard deviation shown by replicate measurements of a single powder and not to total accuracy, which would require measurements on several separate chips of meteorite. We quote natural TL values observed at 250° C, since this appears to be the optimum temperature: low enough to be sensitive to the events of interest and yet high enough to avoid the most trivial heating (Melcher, 1981a,b; Hasan et al., 1987, 1989).

Results and Discussion

Histograms of natural TL values for the present samples

from the Allan Hills and Lewis Cliff regions are shown in Figure 7-2. The histograms have been labeled to identify individual meteorites in the belief that in this form the data will be most helpful, especially with regard to identifying paired meteorites. Unfortunately, most of the samples are unclassified at the present time, and there is little other information relevant to pairing.

The distribution in natural thermoluminescence for the 1986 samples from Lewis Cliff resembles that for the Allan Hills 1985 samples, but the Lewis Cliff 1985 samples seem to show a distribution that favors lower values (Hasan and Sears, 1988). The distribution of natural TL data for the Allan Hills 1985 meteorites shows a peak in the 32–63 krad intervals, consistent with the cluster in Figure 7-1 showing a mean terrestrial age of $150,000 \pm 100,000$ years. Seventy-five per cent of the samples fall in the range 5–100 krad, while three show values exceeding 125 krad, and one (ALH85033) is particularly noteworthy at 258 ± 3 krad. The other highs are 148 ± 2 krad (ALH85110) and 155 ± 2 krad (ALH85151). Such values seem high even for observed falls, and may indicate meteorites which have experienced high radiation doses or unusually low storage temperatures in space. The distribution tails more slowly toward lower values. Thirteen samples (i.e., 15% of all the ALH85 meteorites) register below the 5 krad level we would associate with heated samples, affected by small perihelia, recent shock heating, or atmospheric heating. There are some minor peaks in the histogram (e.g., those at 5.0–6.3 krad and 1.6–2.5 krad) which might indicate that some of the individuals in these peaks are paired. Of the five meteorites in the 5.0–6.3 krad range, three (ALH85071, 85098, and 85143) are H5 chondrites and are possibly paired. The other two are an H6 chondrite (ALH85037) and an LL6 chondrite (ALH85035). The group in the 1.6–2.5 krad range are two H5 chondrites (ALH85102, 85122), which may be paired, two H6 chondrites (ALH85052, 85108), which also may be paired, and one LL6 chondrite (ALH85137).

The 1985 collection from the Lewis Cliff site does not seem to show any tendency to an overall “preferred” value. Instead, values are fairly uniformly spread between 7.3 and 63 krad, although there is an indication that the distribution is bimodal

with a hiatus in the 16 to 20 krad interval. The 20–63 krad range corresponds to the “cluster” in Figure 7-1 with $150,000 \pm 100,000$ year terrestrial ages, while the 5–16 krad range corresponds, approximately, to the “cluster” in Figure 7-1 with $400,000 \pm 200,000$ year terrestrial ages. There is only one Lewis Cliff sample with natural TL greater than 100 krad, namely LEW85448 (206 ± 5 krad), whereas six samples in the Allan Hills 1985 data set had values this high. Eighteen samples, making up 17% of the Lewis Cliff 1985 collection, have natural TL less than 5 krad and have presumably suffered some form of recent heating.

The shape of the histogram for the LEW86 samples resembles that of the ALH85 samples, but with a more pronounced peak at 50–63 krad. Seventy per cent of the samples have values between 13 and 100 krad, which is very similar to the group in Figure 7-1 that has a mean terrestrial age of $150,000 \pm 100,000$ years. There are also minor peaks at 79–100, 25–32, 7.9–10 krad, which may not be significant. High values are relatively common in the LEW86 data, 12 meteorites (7.2%) having values over 100 krad with LEW86286 at a remarkable 327 ± 3 krad, suggestive of high radiation doses or low temperatures in space. Eighteen meteorites (11% of the LEW86 samples) have values below 5 krad, suggestive of recent heating.

The difference in the distribution of natural TL data between the 1985 and 1986 collections at Lewis Cliff is related to find location. Histograms of the natural TL in samples collected on the Lewis Cliff icefields are shown in Figure 7-3. The meteorites have been separated into those found at Meteorite Moraine and those found on the Ice Tongue (Figure 7-4, 7-5), and the latter have also been subdivided according to latitude (Figure 7-4). The northernmost tip of the Tongue has not yet been systematically searched, so the lack of meteorites in the latitude intervals numbered 8–10 in Figure 7-3 is not significant. Nevertheless, it is clear that the distribution of meteorites over the region is not random, but that meteorites tend to cluster along the western edge of the Tongue. The latitude intervals are not equal, but were chosen to separate meteorites found on the Upper Ice Tongue from those found on the Lower Ice Tongue; these regions are separated by a steep step in the ice surface.

The peak in the histogram for the Lewis Cliff 1986 samples (50–63 krad), which is absent in the distribution for the 1985 Lewis Cliff samples, is due, in large part, to the meteorites from Meteorite Moraine. On the basis of the appearance of hand-specimens, considerable pairing among the Meteorite Moraine samples was suspected, and the spread in TL data is less for this site than the others. However, only 25 of our 67 Meteorite Moraine meteorites have yet been classified (10 are H5, 9 are L6, 4 are H6, 1 is LL6, and 1 is L4), while 10 of the 13 in the 50–63 krad peak are unclassified; the other three are L4, L6, and LL6.

Most of the 13% of the samples with natural TL levels below 5 krad were found on the upper part of the tongue (latitude intervals 1–5). Furthermore, there may be a weak tendency for

the histograms to be skewing to higher TL values as one proceeds from the upper part of the Tongue to the lower part (i.e., proceeds north); intervals 3, 4, and 5, for instance, have about half of the samples with TL >5 krad in the range 5–20 krad, while the intervals 6 and 7 have the bulk of their samples in the range 16–100 krad. It is possible that a few major pairings are responsible for this spatial distribution. However, it is also possible that systematic variations in terrestrial age (and therefore natural TL) with location on the ice could result from the mechanisms by which the meteorites were accumulated (e.g., Bull and Lipschutz, 1982; Annexstad, 1986; Drewry, 1986). It will be necessary to make a careful study of potential pairing before seriously examining the possibility of a spatial variation in natural TL levels at this field. It will also help to have data for samples from the remainder of the ice field. The northern tip of the Lewis Cliff Ice Tongue is the prime site for the 1988–1989 field season.

Data for 36 samples collected at other sites, and a further 4 samples collected in the Allan Hills region in 1986, are listed in Table 7-1 but are too few for meaningful discussion of possible trends. Four of the samples have natural TL values less than 5 krad, and two have values in excess of 100 krad (these are listed below). Three of the 5 samples collected at Reckling Peak in the 1986–1987 season have values in the 7.9–16 krad range, while the “preferred values” among samples collected at Grosvenor Mountains and the Dominion Range during the 1985–1986 season, based on these very limited data, are in the 50–125 krad range.

Conclusions

Data for the first eighteen months of systematic measurement of natural thermoluminescence levels in Antarctic meteorites identify several meteorites with unusual histories, allow some crude sorting of meteorites by terrestrial age, and provide data which will be useful in the recognition of paired meteorites. There is evidence in the data that the patterns of natural TL levels vary with find site, which could have implications for concentration mechanisms.

Based on a comparison with Figure 7-1, and the known terrestrial ages for the samples in the plot determined from cosmogenic isotopes, the majority of samples in Allan Hills 1985 and Lewis Cliff 1986 collections have terrestrial ages in range $150,000 \pm 100,000$ years, with most of the remainder in the order of $400,000 \pm 200,000$ years. For the Lewis Cliff 1985 collection, the majority of the meteorites have natural TL values suggestive of terrestrial ages in the range $400,000 \pm 200,000$ years, with a smaller fraction in the $150,000 \pm 100,000$ year range.

Fourteen percent of the 379 Antarctic meteorites in the present study have natural TL values suggestive of recent heating (small perihelion orbits, shock heating, or heating during atmospheric passage). These are as follows:

ALH85; 017, 031, 052, 056, 102, 104, 107, 112, 115, 119, 127, 128, 137,

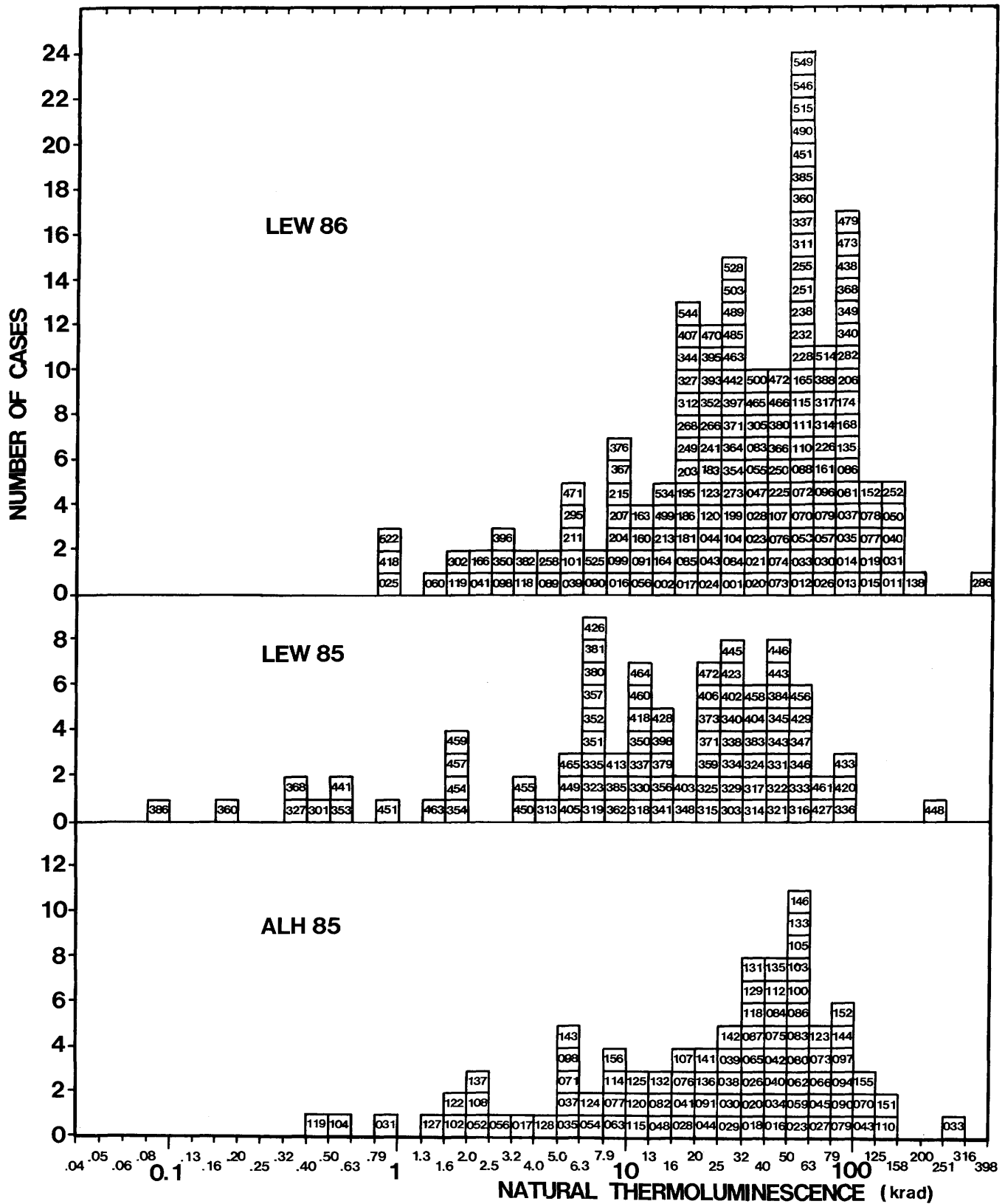


FIGURE 7-2.—Histograms of natural TL values in 86 meteorites from the 1985 collection at the Allan Hills, 86 meteorites collected from the Lewis Cliff region in 1985–1986 and 162 meteorites collected in the Lewis Cliff region in 1986–1987. Two samples from the LEW85 collection (LEW85305 and 85306), and three from LEW86 (LEW86022, 86018, and 86134) collections, plot off the graph to lower values.

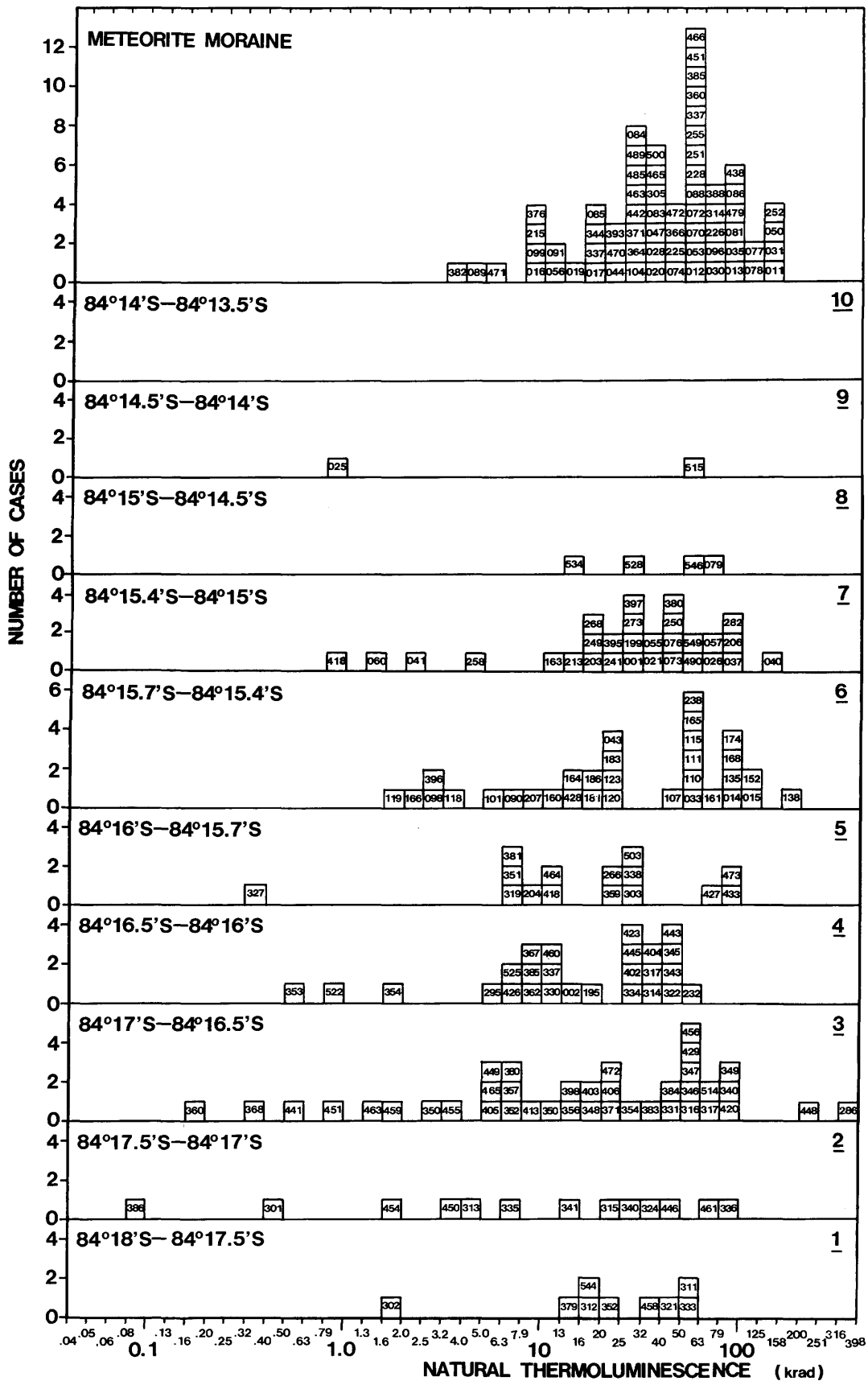


FIGURE 7-3.—Histograms of natural TL values for meteorites collected in the Lewis Cliff region of the Antarctic in the 1985-1986 and 1986-1987 field seasons. Samples from Meteorite Moraine and from the Lewis Cliff Ice Tongue have been plotted separately, the latter being subdivided into 10 regions according to latitude; the sites are located in Figure 7-4. The five samples plotting off the graphs to the left are distributed over the regions as follows: region 2, LEW85305; region 3, LEW85306; region 6, LEW86134; region 10, LEW86022; Meteorite Moraine, LEW86018.

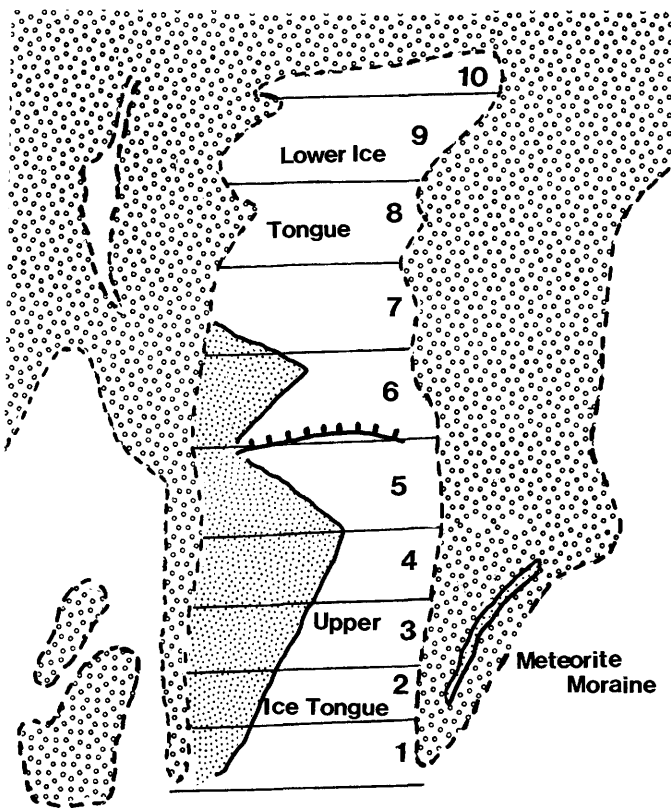


FIGURE 7-4.—Sketch map showing the locations of the regions referred to in Figure 7-3. North is to the top of the figure, the Tongue is approximately 2.3 km wide. The shading refers to moraine and snow (circles) and regions of the highest meteorite densities (dots). Regions 8–10 were searched in the 1988–1989 field season and data are not yet available.

LEW85; 301, 305, 306, 313, 327, 353, 354, 360, 368, 386, 441, 450, 451, 454, 455, 457, 459, 463,

LEW86; 018, 022, 025, 041, 060, 089, 098, 118, 119, 134, 166, 258, 302, 350, 382, 396, 418, 522,

DOM85501, EET86800, GRO85215, ALH86601.

Three meteorites have exceptionally high natural thermoluminescence values which suggest high radiation doses or low storage temperatures in space; these are ALH85033, LEW85448 and LEW86286. Meteorites with natural thermoluminescence values greater than 100 krad, and for which the possibility of exposure to high radiation doses or low temperatures should be borne in mind, are:

ALH85; 043, 070, 110, 151, 155,

LEW86; 011, 015, 019, 031, 040, 050, 077, 078, 138, 152, 252.

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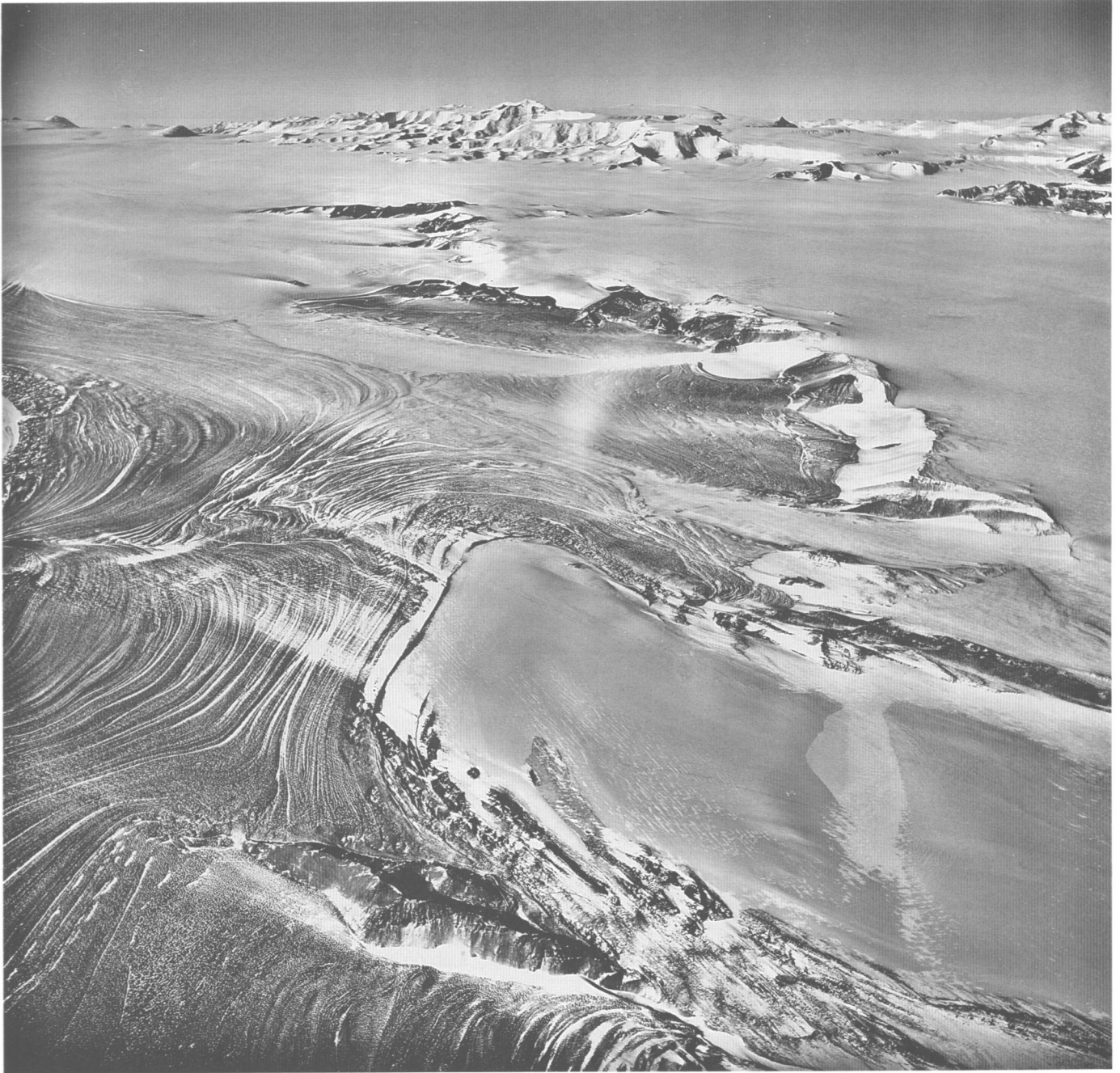


FIGURE 7-5.—Aerial photograph of the Lewis Cliff Ice Tongue looking northeast with the tongue in the foreground. Note the step in the tongue, which is highlighted by the snow infilling. Meteorite Moraine is on the center, extreme right of the photograph. (Photograph TMA999-044 of the United States Geological Survey).

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Appendix

Tables of ANSMET Meteorites

Terminology

Class and type: A = achondrite, unique; An = angrite; Au = aubrite; C = carbonaceous chondrite; Chon. (unique) = unique or ungrouped chondrite; Di = diogenite; E = enstatite chondrite; Eu = eucrite; Ho = howardite; H = high-iron chondrite; I = iron (I, IIA, IIB, IVA = iron groups; silicate incl. = silicate inclusions); L = low-iron chondrite; LL = low-iron low-metal chondrite; M = mesosiderite; Sh = shergottite; Ur = ureilite. Chondrite petrologic type is indicated by digit following the abbreviation.

Olivine composition in mole percent fayalite (Fa), Fe_2SiO_4 .

Pyroxene (orthopyroxene or low calcium clinopyroxene) composition in mole percent ferrosilite (Fs), FeSiO_3 .

Degree of weathering: A = minor; metal flecks have inconspicuous rust haloes, oxide stain along cracks is minor. B = moderate; metal flecks show large rust haloes, internal cracks show extensive oxide stain. C = severe; specimen is uniformly stained brown, no metal survives. e = evaporite deposits visible to naked eye.

Degree of fracturing: A = slight; specimen has few or no cracks and none penetrate the entire specimen. B = moderate; several cracks extend across the specimen, which can be readily broken along the fractures. C = severe; specimen has many extensive cracks and readily crumbles.

Locations: ALH = Allan Hills; BTN = Bates Nunatak; BOW = Bowden Neve; DRP = Derrick Peak; DOM = Dominion Range; EET = Elephant Moraine; GEO = Geologists Range; GRO = Grosvenor Mountains; ILD = Inland Forts; LEW = Lewis Cliff; MET = Meteorite Hills; MIL = Miller Range; MBR = Mount Bald; OTT = Outpost Nunatak; PCA = Pecora Escarpment; PGP = Purgatory Peak; QUE = Queen Alexandra Range; RKP = Reckling Peak; TIL = Thiel Mountains; TYR = Taylor Glacier.

Source of classifications: * = S.G. McKinley and K. Keil; † = S.J.B. Reed and S.O. Agrell; ‡ = C.B. Moore; § = M. Rhodes and S. Haggerty.

~ = Classified using refractive indices.

Abbreviations: n.d. = no data.

TABLE A.—Meteorites listed by source area in numerical sequence (fractions of grams in weight dropped unless total weight is less than 1 gram).

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
76001	20151	L6	25	21	A	77064	6	H5	18	17	B
76002	1510	I				77066*	5	H5	19.0	17.4	A
76003	10495	L6	25	21	A	77069*	0.8	L6	25.4	21.4	B/C
76004	305	LL3	0-34	0-53	A	77070*	18	H5	18.4	16.8	B
76005	1425	Eu		37-57	A	77071	11	H5	18	17	B
76006	1137	H6	18	16	Ce	77073*	10	H5	18.8	17.7	A/B
76007	410	L6	24	21	B	77074	12	H5	18	17	B
76008	1150	H6	19	17	B/C	77076*	2	H5	19.5	16.1	B
76009	407000	L6	24	21	B	77078*	24	H5	19.5	16.7	B
77001	252	L6	25	21	B	77079*	8	H5	18.2	15.8	A
77002	235	L5	25	22	B	77081	9	"H(?)**	11	11	B
77003	780	C3O	4-48	2-25	Ae						
77004	2230	H4	17-20	15-27	C	77082*	12	H5	19.3	16.5	A/B
77005	483	Sh	28	23	A	77084*	44	H5	18.8	16.8	A/B
77007*	99	H5	19.1	16.7	B	77085*	46	H5	18.8	17.6	B
77008*	93	L6	24.6	20.6	A	77086	19	H5	19	17	C
77009	236	H4	18	16	C	77087*	31	H5	19.0	16.7	B
77010	296	H4	18	15-18	C	77088	51	H5	19	17	C
77011	292	L3	4-36	1-33	C	77089*	8	L6	25.5	21.4	B
77012	180	H5	18	16	Ce	77091*	4	H5	18.9	16.1	B/C
77013*	23	L3	9-28	1-35	B	77092*	45	H5	18.5	16.5	A
77014	309	H5	18	17	C	77094*	7	H5	18.5	16.2	B
77015	411	L3	1-21	4-24	Ce	77096*	2	H5	18.7	17.1	A
77016*	78	H5	18.6	17.1	B	77098*	8	H5	18.7	16.7	B
77017*	78	H5	18.8	16.3	B	77100*	18	H5	19.2	16.4	A/B
77018*	52	H5	19.0	17.0	B/C	77101*	4	H5	18.6	17.0	B
77019*	60	L6	24.9	21.4	B/C	77102	12	H5	19	15	B
77021	17	H5	18	17	C	77104*	6	H5	18.9	16.9	A
77022*	16	H5	19.1	17.0	A	77106*	8	H5	18.8	16.5	A/B
77023*	21	H5	19.1	16.8	B	77108*	0.7	H5	18.5	15.9	A/B
77025	19	H5	18	17	C	77111*	52	H6	19.0	16.6	C
77026*	20	L6	24.3	20.7	B/Ce	77112*	22	H5	18.7	16.7	A
77027*	4	L6	25.0	21.5	B/C	77113*	2	H5	18.7	17.2	B
77029*	1	C3O	23.0	2.6	A/B	77114*	45	H5	19.6	17.2	B
77031*	0.5	L3	n.d.	n.d.	B/C	77115*	154	L3	n.d.	n.d.	B/C
77033	9	L3	8-38	8-9	C	77117*	21	L5	24.4	21.0	A/B
77034*	2	L3	n.d.	n.d.	B/C	77118	8	H5	19	17	C
77036*	8	L3	n.d.	n.d.	B	77119	6	H5	18	17	C
77038*	19	H5	19.0	17.1	A/B	77120*	4	H5	18.5	16.0	A/B
77039*	8	H5	18.5	16.3	A/B	77122*	5	H5	19.1	16.8	B
77041*	17	LL6	30.7	25.1	A	77124	4	H5	19	16	C
77042*	20	H5	19.0	16.6	A/B	77125*	19	H5	17.2	15.5	A/B
77043*	11	L3	1-37	1-28	B/C	77126*	25	H5	18.3	16.2	A/B
77045*	18	H5	18.7	17.0	A	77127*	4	L5	25.0	21.1	B
77046*	8	H6	19.0	16.7	A/B	77129*	2	H5	18.9	16.6	B
77047*	20	L3	n.d.	n.d.	C	77130*	25	H5	18.9	16.5	A
77049*	7	L3	n.d.	n.d.	B/C	77131*	26	H6	19.2	16.8	A/B
77050*	84	L3	n.d.	n.d.	B/C	77132*	115	H5	19.0	16.9	A/B
77051*	15	H5	18.8	16.5	A	77133*	19	H6	19.0	17.0	A
77052*	112	L3	n.d.	n.d.	B/C	77134*	19	H6	18.9	16.7	A
77054*	10	H5	18.5	16.9	B	77136*	4	H5	19.1	16.4	A/B
77056*	12	H4	18.8	16.3	A/B	77138*	2	H5	19.2	17.0	A
77058*	4	H5	18.8	16.1	B	77139*	66	H5	18.6	16.4	A/B
77060*	64	LL5	28.1	23.2	A	77140	79	L3	8-44	2-17	Ce
77061	13	H5	18	17	B	77142*	3	H5	18.9	17.1	A/B
77062	17	H5	18	17	B	77143*	39	H5	18.7	16.2	A/B
77063*	3	H5	18.0	16.8	B	77144	8	H6	19	17	B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
77146*	18	H6	18.9	16.9	A/B	77215	820	L3	22-26	9-21	B
77147*	19	H6	19.0	16.6	A/B	77216	1470	L3	15-35	14-23	A/B
77148	13	H6	18	16	C	77217	413	L3	17-25	9-26	B
77149*	26	H6	19.1	16.9	A/B	77218*	45	L5	23.4	19.1	A
77150	58	L6	25	22	C	77219	637	M	26	24-28	B
77151*	17	H5	18.9	16.4	A	77220*	69	H5	17.7	16.0	B
77152*	18	H5	18.7	16.9	A	77221	229	H4	15	13-15	C
77153*	12	H5	19.2	16.7	A	77222*	125	H4	18.0	15.3	A/B
77155	305	L6	24	20	A/B	77223	208	H4	17	15-23	C
77156*	18	E4	0.8	1.5	B	77224	787	H4	19	17	C
77157*	88	H6	18.6	15.7	A/B	77225	5878	H4	17	16	Ce
77158*	20	H5	18.9	16.9	B	77226	15323	H4	18	16	Ce
77159*	17	L6	24.4	20.8	A/B	77227*	16	H5	18.9	16.6	A
77160	70	L3	3-46	6-40	C	77228*	19	H5	18.5	16.3	B
77161*	6	H5	19.3	17.1	B	77230	2473	L4	22-25	18-29	C
77162*	29	L6	25.3	20.9	A	77231	9270	L6	24	21	A/Be
77163*	24	L3	n.d.	n.d.	B/C	77232	6494	H4	17	15	C
77164	38	L3	6-39	3-41	C	77233	4087	H4	14-21	15-17	C
77165	31	L3	8-33	6-35	C	77235*	5	H5	18.9	16.7	A/B
77166*	139	L3	n.d.	n.d.	C	77237*	4	H5	18.5	15.8	A
77167	611	L3	2-41	3-17	C	77239*	19	H6	18.7	15.9	B
77168*	25	H5	19.0	16.5	B	77240*	25	H5	18.8	16.0	A
77170*	12	L3	n.d.	n.d.	B/C	77241*	144	L3	n.d.	n.d.	C
77171*	24	H5	18.9	17.0	A/B	77242*	56	H5	18.8	16.2	B
77173*	26	H5	19.1	17.0	B	77244*	40	L3	n.d.	n.d.	B/C
77174*	32	H5	18.3	16.0	A	77245*	33	H5	19.2	17.2	A/B
77175*	23	L3	n.d.	n.d.	B/C	77246*	42	H6	19.2	16.5	B
77176*	55	L3	0.3-34	1-37	B	77247*	44	H5	18.8	16.4	A/B
77177	368	H5	18	16	C	77248*	96	H6	18.7	16.7	B/C
77178*	6	L3	1-36	2-40	B/C	77249	504	L3	7-35	2-25	C
77180	191	L6	24	20	C	77250	10555	I			
77181*	33	H5	20.0	17.3	B	77251*	69	L6	25.0	21.3	B
77182	1135	H5	19	17	C	77252	343	L3	22-28	2-22	B
77183	288	H6	19	16	C	77253*	24	H5	19.2	16.9	A/B
77184*	128	H5	17.8	15.9	B	77254	246	L5	23	20	A/B
77185*	28	L3	n.d.	n.d.	A/B	77255	765	I			
77186*	122	H5	18.8	16.0	A/B	77256	676	Di		23	A/B
77187*	52	H5	18.1	16.3	A/B	77257	1996	Ur	13	12	Ae
77188*	109	H5	18.1	16.1	A/B	77258	597	H6	18	16	B/Ce
77190	387	H4	17-19	15-22	C	77259	294	H5	18	15	C
77191	642	H4	16-18	14-16	C	77260	744	L3	7-23	1-28	C
77192	845	H4	16-18	15-21	C	77261	412	L6	24	21	B
77193*	7	H5	19.0	15.7	A	77262	862	H4	15-19	13-16	B/Ce
77195*	5	H5	18.9	16.4	A	77263	1669	I			
77197*	20	L3	10-27	4-21	A/B	77264	11	H5	19	16	A/B
77198*	7	L6	24.4	20.6	B	77265*	18	H5	17.6	15.9	B
77200*	0.9	H6	19.7	17.6	C	77266*	108	H5	19.6	17.7	B
77201*	15	H5	18.8	15.3	A	77267*	104	L5	24.7	20.9	A
77202*	3	H5	18.6	16.6	B	77268	272	H5	18	16	C
77205*	3	H5	18.8	16.7	B	77269	1045	L6	24	22	Be
77207*	5	H5	17.8	16.7	A/B	77270	589	L6	24	21	A/B
77208	1733	H4	17	14	C	77271	610	H6	18	16	C
77209*	32	H6	18.8	16.4	B	77272	674	L6	24	20	B/C
77211*	27	L3	n.d.	n.d.	B/C	77273	492	L6	24	20	B
77212*	17	H6	18.9	17.0	A/B	77274	288	H5	18	16	C
77213*	8	H5	18.6	16.5	A	77275*	25	H5	18.3	15.6	A
77214	2111	L3	1-49	4-23	C	77277	143	L6	24	20	A/B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
77278	313	LL3	11-29	9-21	A	78041‡	118	L3	0-41		B
77279*	175	H5	18.8	17.1	A	78042	214	L6	24	20	B
77280	3226	L6	24	21	Be	78043	680	L6	25	21	B
77281	1231	L6	24	20	B	78044	164	L4	23-25	19-24	B/C
77282	4127	L6	24	20	B	78045	397	L6	25	21	B/C
77283	10510	I				78046	70	L3	8-25	8-20	
77284	376	L6	25	21	A/B	78047†	130	H5	18.8		B
77285	271	H6	18	16	C	78048	191	L6	24	21	A/B
77286	246	H4	17	12-16	C	78049‡	96	H5	19.4		B
77287	230	H5	18	16	C	78050	1045	L6	23	20	B
77288	1880	H6	19	17	C	78051	120	H4	18	15-18	
77289	2186	I				78052†	97	H5	17.9		C
77290	3784	I				78053	179	H4	17	16	C
77291*	6	H5	18.9	15.9	A	78055‡	14	L6	25.5		B
77292	200	L6	24	20	B	78057	9	H4	18	16	
77293*	110	L6	24.7	20.9	B	78059‡	9	L6	21.5		B
77294	1351	H5	17	15	Ae	78062	11	LL6	29	24	
77295*	141	E4	0.8	1.7	B	78063‡	77	LL6	29.1		A
77296	963	L6	24	21	A/Be	78065‡	7	H6	18.0		B
77297	952	L6	24	20	A	78067	8	H6	18	16	
77299	261	H3	11-21	15-20	A	78069‡	4	H6	19.1		B
77300	235	H5	18	16	C	78070	10	L4	23	13-25	
77301*	55	L6	24.9	20.9	A	78074	200	L6	24	21	B
77302	236	Eu		37-64	A	78075	281	H5	18	16	B/C
77303*	79	L3	n.d.	n.d.	B/C	78076	276	H6	18	16	B
77304	650	L4	18-27	13-19	B	78077	331	H4	19	15-18	C
77305	6444	L6	24	21	B/C	78078	290	L6	24	20	A/B
77306	20	C2	1-45	1	A	78079	5	H5	18	16	
77307	181	C3	1-30	1-12	Ae	78080	25	H5	18	16	
78001‡	85	H5	18.6		B	78081†	18	H5	19.1		
78002‡	11	H6	19.0		A	78082‡	24	LL6	27.7		A
78003	125	L6	24	20	C	78084	14280	H4	18	8-24	B/Ce
78004†	36	H5	19.2			78085	219	H5	18	16	Be
78005‡	28	H5	19.3		B	78086†	9	H6	19.0		
78006	8	Ho		25-61	A	78088†	5	H5	18.8		
78008	7	H5	18	16		78090†	8	H5	18.7		
78010‡	1	H5	19.4		B	78092†	16	H5	19.0		
78012	38	H5	18	16		78094†	4	H5	19.1		
78013	4	L3	11-45	1-31		78096†	7	H5	18.9		
78015	35	L3	8-35			78098†	2	H5	18.9		
78017‡	3	L3	3-43		B	78100	85	I			
78018‡	18	H5	19.2		B	78101	121	L6	24	21	
78019	30	Ur	22	18	B/C	78102	337	H5	18	17	B/C
78021	17	H5	18	16		78103	590	L6	24	20	B
78023	10	H5	18	16		78104	672	L6	24	20	B
78025‡	8	H5	18.9		A	78105	942	L6	23	20	B
78027†	29	H5	19.3			78106	465	L6	24	20	A/B
78028	4	H5	18	16		78107	198	H5	18	17	C
78029‡	4	H4	19.2		B	78108	173	H5	18	16	B/C
78031	5	H5	18	16		78109	233	LL5	28	23	A/B
78033‡	5	H4	19.2		B	78110	161	H5	18	16	B/C
78035	2	H6	18	16		78111	127	H5	18	16	B/C
78037‡	0.5	L3	7-38		B	78112	2485	L6	25	20	B
78038	363	L3	4-42	2-19	C	78113	299	Au			A/Be
78039	299	L6	24	21	B	78114	808	L6	25	20	B/C
78040	212	Eu		33-52	A	78115	848	H6	18	16	B
						78116†	128	H5	18.7		B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
78117‡	4	H5	18.5		A	78190	20	H5	18	16	
78119‡	103	L3	0-28		A	78191	20	H6	18	16	
78120	44	H4	18	16		78193	13	H4	18	16	B/C
78121†	30	H5	19.2			78194	25	H5	18	16	
78122	5	H6	19	17		78196	11	H4	18	16	B/C
78123‡	18	H5	19.3		B	78197	20	H5	18	16	
78124	28	H6	17	15		78199	13	H5	18	16	
78125†	19	L6	25.0		B	78201	10	H5	18	16	
78126	607	L6	25	21	B	78203	11	H5	18	16	
78127	195	L6	24	20	B/C	78205	9	H5	18	16	
78128	155	H5	19	17	C	78207	8	H6	19	17	
78129‡	128	H5	19.4		B	78209	12	H5	18	15	B/C
78130	2733	L6	25	21	B/C	78211	11	H6	18	16	B
78131	269	L6	25	21	B/C	78213	10	H6	18	15	B
78132	656	Eu		40-68	A	78215	6	H6	18	16	B/C
78133	60	L3	1-34	1-16		78217‡	8	H5	18.8		B
78134	458	H4	18	15-20	B/C	78219‡	8	H5	19.4		B
78135†	131	H6	19.0		B	78221	5	H5	18	16	B
78136‡	52	H5	19.1		A	78223	6	H4	18	16	B
78137	70	H6	17	15		78225	5	H5	18	16	B
78138‡	11	LL3	0-35		B	78227	2	H5	18	16	B/C
78139†	17	H5	19.3			78229	2	H6	18	15	B
78140‡	17	H4	18.4		B	78231	2	H6	18	16	B/C
78141	24	H5	18	16		78233	1	H5	18	16	B/C
78142†	32	L5	24.2			78235‡	19	L3	8-28		B
78145‡	34	H6	19.6		A	78236	14	L3	2-37	3-26	
78146	17	H5	18	16		78238	10	L3	2-34	3-21	
78147†	31	H5	6	19.4		78239‡	16	L3	1-34		B
78149‡	23	L3	18-31		B	78241	7	H5	18	16	
78150	16	H5	18	16		78243	2	L3	1-36	3-30	
78152	5	H6	18	16		78245	4	H5	18	16	
78153	152	LL6	29	24	B/C	78247	3	H5	18	16	
78154‡	12	H5	19.3		B	78249	4	H6	18	16	
78156	9	L6	24	21		78251	1312	L6	23	20	B
78157‡	63	H4	19.0		B	78252	2789	I			
78158	15	Eu		40-68	A	78253‡	7	H5	18.9		B
78159	23	H5	18	16		78255‡	3	H5	19.4		A
78160†	16	H5	19.3			78257‡	2	H5	19.2		B
78162‡	33	L3	2-30		B	78259‡	6	H5	19.7		A
78163‡	10	H5	18.7		B	78261	5	C2	0-50	1-8	A
78164	25	H5	18	16		78262	26	Ur	22	19	B/C
78165	21	Eu		37-61	A						
78168‡	34	H4	19.2		B	79001	32	L3	6-39	2-31	C
78169‡	22	H6	19.2		B	79002	223	H6	16	18	C
78170	21	L3	3-36		B	79003	5	LL3	10-38	5-26	B
78171‡	23	L6	25.4		B	79004	35	H5	16	14	B/C
78172‡	29	H4	19.7		B	79005	60	H6	18	16	B
78173‡	20	H5	19.7		B	79006	41	H5	18	15	B/C
78174‡	13	H5	18.2		B	79007	142	L6	23	19	A/B
78176‡	8	L3	8-26		B	79008	12	H5	17	15	B
78178‡	7	H5	19.0		B	79009	76	H5	18	15	Ce
78180‡	8	L3	2-33		B	79010	25	H5	17	15	B/C
78182	10	H5	18	16		79011	14	H5	18	16	B/C
78184	8	H6	18	16		79012	192	H5	17	15	C
78186	3	L3	3-36	3-24		79013	28	H5	18	16	C
78188	0.9	L3	1-34	5-29	C	79014	11	H5	18	16	B
78189	23	H6	18	16		79015	64	H5	17	15	B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
79016	1146	H6	17	15	B/C	80120	60	L6	24	20	B
79017	310	Eu		28-53	A	80121	39	H4	19	17	B/C
79018	121	L6	23	20	B/C	80122	50	H6	18	16	B/C
79019	12	H6	17	15	B	80123	28	H5	18	16	C
79020	4	H6	17	15	B/C	80124	12	H5	18	16	B
79021	29	H5	18	17	B	80125	139	L6	24	20	B/C
79022	31	L3,4	1-28	9-22	A/B	80126	35	H6	19	17	A/B
79023	68	H4	17	14-17	B/C	80127	47	H5	18	16	B
79024	22	H6	17	15	C	80128	138	H4	18	15-20	B
79025	1208	H5	17	15	C	80129	93	H5	18	15	B
79026	572	H5	18	16	B	80130	5	H6	18	16	B/C
79027	133	L6	24	20	B	80131	20	H4	19	16-22	B
79028	16	H6	18	16	B	80132	153	H5	18	16	B
79029	506	H5	18	16	C	80133	4	L3	1-35	5-30	B
79031	3	H5	16	14	C						
79032	3	H5	16	14	C	81001	53	Eu		59	Ae
79033	281	L6	24	20	B	81002	14	C2	0-52	0-2	Ae
79034	13	H6	18	16	B	81003	10	C3V	0-60	1	A/B
79035	38	H4	17	14-18	B	81004	5	C2	0-52	0-2	A/B
79036	20	H5	18	16	B	81005	31	Lunar	11-40	7-47	A/B
79037	15	H6	18	16	B	81006	255	Eu		35-60	A
79038	50	H5	17	15	C	81007	164	Eu		38-55	A/B
79039	108	H4	16	15	B	81008	44	Eu		32-59	A/B
79040	13	H5	18	15	B	81009	229	Eu		30-63	A
79041	20	H5	18	16	B	81010	219	Eu		31-57	A
79042	11	H5	18	16	B	81011	406	Eu		33-60	A/B
79043	62	L6	23	20	C	81012	37	Eu		33-62	A/B
79045	115	L3	2-38	2-29	C	81013	17727	I			
79046	90	H5	18	15	B	81014	188	I			
79047	19	H5	18	15	B	81015	5489	H5	19	16	Be
79048	37	H5	18	16	B	81016	3850	L6	25	21	Be
79049	54	H6	18	16	C	81017	1434	L6	25	21	B
79050	27	H5	18	15	C	81018	2237	L5	24	21	B
79051	24	H5	18	15	C	81019	1051	H5	19	16	B/Ce
79052	23	L6	23	20	B/C	81020	1353	H5	19	16	Be
79053	86	H5	17	15	B/C	81021	695	E6		0-1	A
79054	36	H5	18	16	B	81022	913	H4	19	17	B/C
79055	15	H6	18	16	B/C	81023	418	L5	25	21	B
						81024	798	L3	3-28	2-24	C
80101	8725	L6	24	20	Be	81025	379	L3	1-41	3-40	C
80102	471	Eu		34-52	A	81026	516	L6	25	21	B
80103	536	L6	24	20	B	81027	3835	L6	25	21	C
80104	882	I				81028	80	L6	25	21	B
80105	445	L6	24	20	B	81029	153	L6	25	21	C
80106	432	H4	19	16-19	C	81030	1852	L3	1-49	5-33	B/C
80107	178	L6	24	20	B	81031	1595	L3	1-43	3-35	C
80108	125	L6	24	20	B	81032	727	L3	0-42	2-14	C
80110	168	L6	24	20	B	81033	252	H5	18	16	C
80111	42	H5	18	16	B	81034	255	H5	19	17	B
80112	331	L6	24	20	B	81035	256	H6	19	17	C
80113	313	L6	24	20	B	81036	252	H5	19	17	C
80114	233	L6	24	20	B	81037	320	H6	20	17	B
80115	306	L6	24	20	B	81038	229	H6	19	17	C
80116	191	L6	24	20	B/C	81039	206	H5	19	17	A/B
80117	89	L6	24	20	B	81040	195	L4	25	21	B/C
80118	2	H6	17	15	B	81041	729	H4	18	15-23	C
80119	34	L6	24	20	B	81042	534	H5	19	17	C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
81043	106	H4	18	15	B/C	81100	155	H5	19	17	B
81044	387	H4	18	16	C	81101	119	Ur	10-22		A/B
81045	90	H4	18	16	C	81102	196	H6	19	17	B/C
81046	17	H4	18	16	C	81103	136	H6	19	17	B/C
81047	81	H4	18	16	B/C	81104	184	H4	19	17	C
81048	191	H4	18	16	B/C	81105	93	H4	18	16	C
81049	9	H4	18	16	B/C	81106	48	L6	24	20	B
81050	26	H4	18	16	C	81107	140	L6	24	21	B
81051	43	H4	18	16	B/C	81108	69	H5	18	16	B
81052	29	H4	18	16	C	81109	1	H4	19	17	B
81053	3	L3	1-29	1-42	C	81110	3	H5	19	17	B/C
81054	2	H6	19	17	B	81111	210	H6	19	17	B/C
81055	5	H6	19	16	B	81112	150	H6	19	17	B/C
81056	1	H4	19	17	B	81113	111	H5	18	16	B/C
81057	8	H4	19	13-21	B	81114	79	H4	18	16	B/C
81058	66	H4	18	15	C	81115	155	H5	19	17	C
81059	540	M	28	25-32	C	81116	2	H5	19	17	B
81060	28	L3	2-28	5-27	C	81117	33	H4	18	14-21	B
81061	24	L3	3-33	5-27	B/C	81118	85	H5	19	16	B/C
81062	0.5	H5	18	16	C	81119	107	L4	24	21	B
81063	5	H5	18	16	B/C	81120	14	H5	18	16	B/C
81064	191	H5	18	15	C	81121	88	L3	8-40	1-24	B
81065	13	L3	10-41	5-24	B/C	81122	21	L6	25	21	B
81066	9	L3	1-44	1-25	C	81123	2	LL6	30	25	B
81067	228	H5	19	17	C	81124	9	H5	19	17	B
81068	24	H4	19	16	B	81125	10	H5	19	17	B
81069	7	L3	4-38	1-31	B/C	81126	22	H5	19	16	B
81070	4	H5	19	17	B/C	81127	15	H6	19	17	B/C
81071	2	H5	19	17	B	81128	16	H5	19	17	B/C
81072	3	H5	19	17	B/C	81129	32	H5	18	16	A/B
81073	3	H4	19	8-18	B/C	81130	30	H5	18	16	B
81074	8	H4	19	16	B	81131	13	L6	25	22	A/B
81075	16	H5	19	17	B	81132	5	H5	18	16	B
81076	10	H6	19	16	B	81133	21	H5	18	16	B
81077	4	H5	19	17	B	81134	15	H6	18	16	B/C
81078	6	H6	19	16	B/C	81135	10	H5	19	16	B
81079	7	H6	19	16	C	81136	1	H5	20	17	B
81080	17	H5	19	17	A/B	81137	9	H6	19	17	B/C
81081	5	H5	19	17	B	81138	4	H5	19	17	B
81082	6	H5	19	17	B	81139	7	H5	19	17	B/C
81083	7	H5	19	16	B	81140	14	H4	19	17	B/C
81084	16	H5	19	16	B	81141	1	H5	19	17	B/C
81085	16	L3	1-39	2-25	C	81142	1	H4	18	16	B/C
81086	6	H6	19	16	B	81143	13	H5	18	16	B/C
81087	8	L3	2-29	3-31	B/C	81144	3	H5	19	16	B
81088	4	H5	19	17	B	81145	21	L3	5-40	3-23	B
81089	11	H5	19	17	B	81146	24	H6	18	16	C
81090	10	H5	19	16	B	81147	2	H4	19	16	B
81091	12	H5	19	16	B	81148	13	H5	19	17	B
81092	16	H4	19	17	B	81149	9	H4	19	16	B
81093	271	H6	20	17	A/B	81150	2	L6	25	22	C
81094	152	H6	19	16	C	81151	5	LL5	28	23	B/C
81095	59	H4	18	16	B/C	81152	10	H5	18	16	B
81096	83	H6	19	17	B	81153	4	L5	24	21	B
81097	80	H4	18	16	B	81154	1	H6	19	17	B
81098	71	M		28	C	81155	5	H5	19	17	A/B
81099	152	L6	25	21	A/B	81156	20	L3	4-42	1-30	B/C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALHA					
81157	12	H4	19	17	B/C	81214	4	L3	0.2-38	0.1-45	B/C
81158	2	H5	19	17	B/C	81215	11	H5	18	16	A
81159	10	L6	25	21	B/C	81216	2	H5	18	17	C
81160	12	H6	19	17	C	81217	5	L6	24	20	C
81161	122	H5	19	16	C	81218	6	H5	19	16	C
81162	59	L3	1-40	4-20	C	81219	24	H5	19	17	B
81163	82	H5	19	17	C	81220	3	H5	18	16	B/C
81164	20	H5	18	16	B	81221	9	L6	25	21	C
81165	6	H5	19	16	B	81223	10	H6	18	16	A/B
81166	26	H5	19	16	B	81224	14	H6	19	17	B/C
81167	59	L6	25	22	B/C	81225	14	H6	19	17	B
81168	8	H5	19	17	C	81226	3	H5	19	17	C
81169	6	H5	18	16	B	81227	11	H5	19	17	B
81170	59	H5	19	17	B	81228	8	H5	18	16	B/C
81171	24	H5	19	17	B/C	81229	40	L3	7-32	2-30	C
81172	33	L6	24	21	C	81230	13	H5	18	16	B
81173	26	H5	19	16	A/B	81231	9	H4	19	16	B/C
81174	33	H5	19	17	B	81232	5	H5	18	16	B
81175	13	H5	19	17	A/B	81233	25	H5	19	17	C
81176	95	H5	19	17	B	81234	5	H4	18	16	C
81177	17	H4	19	16	B/C	81235	7	L6	25	21	C
81178	30	H5	19	17	B/C	81236	41	H5	18	16	A/B
81179	14	H5	19	17	B	81237	27	H5	18	16	B
81180	17	H6	18	16	C	81238	24	H5	19	16	C
81181	15	L6	25	22	B	81239	32	H5	19	17	B
81182	5	H5	18	16	B	81240	41	H5	19	18	C
81183	104	H5	17	15	C	81241	34	H5	17	14	B
81184	17	L4	24	20	A/B	81242	20	H5	18	17	B/C
81185	65	LL6	30	25	A/B	81243	15	L3	5-44	6-31	C
81186	23	H5	18	16	B	81244	5	H5	19	17	B
81187	40	A	4	6.5	B/C	81245	4	H5	19	17	B/C
81188	9	H5	19	17	A/B	81246	3	H5	19	17	C
81189	3	E4	2	3	C	81247	104	L6	25	21	A/B
81190	48	L3	0.3-32	4-28	C	81248	5	H6	18	16	C
81191	30	L3	2-29	1-30	C	81249	10	H5	18	17	B/C
81192	9	H5	19	16	A/B	81250	17	H6	18	16	B
81193	13	H6	18	16	B	81251	158	LL3	1-29	2-28	B/C
81194	17	H5	19	16	B	81252	2	H5	18	16	B
81195	5	H5	18	16	B	81253	10	H6	18	16	A/B
81196	9	H6	18	16	B	81254	9	H6	18	16	C
81197	68	H5	17	15	B/C	81255	12	H5	18	16	B
81198	0.5	L5	24	21	B/C	81256	28	H5	18	15	C
81199	16	H4	19	16	C	81257	29	L6	24	21	B
81200	9	H4	19	17	B/C	81258	1	C3V	0-28	0-1	B
81201	7	H5	18	16	B/C	81259	10	L3	0-22	0-29	C
81202	5	H5	19	17	C	81260	124	E6		0.3	A/Be
81203	4	L6	25	21	C	81261	12	"H(?)"*	11	11	A/B
81204	7	H6	18	16	B			*(Acapulco-like)			
81205	3	L6	25	23	B	81262	55	L6	25		
81206	4	H4	18	15-21	B/C	81263	6	H5	18	16	B
81207	14	H5	18	16	C	81265	8	H5	19	17	B/C
81208	2	Di/M		25	Ce	81266	12	L6	24	21	A/B
81209	14	H5	18	16	B/C	81267	27	H4	18	15-22	C
81210	0.6	H6	19	17	B	81268	18	H6	18	16	C
81211	7	H5	18	16	B	81269	5	H5	18	16	B/C
81212	11	H4	18	16	B/C	81270	4	H5	18	16	C
81213	3	H5	19	17	B/C	81271	28	H6	18	16	B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALHA						ALH					
81272	23	L3	2-36	3-22	C	82108	14	H5	18	16	B/C
81273	43	H6	19	17	C	82109	47	H5	18	16	B/C
81274	19	H5	18	16	A/B	82110	39	H3	1-24	4-27	B/C
81275	11	H5	18	16	B	82111	63	L6	24	21	A/B
81276	42	H5	18	16	C	82112	28	H5	17	16	C
81277	7	H5	18	16	B	82113	61	H6	18	16	A/B
81278	1	L6	24	21	B	82114	41	H5	17	15	A/B
81279	27	H4	17	16	C	82115	48	H5	18	16	A/B
81280	55	L3	1-32	2-24	C	82116	18	H6	18	16	B
81281	46	H5	18	16	B	82117	4	L5	25	22	B
81282	31	L6	24	21	A/B	82118	111	L6	24	20	A/B
81283	0.6	H5	18	16	B/C	82119	24	H5	18	16	B/C
81284	10	H5	19	17	B/C	82120	7	H5	19	17	B
81285	20	LL6	27	23	C	82121	2	L6	24	20	A
81286	28	H5	19	17	B	82122	142	H5	18	16	B
81287	78	H5	17	15	C	82123	111	L6	25	20	B
81288	20	H6	18	16	B	82124	26	H6	18	16	C
81289	4	L6	24	21	A	82125	178	L6	24	20	C
81290	2	H4	18	17	B	82126	140	H4	18	15	B/C
81291	4	H6	18	16	B	82127	5	H6	18	16	A/B
81292	13	L3	11-34	2-31	C	82128	15	H4	18	16	B/C
81293	2	H5	18	16	B	82129	14	H5	18	17	B/C
81294	9	H5	18	16	B	82130	45	Ur	3	4	B
81295	105	H5	19	16	C	82131	1.0	C2	0.3		A
81296	13	H5	17	15	B/C	82132	6	E4		0.4	Ce
81297	20	H5	18	16	B	82133	20	H4	18	16	B/C
81298	16	H6	19	17	B	82134	28	H5	16	15	B/C
81299	0.5	L3	1-37	2-16	C	82135	12	C4	27	24	A
81300	10	H5	19	16	A/B	82136	4	H4	18	5-20	B
81301	12	H5	19	16	B/C	82137	11	L5	23	20	B
81302	4	H5	18	16	B/C	82138	5	H6	19	17	B
81303	4	H6	18	16	B/C	82139	0.2	L6	24	20	B
81304	42	L6	24	21	A/B	82140	0.3	L6	25	20	C
81305	1	H5	18	16	B/C	82141	0.6	H5	19	17	C
81306	7	H5	19	17	B	82142	20	L6	25	21	C
81307	57	L6	24	21	B	82143	3	H6	18	16	C
81308	19	H5	18	16	B/C	82144	7	H5	19	17	B
81309	0.6	H4	18	16	C						
81310	0.7	H6	19	17	B	83001	1569	L4	23-28	20-32	B
81311	0.9	L6	24	21	B	83002	367	L5	23	19	B
81312	0.7	C2	1-35	1-31	A	83003	322	H5	17	15	A/B
81313	0.5	Eu		38		83004	814	L6	23	19	B
81314	3	H5	18	16	B	83005	228	H5	17	15	C
81315	2	"H(?)"*	11	11	A/B	83006	230	H5	17	15	B/C
		*(Acapulco-like)				83007	285	LL3	0.5-43	3-37	B
81316	0.7	LL4	29	23	B	83008	272	L3	10-24	5-24	B
81317	0.4	H6	18	16	C	83009	2	Au			A/B
						83010	395	L3	4-31	2-28	B
ALH						83011	213	L5	23	19	C
82100	24	C2	1-47	1-2	A	83012	203	H5	18	16	B/C
82101	29	C3O	1-50	1-10	A	83013	246	H6	18	16	A/B
82102	48	H5	18	16	B/C	83014	1	Ur	18	15	B
82103	2529	H5	17	16	B	83015	3	Au			A/B
82104	399	L5	25	21	A	83016	4	C2	0.3-30	0-1	A/B
82105	363	L6	24	21	A/B	83017	0.6	L3	0.8-28	4-20	
82106	35	Ur	3	4	B	83018	4	E6		0	B/C
82107	9	L5	22	19	B/C	83019	3	H4	17-21	11-22	B/C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALH						ALH					
83020	3	H5	18	16	B	83102	1786	C2	0-2		B/Ce
83021~	42	L6			B	83103~	52	H6			B
83022~	5	LL6			B	83104	2	H5	18	16	B
83023	4	L4	23	20	B	83105~	0.7	L6			A
83024	6	H6	17	15	B/C	83106	22	C2	0.2-5		A
83025	78	H5	17	15	C	83107	38	H5	18	16	B/C
83026	0.1	C3O	0.3-18	0.7-12	B	83108	1519	C3O	0.9-38	1-17	A
83027~	3	L6			B						
83028~	16	H6			B	84001	1931	Di		27	A/B
83029	96	H5	19	16	B/C	84002	7554	L6	24	20	Be
83030	49	H5	18	16	B/C	84003	3089	H5	16	15	A/B
83031	10	H5	19	16	B	84004	9000	H4	17-18	16-19	Be
83032~	3	LL6			B	84005	12000	L5	21	18	A/B
83033	21	L6	23	20	B/C	84006	16000	H4,5	18	17-18	B/Ce
83034	6	H5	18	16	B	84007	706	Au			Ae
83035	1	H5	18	16	B	84008	302	Au			A/B
83036	24	H5	17	15	A	84009	336	Au	0	0	A
83037	2	H5	18	16	B/C	84010	303	Au	0	0	A
83038	87	L3	7-35	2-22	C	84011	138	Au			A
83039	6	H5	18	16	B	84012	225	Au	0	0	A
83040	78	H5	18	16	B/C	84013	160	Au	0	0	A/B
83041~	0.3	L6			C	84014	49	Au	0	0	A/B
83042	0.5	H3	7-33	2-16	B	84015	264	Au	0	0	A
83043~	3	L6			B	84016	150	Au	0	0	A
83044	5	H5	19	17	A	84017	80	Au	0	0	A
83045	2	L5	24	20	B/C	84018	82	Au	0	0	A
83046	33	H5	17	15	A/B	84019	93	Au	0	0	A
83047	20	H5	19	16	B/C	84020	191	Au	0	0	A/B
83048	2	L5	24	20	B/C	84021	36	Au	0	0	A
83049	6	H5	18	16	B	84022	13	Au	0	0	A
83050	10	H6	17	15	A/B	84023	262	Au	0	0	A
83051	16	H5	17	15	A/B	84024	194	Au	0	0	A
83052	53	L6	23	20	C	84025	5	Brachinite	32-33	11	A/Be
83053	63	H5	17	15	C	84027	8	LL7?	27	23	B
83054~	17	LL6			A	84028	736	C3V	0-50	2	Ae
83055	18	H5	18	16	B/C	84029	120	C2	0-2		Ae
83056	1	H5	18	16	A/B	84030	6	C2	0-2		A
83057	63	H5	18	16	B	84031	12	C2	0-2		Ae
83058~	29	L6			A	84032	8	C2	0-2	2	A
83059	4	H5	19	17	B/C	84033	60	C2	0-1	2	Ae
83060	9	H5	18	16	C	84034	44	C2	0-2		A
83061	34	H5	17	15	B/C	84035	3	C2	0.5-6	0.7-7	Ae
83062	77	H5	17	15	B/C	84036	3	C2	0.7-40	2-13	A
83063~	17	L6			A/B	84037	3	C3V	0.8-9	0.5-12	Be
83064	12	H5	18	16	C	84038	12	C4	25-30	26-28	Ae
83065	54	H5	17	15	C	84039	33	C2	0.4-31	0.8-1.5	A/B
83066	46	H5	17	15	C	84040	29	C2			Ae
83067	96	L6	24	20	A/B	84041	1	C2			Ae
83068	0.8	H5	17	15	C	84042	51	C2	0-2		A
83069	78	L5	25	21	A	84043	17	C2			Ae
83070	216	LL6	29	23	A	84044	147	C2	0-2		Ae
83071	5	H6	18	16	B/C	84045	11	C2			Ae
83072	2	H5	18	16	C	84046	2	C2	0.3-2.1	0.7-1.0	A
83073	49	H5	18	16	C	84047	4	C2			A/Be
83074	6	H5	17	16	C	84048	13	C2			Ae
83100	3019	C2			Be	84049	29	C2			Ae
83101	639	L6	25	23	A	84050	3	C2			Ae

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALH						ALH					
84051	34	C2			A/Be	84108	215	H6	18	16	B
84052	11	LL6	29	24	A/B	84109	246	H6	19	16	B/C
84053	5	C2	0.5-1.5	5	A	84110	319	H6	18	16	B/C
84054	19	C2	0.5-36	3	Ae	84111	132	H5	18	16	B
84055	6901	H5	16	14	Be	84112	146	L6	24	21	A/B
84056	2140	L6	24	21	Be	84113	212	H6	18	16	B/C
84057	368	L6	23	19	B/Ce	84114	120	H6	18	16	B
84058	2003	L6	23	20	B	84115	195	H6	18	16	B/C
84059	857	H4	18	16	B/C	84116	56	LL6	28	23	B
84060	339	H5	17	15	B	84117	72	H5	18	16	B
84061	676	L6	24	21	B	84118	114	H6	18	16	B
84062	958	L6	23	19	A/B	84119	34	LL6	28	23	A
84063	760	L5	22	19	A/B	84120	129	L3	22	6-21	A/B
84064	1889	H5	17	15	B	84121	141	H5	17	15	C
84065	1642	L6	23	20	A/B	84122~	81	LL6			A/B
84066	356	L6	23	19	B	84123~	97	LL6			B
84067	391	H5	17	15	C	84124	114	H5	18	16	C
84068	1114	H5	17	15	B	84125~	76	LL6			A
84069	1136	H5	19	16	A	84126	41	LL3	7-31	3-24	B
84070	3952	L6	23	19	A/B	84127~	84	L6			B
84071	798	H6	19	16	B	84128	2	H5	19	17	C
84072	721	L6	24	20	Be	84129	38	L6	23	20	A
84073	631	H5	17	15	B	84130~	45	L6			B/C
84074	758	H5	17	15	A/B	84131	108	H5	18	15	C
84075	789	H5	17	15	C	84132	158	L6	23	20	B
84076	369	H5	18	16	B/C	84133	70	H5	18	16	B
84077	276	H5	18	16	B	84134	113	L6	23	20	B
84078	283	H5	18	16	B/C	84135	31	H5	18	16	B/C
84079	750	L6	23	20	A/B	84136	84	Ur	0-5	4	B
84080	287	L6	24	20	B	84137	145	H5	18	16	B/C
84081	612	LL6	29	23	A	84138	20	H5	19	17	B
84082	557	H6	19	17	C	84139	157	H5	19	17	A
84083	420	H6	18	16	B/C	84140	164	L6	24	21	C
84084	332	H4	18	16	B	84141	130	L6	24	21	B
84085	554	H5	17	15	B/C	84142~	78	L6			A/B
84086	234	LL3	25-29	17-26	A/B	84143~	74	L6			B
84087	315	L6	24	20	A/B	84144	54	H5	17	15	C
84088	298	H5	18	16	B	84145	19	H5	17	15	B
84089	304	H5	18	16	B/C	84146	33	H5	18	16	B
84090	202	L6	25	22	Ce	84147	54	H6	17	15	C
84091	215	H5	19	17	B/C	84148	168	H5	17	15	C
84092	214	L6	23	20	A/B	84149	12	H5	17	15	C
84093	114	H6	17	15	B	84150	20	H6	19	17	B/C
84094	208	H5	17	15	C	84151	112	H6	18	15	B
84095	277	L6	24	20	A/B	84152	6	H5	17	15	B/C
84096	294	LL6	31	27	A/B	84153	243	H6	17	15	B/C
84097	389	L6	24	21	B	84154	88	LL6	31	25	A
84098	261	H5	17	15	B/C	84155	114	H5	18	16	B/C
84099	150	H5	17	15	B/C	84156	28	H5	18	16	B/C
84100	110	H5	18	16	B	84157	89	H5	17	15	B/C
84101	221	H6	19	17	C	84158	54	H5	18	15	B/C
84102	214	L6	24	21	B	84159	101	H6	19	17	C
84103	137	H4	17	15	B	84160~	54	L6			B
84104	201	L6	24	20	B	84161	83	H5	17	15	C
84105	261	H6	15	14	C	84162	42	H5	18	15	C
84106~	95	L6			B/C	84163	135	H5	17	15	C
84107	134	LL6	29	23	A	84164	101	L6	24	20	A/B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALH						ALH					
84165	95	I				84222	10	H5	19	17	C
84166~	39	L6			B	84223	11	H5	18	16	C
84167	151	H5	17	15	C	84224	7	H6	18	16	B
84168	14	LL6	30	24	B	84225	9	H5	18	16	C
84169	98	L6	25	22	B/C	84226	28	H5	17	15	B
84170	39	E3	0.6-28	0.9-17	B	84227	12	H5	18	16	C
84171~	37	H6			C	84228	10	H5	18	16	B/C
84172	3	H5	16	15	B/C	84229~	7	L6			B
84173	2	L6	25	21	C	84230	2	H4	18	14-19	B
84174~	32	L6			B	84231~	43	L6			B
84175	35	H5	19	16	C	84232	10	H4	17	14-20	C
84176	5	H6	18	16	C	84233	14	I (incl.)			e
84177	7	L5	24	20	B	84234~	4	L6			A
84178	0.4	H5	18	16	B	84235	6	E4		0.5-2.3	C
84179	46	H5	18	16	B/C	84236	32	H5	18	16	B
84180	47	H6	18	16	B	84237	8	H5	17	15	C
84181~	33	L6			A/B	84238~	2	L6			B
84182	14	L6	24	21	B	84239	15	H5	18	16	B
84183	28	H5	17	15	B	84240	26	H5	18	16	C
84184	42	H5	18	16	B	84241	17	H5	17	15	C
84185	5	H5	18	16	C	84242	17	H6	19	17	C
84186~	20	H6			B	84243~	49	H6			Ce
84187	26	H6	18	16	C	84244~	34	L6			B
84188	3	E4		0.7-3	C	84245	19	H5	17	15	B
84189~	9	H6			C	84246	2	H5	18	16	A/B
84190	8	A	4	6	C	84247~	50	L6			A/B
84191	14	C2	0.4-.8	0.8-7	A	84248	5	H5	19	16	B
84192	4	H5	18	16	C	84249	23	H5	18	16	B/C
84193~	9	L6			A/B	84250	10	E4		0.5-4	B
84194	4	H5	18	16	C	84251	34	H5	18	16	B/C
84195	2	L4	22	15-20	B	84252	3	H6	18	16	B/C
84196	10	H5	18	16	B/C	84253	7	H5	18	16	B/C
84197~	8	L6			B	84254	2	E4		0.3-4	B
84198	5	LL6	29	24	A/B	84255	11	LL6	28	24	A
84199	27	H5	17	15	C	84256~	3	L6			B
84200	8	E4		0.6-4	B	84257~	19	H6			B
84201	6	H5	18	16	B/C	84258	3	L5	25	21	B
84202	88	H5	17	15	C	84259	23	H5	18	16	C
84203~	9	L6			A/B	84260	15	H5	19	16	B
84204~	24	H6			C	84261~	5	L6			A
84205	25	L3	12-33	4-19	B	84262	15	H6	17	15	C
84206	15	E4		0.7-6	A/B	84263	5	H5	18	16	C
84207~	4	L6			B	84264	138	L6	24	21	A
84208	21	H6	17	15	C	85001	212	Eu		32	A/B
84209	6	L5	23	20	C	85002	438	C4	30	23-29	A
84210~	9	L6			C	85003	50	C3O	1-56	0.5-23	A/B
84211	49	H6	19	17	B/C	85004	8	C2			B
84212~	7	L6			B/C	85005	19	C2	0.5-39	0.9-2.2	A
84213	7	H5	18	16	B	85006	49	C3V	0.3-43	0.9-4.9	A
84214~	5	H6			B/C	85007	82	C2	0.3-30		B
84215	9	H6	18	16	B/C	85008	32	C2	0.3-45	0.9-2.5	B
84216	5	H5	18	16	B/C	85009	47	C2	0.4-59	0.8-1.6	A
84217	3	H5	18	16	C	85010	3	C2	0.7-28	3-20	A/B
84218~	33	L6			A/B	85011	11	C2	0.6-39	0.8-2.5	A/B
84219~	10	L6			C	85012	4	C2	0.5-18	0.7-46	Be
84220	8	E4		1-4	C	85013	130	C2	0.5-36		A
84221	16	H5	18	16	C						

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALH						ALH					
85014	75	L6	25	21	A	85071	19	H5	18	16	C
85015	3	Di	39	25	A	85072~	4	H6			C
85016	1412	L6	23	20	A/B	85073~	16	LL6			A/B
85017	2361	L6	24	20	A	85074	3	H5	18	16	C
85018	812	H6	17	15	B	85075~	36	L6			B
85019	633	LL6	28	23	A	85076~	78	L6			Be
85020	744	H6	17	15	B	85077	12	H5	18	16	B/C
85021	647	H5	17	15	Be	85078	1	L6	23	20	C
85022	952	L6	24	20	B	85079~	83	LL6			A/B
85023	439	H6	18	16	B/C	85080~	54	L6			B
85024	388	H5	18	15	B/C	85081	12	H6	18	16	B
85025	713	H5	18	16	C	85082~	19	L6			A/B
85026	817	L6	24	21	A	85083~	93	L6			A/B
85027	370	L6	24	20	B	85084~	18	LL6			B
85028	326	H6	19	17	C	85085	12	Chon.	1-5	1-4	A/B
85029	389	L6	24	21	A/B			(unique)			
85030	620	H6	17	15	B/C	85086	12	H5	18	16	B/C
85031	201	H6	17	15	B/C	85087~	11	L6			A/B
85032	424	H6	17	15	C	85088	0.4	H5	18	16	C
85033	250	L4	23	6-24	A	85089	1	H5	18	16	B/C
85034	344	L6	24	21	A	85090~	11	L6			B/C
85035	420	LL6	27	23	C	85091	31	H5	18	16	B/C
85036	231	H6	19	16	C	85092	26	L5	23	19	A/B
85037	141	H6	18	16	B/Ce	85093~	11	L6			B
85038	125	H5	17	15	B/C	85094~	9	H6			C
85039	140	L6	23	20	A	85095~	33	L6			B
85040~	96	L6			B	85096~	3	L6			A
85041	168	H6	18	16	C	85097	61	H5	18	16	B/C
85042	128	H5	17	15	B/C	85098	7	H5	18	16	C
85043	205	H5	18	16	B	85099	7	H5	18	16	B/C
85044	105	H6	18	16	C	85100	58	H5	18	16	B
85045	145	L3	22-26	13-22	A/B	85101~	8	L6			B
85046	149	L6	23	20	B	85102	13	H5	18	16	B
85047~	4	L6			B	85103~	87	L6			A
85048	17	H5	18	16	C	85104	99	H5	17	15	B/C
85049~	5	L6			B/C	85105~	12	L6			A/B
85050~	0.9	L6			A	85106	3	C2	0.3-30		B
85051	5	H5	18	16	B/C	85107	37	H5	18	16	B/C
85052	17	H6	18	16	A/B	85108	15	H6	17	15	C
85053	0.5	L4	25	14-20	C	85109~	21	H6			Ce
85054	55	H5	18	16	C	85110	22	H5	17	15	B
85055	6	H5	18	16	C	85111	13	H5	18	16	C
85056	7	H5	18	16	C	85112~	23	L6			A/B
85057~	0.8	LL6			A	85113~	40	L6			A/B
85058	0.3	L4	25	17-19	A/B	85114	11	H5	18	16	C
85059~	9	LL6			A	85115~	22	L6			B
85060~	0.5	L6			B	85117~	28	H6			B/C
85061~	2	L6			A/B	85118	48	L5	24	21	B/Ce
85062	167	L3	1-25	3-19	B/Ce	85119	21	E4		0.3-12	Be
85063~	13	L6			B	85120	8	H5	18	16	C
85064~	4	L6			C	85121	55	H3	9-20	3-31	B
85065~	10	L6			B	85122	61	H5	19	16	B
85066	8	LL6	28	23	B	85123	15	L5	23	20	B
85067	1	H5	18	16	B	85124~	63	L6			B
85068	4	H5	18	16	C	85125	19	H5	17	15	B/C
85069	5	H6	19	16	B	85126	47	H5	17	15	B/C
85070	13	L3	4-25	1-29	A/B	85127	10	H6	19	17	C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
ALH						DOM					
85128~	16	H6			C	85500	60	H5	18	16	B
85129~	127	LL6			A/B	85501	126	H5	17	15	C
85130	100	H6	18	16	B	85502	302	L6	24	21	B
85131~	34	L6			B	85503	720	L6	25	21	A
85132~	49	L6			A/B	85504	121	L4	24	18-21	B/C
85133	91	H5	17	15	B	85505	31	LL5	26	22	B
85134	10	H5	18	16	C	85506	59	LL5			A/B
85135~	12	LL6			B/C	85507	190	H5	19	17	C
85136	75	H6	17	15	B	85508	14	H6	19	17	C
85137~	7	LL6			A/B	85509~	76	L6			B/C
85138~	18	LL6			B	85510~	32	L6			B/C
85139	26	H6	17	15	B						
85140	9	H6	19	16	B/C	DRPA					
85141	11	H5	18	16	C	78001	15200	I			
85142	51	H5	17	16	B/C	78002	7188	I			e
85143	18	H5	19	16	C	78003	144	I			e
85144	18	H5	18	16	B	78004	134	I			
85145	46	H5	18	16	C	78005	18600	I			e
85146	40	H5	18	16	A/B	78006	389	I			
85147~	3	L6			B	78007	11800	I			
85148~	4	H6			A	78008	59400	I			
85149~	17	L6			B/C	78009	138100	I			
85150	13	L5	24	19	B						
85151	14	Chon. (Carlisle Lakes-like)	0.4-41	6-30	B	EETA					
						79001	7942	Sh	23-27	16-67	Ae
85152~	36	LL6			A/B	79002	2843	Di	24-25	22	B
85153	0.4	H4	18	16-21	B	79003	436	L6	24	20	B
85154~	5	LL6			A/B	79004	390	Eu		30-61	B
85155	18	L3	8-28	4-20	A/B	79005	451	Eu		30-61	A
85156	32	H6	19	16	C	79006	716	Ho		19-57	B
85157~	20	L6			B	79007	200	H5	18	16	B
85158~	3	LL6			B	79009	140	L5	24	20	B
85159	11	E4		0.3-1.8	B/C	79010	287	L6	24	20	B
						79011	86	Eu		30-61	B
86600	411	L6	24	21	B	EET					
86601	309	H5	18	16	B	82600	247	Ho		22-53	Ae
86602	265	L6	24	20	B	82601	150	L3	2-39	1-35	B/C
86603	104	H5	18	16	A/B	82602	1824	H4	19	16	B
86604	13	L6	24	20	B/C	82603	8210	H5	19	17	Be
86605~	12	L6			A/B	82604	1571	H5	19	16	B/C
86606	4	H5	17	15	B/C	82605	625	L6	25	21	B
86607	3	H6	18	16	C	82606	982	L6	25	21	B
86608~	10	L6			B/C	82607	165	L6	23	20	B/C
86609~	8	L6			A/B	82608	95	LL6	28	23	A/B
86610	0.8	L5	23	20		82609	326	H4	18	17	B/C
86611	9	H5	18	16	C	82610	42	H6	19	17	B
86612	2	H5	19	17	C	82611	13	L4	24	21	B
						82612	32	L6	25	21	A
BOW						82613	4	L4	24	20	B
85800	141	H6	18	16	C	82614	8	H5	18	16	A/B
						82615	29	H6	19	17	B
BTNA						82616	2	H4	18	16	B/C
78001	161	L6	24	21	B						
78002	4301	L6	24	20	B	83200	779	H5	17-18	17-19	B/C
78004	1079	LL6	30	24	B	83201	1060	H6	18-20	18	B/C
78005	82	H6	18	16	B	83202	1213	L6	24-25	22-23	A/B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
EET						EET					
83203	546	H5	20	18-21	B/C	83262	24	H5	17	16	A
83204	377	LL6	29-31	27	A	83263	10	H6	19	17	C
83205	471	L6	25	22	A/B	83264~	17	L6			B
83206	462	L6	24	22	B	83265~	55	L6			B
83207	1238	H4	18	16-18	B	83266~	56	L6			B
83208	263	H5	17-19	16-17	B/C	83267	28	H3	13-23	12-20	B
83209	520	L6	25	22-23	B/C	83268	19	L6	24	20	C
83210	426	L6	24-25	22	A/B	83269	8	L5	23	19	A/B
83211	543	H4	18-20	16-20	B/Ce	83270	2	H6	19	16	C
83212	402	Eu			B	83271	67	L6	24	21	A/B
83213	2727	LL3	13-30	3-26	Be	83272~	35	L6			B
83214	1398	L6	24-25	22-24	B	83273~	147	LL6			A/B
83215	510	H6	18	19	B/C	83274	83	L3	5-28	5-15	B
83216	790	L6	24	20	B	83275~	86	H6			B
83217	375	L6	24	20	B	83276	49	L6	24	20	B
83218	192	L6	23	20	B	83277	53	L5	23	19	A/B
83219	243	L6	23	20	B	83278	72	H5	17	15	B
83220	331	L6	23	20	B	83279~	36	L6			B
83221	314	H4,6	17	15	C	83280~	29	L6			B/C
83222	317	L6	24	20	B	83281	51	H6	18	16	C
83223	219	H5	18	16	B	83282	79	H5	18	16	B/C
83224	9	C2	0.2-41	0-1	A/B	83283	57	Eu			B
83225	44	Ur	18	15	B/C	83284~	53	L6			B
83226	33	C2	0.5-69	0.6-10	A/B	83285	3	H5	18	16	B
83227	1973	Eu			B	83286~	34	L6			B
83228	1206	Eu			B	83287	46	H5	17	15	B
83229	313	Eu			B	83288~	38	H6			C
83230	530	I				83289	8	L6	24	20	B
83231	66	Eu			B	83290	1	LL6	29	25	B
83232	211	Eu			B	83291	5	L5	24	21	B/C
83234	181	Eu			B	83292	9	H5	18	16	B/C
83235	255	Eu			B	83293	19	H5	18	16	B
83236	6	Eu			B	83294~	82	L6			B
83237	883	L6	25-26	23-25	B	83295	28	H6	18	16	B
83238	382	L6	25	21	A	83296~	63	L6			A/B
83239	282	L6	24	20	C	83297~	18	L6			B/C
83240	248	L5	23	20	B	83298	9	L6	24	20	C
83241	203	L6	23	19	B	83299	6	H6	19	17	C
83242	282	L5	23	20	B	83300	115	H5	18	16	C
83243	288	L6	23	19	A	83301~	87	L6			B
83244	384	L6	24	20	B	83302~	130	L6			A/B
83245	59	I				83303	12	H5	18	15	B/C
83246	48	Di			A/B	83304~	37	L6			A/B
83247	22	Di			B/C	83305	167	H5	17	15	B
83248	39	H3	3-24	3-23	B	83306	42	L6	23	20	B
83250	11	C2	0.3-22	2-14	Be	83307	5	E4	2-5	0.5-5	C
83251	261	Eu			B	83308	137	L5	22	18	B
83252	184	L6	24	21	B/C	83309	61	Ur	11-21	4-14	C
83253	44	L6	23	20	B	83310	64	H6	18	16	C
83254	8	E4		0-9	Ce	83311	15	C4	31		A/B
83255~	39	L6			B	83312	93	L6	24	20	B
83256	5	H5	18	16	B	83314~	24	L6			B
83257~	14	L6			B	83315~	113	L6			B/C
83258~	47	L6				83316~	51	L6			B/C
83259	4	L6	24	20		83317	119	L6	23	20	B
83260	15	L3	7-19	5-25	B/C	83318	55	L4	23	19	A/B
83261~	54	L6			A	83319~	7	L6			C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
EET						EET					
83320	56	H6	18	16	C	83380~	119	LL6			B
83321	11	H6	18	16	C	83382	12	H6	18	16	B
83322	14	E4	0.2-2		A/B	83383~	117	L6			B
83323	140	L6	23	20	B	83384~	22	L6			B
83324	143	H5	17	15	B/C	83385~	4	H6			B/C
83325~	93	L6			C	83386	38	L5	24	20	A/B
83326	113	H5	17	15	C	83387~	81	L6			C
83328~	88	L6			B/C	83388	35	H5	19	16	C
83329	68	L4	22	5-21	B	83389	19	C2	0.2-37	1-13	A/B
83330~	49	L6			B	83390	15	I			
83331	0.3	H5	17	15	B/C	83391~	91	LL6			A/B
83333	189	I				83392~	164	L6			B
83334	3	C2			A	83393~	30	H6			B/C
83335	227	L6	23	20	A/B	83394~	54	H6			C
83336~	130	L6			B/C	83395	65	L3	6-30	2-17	B
83338	27	H5	18	16	C	83396~	198	L6			A/B
83339~	73	L6			B	83397	32	H6	19	16	C
83340	15	L5	26	22	B	83398	67	L5	25	21	B
83341~	65	LL6			B	83399	203	L3	3-26	6-25	C
83342	149	L6	23	20	B	83400	113	H5	17	15	C
83343	125	L6	23	20	B	83401~	112	LL6			A/B
83344~	87	L6			C	83402	50	H5	17	15	C
83345	12	L6	24	20	C	83403	12	H5	18	16	C
83346	22	H5	18	16	B						
83347	37	H5	17	15	C	84300	72	I (incl.)			
83348	299	L6	23	20	A/B	84301	75	L6	24	20	B
83349	28	H5	19	16	C	84302	60	A	5	8	B/C
83350~	89	L6			A/B	84303	58	H5	18	16	C
83351	81	H5	18	16	B	84304	152	L6	24	20	B
83352~	20	LL6			B/C	84305	10	LL6	27	22	A/B
83353~	54	L6			A/B	84306	4	H6	19	16	C
83354	8	L6	24	20	C	84307	5	L6	23	20	C
83355	66	C2	0-28	0-9	A/B	84308	9	L6	24	20	B
83356~	18	L6			B						
83357~	35	LL6			B/C	86800~	116	L6			A
83358~	26	L6			B/C	86801	83	L6	24	21	B
83359~	66	LL6			C	86802	30	H4	18	13-17	A
83360~	40	H6			C						
83361	6	LL5	27	23	A/B	GEO					
83362~	10	H6			B/C	85700	2409	L6	24	20	B
83363	185	L6	24	20	B	85701	439	L6	23	20	A
83364	205	L6	24	20	A/B						
83365~	158	L6			B	GRO					
83366~	189	L6			B	85200	3822	H5	18	16	B/C
83367	107	H6	18	16	C	85201	1401	I			
83368	51	L6	24	20	C	85202	27	C2	0.8-1.2		A/Be
83369	39	H5	16	14	C	85203	1450	H5	18	16	B
83370~	24	L6			C	85204	1755	L6	24	21	A
83371~	170	L6			B	85205	1000	L6	25	20	A/B
83372	169	H5	18	16	B	85206	2420	H5	17	15	B/Ce
83373	159	H6	17	15	C	85207	2372	L6	24	20	A/B
83374	96	H6	18	16	C	85208	1357	L6	23	20	A
83375~	267	L6			B	85209	1126	L6	25	21	A
83376	79	Ho		21-49	A/B	85210	247	H5	18	16	B
83377	152	H5	18	16	C	85211	355	H5	19	17	B
83378~	212	L6			B	85212	342	L4	23	16-20	B
83379~	177	L6			B	85213	4364	L6	23	20	B

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
GRO						LEW					
85214	260	L5	24	21	B	85349	17	L6	23	19	C
85215	35	L5			B	85350	24	L4	24	20	B/C
85216	13	L5			B	85351	12	H4	17	14-21	B/C
85217	34	L5			B/C	85352	9	H5	17	15	C
85218	7	H6	18	16	C	85353	25	Eu		22-62	B
						85354~	12	L6			B/C
ILD						85355	6	H5	17	15	C
83500	2523	I			e	85356~	8	L6			B/C
LEW						85357	61	H5	18	16	B/C
85300	210	Eu		32-63	A/B	85358	14	H5	18	16	C
85301~	13	H6			B/C	85359	18	H6	17	15	C
85302	115	Eu		24-59	A/B	85360~	13	L6			B
85303	408	Eu		30-62	A/B	85361	4	L6	23	20	C
85305	41	Eu		31-57	A	85362	15	H6	18	16	C
85306	6	C2	0.2-33	0.7-5.5	A	85363	44	L5	23	20	B
85307	2	C2	0.6-46		A	85364	4	H5	18	16	C
85309	54	C2	0.2-41	0.9-1.5	A/Be	85365	8	L4	24	20	C
85311	200	C2	0.4-36	0.9-1.1	Be	85366	3	H4	17	12-18	C
85312	32	C2	0.2-45	0.7-1.8	B	85367	6	H5	17	15	C
85313	191	Ho		15-64	B	85368	18	H6	18	16	C
85314	14	H5	18	16	C	85369	6	I			
85315	10	H6	18	16	C	85370	11	H4	17	15	B/C
85316	34	H5	17	15	C	85371	55	H5	18	16	C
85317	9	L4	25	18-22	A/B	85372	9	H5	18	16	C
85318	152	H5	17	15	C	85373~	45	H6			Ce
85319	11491	H5	18	16	B/Ce	85374	10	H6	18	16	B
85320	110224	H5	19	16	Be	85375	37	H5	17	15	C
85321	527	L6	24	20	B/C	85377~	31	H6			C
85322	582	H6	19	17	C	85378~	66	H6			C
85323	874	L6	23	20	Be	85379	26	H5	17	15	C
85324	514	H5	18	16	B	85380~	14	L6			B
85325	537	L6	25	21	B/C	85381~	22	H6			C
85326	225	H5	19	17	C	85382	10	H5	18	16	B/C
85327	439	H5	17	15	B/C	85383	18	H3	6-23	2-18	C
85328	107	Ur	20	17	B/C	85384~	6	H6			C
85329	170	H6	19	16	A/B	85385	13	L5	23	20	B/C
85330	67	H6	18	16	B/C	85386~	14	LL6			A/B
85331	54	H6	17	15	B/C	85387	4	H5	17	15	C
85332	114	Chon. (unique)	0-37	1-30	B/C	85388~	4	L6			B/C
						85389	4	H5	17	15	C
85333	48	L4	25	21	B	85390	1	L4	24	12-24	C
85334	177	H5	18	16	B/C	85391	9	H6	18	16	C
85335	107	H6	17	15	C	85392	28	H6	18	16	C
85336	60	H5	18	16	B/C	85393	51	H5	18	15	Be
85337~	57	H6			C	85394	15	L5	23	19	C
85338	99	H5	16	14	B	85395	17	H5	18	16	B/C
85339	29	L3	1-30	3-13	A/B	85396	60	L3	2-26	3-25	C
85340	103	L5	23	19	B	85397	57	L6	19-22	17-20	C
85341	76	H5	17	15	C	85398	38	H4	18	14-18	C
85342	7	H5	18	16	C	85399~	8	H6			C
85343	78	L4	22	18	A	85400	6	H6	18	16	B/C
85344	3	H5	17	15	C	85401	4	L3	1-28	1-20	B/C
85345	32	H5	17	16	B/C	85402~	66	H6			C
85346~	30	L6			B	85403~	12	L6			A/B
85347	31	H5	17	15	C	85404	34	H5	19	16	B
85348	31	H6	19	16	C	85405	63	H5	19	16	B/C
						85406	7	H5	19	16	C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
LEW						LEW					
85407	19	H5	18	16	C	85465~	57	L6			B
85408~	3	H6			B	85466	14	H5	18	16	C
85409	29	H5	17	15	B/C	85467~	5	LL6			B/C
85410~	2	H6			C	85468	15	H4	18	16	B/C
85411~	4	H6			C	85469~	8	H6			C
85412	71	H6	19	16	C	85470	19	H6	18	16	C
85413~	14	L6			B	85471	239	L6	25	22	C
85414	26	H5	19	17	C	85472	67	L6	23	20	B/C
85415	3	LL6	30	24	A	86001	291	Eu		22-57	Be
85416	6	H5	18	16	C	86002	33	Eu		31-61	A/B
85417	9	L5	24	20	B/C	86003	2	Eu		26-64	B
85418	37	H6	18	16	C	86004	2	C2	0-54	0-7	B
85419	39	L6	23	20	C	86005	5	C2	0-38	0-3	A/Be
85420	12	L6	25	20	B/Ce	86006	0.8	C3V	0-27	0-5	B
85422	27	H5	17	15	C	86007	2	C2	0-42	0-4	A/Be
85423	11	H5	17	15	B/C	86008	6	C2	0-25	0-3	B
85424~	4	L6			B/C	86009	6	C2	0-45	0-2	A/Be
85425	3	L6	23	20	C	86010	7	An	63	19	A/B
85426	16	H5	18	16	B/C	86011	3398	L6	25	21	A/B
85427	15	L5	25	21	B	86012	2157	L6	25	21	A
85428~	21	L6			B/C	86013	1812	L6	25	21	B
85429	7	LL6	27	23	C	86014	662	L4	24	17-22	C
85430	13	L6	23	20	C	86015	780	H6	19	17	C
85431~	30	L6			C	86016	525	L6	25	21	A/B
85432~	2	L6			B	86017	688	H6	19	16	B
85433	57	H5	18	17	C	86018	502	L3	0.7-32	2-9	Be
85434	19	L3	1-23	2-11	C	86019	432	L6	24	20	B
85435	21	H5	17	15	C	86020	361	H5	18	16	C
85436	9	L6	23	20	C	86021	326	L3	18-28	4-17	Ce
85437	9	L3	1-23	2-11	C	86022	352	L3	6-34	1-31	B/Ce
85438~	3	LL6			A/B	86023	322	L6	23	20	B
85439~	3	L6			C	86024	249	L4	22	19	A/B
85440	44	Ur	9	8	B	86025	190	L6	23	20	Ce
85441	11	Ho		25-48	B	86026	22	H5	18	16	B/C
85442~	29	L6			B/C	86028	26	H6	18	16	B
85443	10	L4	25	10-23	B	86029	17	H5	18	16	C
85444~	2	L6			C	86030	13	H6	18	16	C
85445	11	H4	18	13-16	B/C	86031	74	H5	19	16	C
85446~	42	H6			C	86032	1	H5	18	16	B/C
85447	16	H5	18	16	C	86033	22	H4	18	15-17	B/C
85448	34	H5	18	16	C	86034	6	L4	25	21-23	C
85449~	12	L6			C	86035	78	H5	19	16	B/C
85450	27	H5	17	15	B/C	86036	9	H5	18	16	B/C
85451	15	L5	23	20	B/C	86037	6	H5	19	16	B/Ce
85452	9	L3	5-23	2-18	C	86038~	19	L6			C
85453	5	H5	18	16	C	86039	41	H5	19	16	B/C
85454~	8	L6			C	86040	49	L4	23	19	C
85455	8	H5	17	15	C	86041	23	H5	17	15	B/C
85456	19	H5	18	16	C	86042	5	L6	24	21	B
85457~	20	L6			B/C	86043	14	L6	25	21	B/C
85458	17	H5	18	16	B/C	86044	19	H5	18	16	C
85459	32	H5	17	15	B/C	86045	5	H5	18	16	C
85460	6	H5	18	16	C	86046	5	H5	18	16	C
85461~	21	L6			B/C	86047	69	H5	18	16	C
85462	23	H6	18	16	C	86048~	6	L6			C
85463~	12	L6			C	86049	15	H5	18	16	C
85464	24	H5	19	16	C						

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
LEW						LEW					
86050	11	H5	18	16	B/C	86107	47	H5	19	17	C
86051	2	H5	18	16	B/C	86108	4	H5	18	16	C
86052	2	H6	18	16	B/C	86109	17	H5	18	16	C
86053	4	H5	19	17	B/C	86110~	34	L6			C
86054~	2	L6			B/C	86111	33	H5	18	16	C
86055	41	H5	19	17	B/C	86112	18	H5	19	17	Ce
86056~	7	L6			B/C	86113~	7	L6			B/C
86057~	55	LL6			B/C	86114	9	H4	18	7-25	B/C
86058	22	H5	19	17	B/C	86115~	33	L6			C
86059	2	H5	19	16	B/C	86116	17	H5	19	17	C
86060	23	H5	17	15	C	86117~	13	LL6			B
86061	9	L4	24	20	B	86118	30	H5	18	16	C
86062	13	H5	19	16	C	86119	44	H4	18	15-20	C
86063	7	H5	18	16	C	86120~	33	H6			C
86064~	24	L6			C	86121	8	H5	18	16	B/C
86065	9	L5	25	21	C	86122	9	H5	19	17	C
86066~	18	H6			C	86123	12	H4	19	10-21	B/C
86067	9	H4	19	8-20	C	86124	8	L5	25	20	B/C
86068	6	H5	18	16	C	86125	14	H5	17	15	C
86069~	0.6	LL6 ²			C	86126	7	H5	19	17	C
86070~	19	LL6			A/B	86127	12	L3	2-26	2-17	B
86071	8	H5	19	16	B/C	86128	15	H5	18	16	C
86072	12	H5	18	16	C	86129	7	H5	19	17	B/C
86073~	38	L6			B/C	86130	3	H5	19	16	C
86074	19	H5	19	16	B/C	86131	10	H5	18	16	C
86075~	4	L6			B/C	86132~	12	L6			C
86076	24	H5	19	16	B/C	86133~	8	L6			A
86077	9	H5	19	17	B/C	86134	29	L3	2-24	1-20	B/C
86078	37	H5	19	16	B/C	86135~	10	L6			C
86079	7	H5	18	16	B/C	86136	13	H5	18	16	C
86080	14	H5	18	16	C	86137~	6	H6			C
86081	28	H5	18	16	C	86138	47	L4	24	15-24	C
86082~	8	LL6			B	86139~	4	H6			C
86083	199	H5	18	16	Ce	86140~	9	L6			B
86084~	53	L6			C	86141~	5	L6			C
86085~	197	L6			C	86142	14	H5	18	16	C
86086	104	H5	18	16	C	86143	23	H5	18	16	C
86087	11	H5	18	16	C	86144	11	L3	1-25	2-16	B/C
86088	38	H5	19	17	C	86145	4	LL5	28	23	B/C
86089	85	H6	18	16	C	86147	13	H5	18	16	C
86090~	23	L6			C	86148	2	H5	17	15	B/C
86091	67	H5	18	17	C	86149	19	H6	18	16	C
86092	21	H5	19	17	B	86150	7	H5	18	16	B
86093	15	H5	19	17	C	86151	13	H5	18	16	C
86094	15	H5	19	17	C	86152	15	H5	18	16	C
86095	14	H5	19	17	C	86153	31	H5	19	16	C
86096	71	H5	19	16	C	86154	9	H5	19	16	B
86097~	2	L6			C	86155	18	H5	18	16	B/C
86098	53	L4	23	19	C	86156	24	H5	18	16	B/C
86099	28	H5	18	16	C	86158	9	L3	5-25	5-20	B
86100	24	H5	18	16	C	86159	8	H5	18	16	C
86101~	28	LL6			B	86160~	15	H6			C
86102	22	H3	1-48	1-41	C	86161~	29	LL6			B
86103	9	H5	19	16	C	86162~	2	LL6			A
86104	34	H5	19	16	C	86163~	15	H6			C
86105	6	H3	1-50	1-32	C	86164	26	H5	19	16	C
86106	6	H5	18	16	C	86165	18	H4	18	16	C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
LEW						LEW					
86166~	21	L6			C	86225	103	H5	18	16	C
86167	13	H5	19	17	C	86226	49	H5	19	16	C
86168~	18	H6			C	86228	29	H5	18	16	C
86169~	26	L6			B/C	86230	2	H5	17	15	C
86170~	4	H6			B/C	86231~	18	L6			B/C
86171	18	H4	18	15-21	Ce	86232	19	H5	18	16	C
86172	7	H5	18	16	C	86233	10	H5	17	15	C
86173~	2	L6			C	86234	14	H5	17	15	C
86174	27	H5	18	16	C	86235	7	H5	18	16	C
86175~	2	L6			B	86236~	1	H6			C
86176	6	H4	17	13-15	C	86237	14	H5	17	15	C
86177	19	H6	18	16	C	86238~	29	L6			B
86178~	13	H6			C	86239~	25	H6			C
86179~	5	L6			B/C	86240	7	H5	17	15	C
86180	11	H5	18	16	C	86241	33	H6	18	16	C
86181	31	H6	19	16	C	86242	13	H5	18	16	C
86182~	19	H6			C	86243	6	H5	17	15	C
86183~	23	H6			C	86244	5	H5	18	16	C
86184	16	L6	24	20	C	86245	3	H5	17	15	C
86185	5	LL6	28	23	C	86246	2	L3	1-29	2-18	C
86186~	47	L6			Ce	86247	4	H5	18	16	C
86187	11	H5	18	16	C	86249	45	H6	18	16	C
86188	6	H5	18	16	C	86250	142	H5	19	17	C
86189	10	H5	17	15	C	86251	23	L4	23	12-21	C
86190~	28	H6			C	86252~	33	H6			C
86191	11	H5	18	16	C	86253~	10	H6			B/C
86192	11	H5	19	17	C	86254	9	H5	17	15	C
86193~	8	L6			C	86255	25	H5	18	16	C
86194	10	H5	18	16	C	86256	22	H5	18	16	C
86195~	42	L6			A/B	86257	4	H5	17	15	C
86196~	19	H6			B/C	86258	24	C4	32	26	B
86197	18	H5	18	16	C	86259	8	H5	18	16	C
86198	15	H5	18	16	B/C	86260	12	L5	25	20	C
86199	32	H5	18	16	C	86261	14	H5	17	15	C
86200	3	H5	17	15	C	86262	10	H5	17	15	C
86201~	18	H6			C	86263	15	H5	18	16	C
86202	12	H6	18	16	C	86264	5	L4	23	13-18	C
86203~	61	L6			B/C	86265	2	H5	19	17	C
86204~	22	H6			C	86266	41	H5	18	16	C
86205~	17	H6			C	86267	18	L4	24	12-19	C
86206	36	H5	18	16	C	86268~	22	L6			B/C
86207	18	L3	1-25	2-21	C	86269~	22	L6			C
86208	7	H5	17	15	C	86270	4	L3	0.6-28	0.4-19	B/C
86209	12	H5	17	15	C	86271	20	H5	18	16	C
86210	9	M	45	24-61	C	86272	16	H5	18	16	C
86211	163	I				86273	30	L6	25	20	B
86212~	6	H6			C	86274~	36	L6			B/C
86213	28	L3	2-20	1-16	Ce	86275	35	H5	19	16	C
86215	123	H5	18	16	C	86281	56	H6	17	15	C
86216	6	Ur	12-20	12-18	C	86282~	62	L6			B
86217	20	H5	19	17	C	86286	45	H5	19	16	B/Ce
86218~	6	H6			C	86287~	42	H6			C
86220	25	I (incl.)	7	9		86288~	11	L6			C
86221~	18	H6			C	86289~	18	L6			B/C
86222	9	L5	23	19	B	86292	33	H5	19	17	Ce
86223	13	H5	19	16	C	86295~	44	H6			B
86224	7	L5	24	20	B/C	86302	40	H5	19	17	C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
LEW						LEW					
86305	40	H5	19	16	C	86369	7	H5	18	16	C
86307	5	L3	3-29	2-14	B	86370	9	H5	18	16	C
86309~	14	L6			B	86371	147	H5	19	17	C
86311~	67	L6			B	86372~	12	L6			C
86312	102	H5	16	14	Be	86373	30	H5	19	16	C
86314	41	H5	19	16	C	86374	32	H5	19	16	C
86317~	62	L6			B	86375	11	H5	19	16	C
86318	7	H4	16	14	Ce	86376	41	H5	19	17	C
86319	3	H5	17	15	C	86377	2	H4	16	14	C
86320	3	H5	19	16	C	86378~	4	LL6			C
86321	33	H5	19	16	C	86379	9	H4	17	12-21	C
86322	18	H5	18	16	C	86380	32	H4	16	14-21	B/C
86323	5	H5	17	15	C	86381~	7	H6			C
86324	8	H5	18	16	C	86382	22	H6	18	16	C
86325	20	H5	18	16	C	86383	11	H5	18	16	C
86326	7	H5	17	15	C	86384	6	H5	17	15	C
86327	44	H5	19	17	C	86385	34	H5	18	16	C
86328~	7	H6			C	86386	3	LL4	27	18-25	B
86329	5	H5	19	16	C	86387	26	H5	18	16	C
86330~	21	L6			C	86388	24	H5	19	17	C
86332	14	H5	18	15	C	86389	2	H5	18	16	C
86333~	9	H6			C	86390	30	H4	16	11-15	C
86334	6	LL6	27	23	A	86391	15	H5	19	16	C
86335~	3	H6			C	86392	6	L5	25	21	B
86336	8	H5	17	15	C	86393	70	H5	18	16	C
86337	26	H5	18	16	C	86394	3	H5	18	16	C
86338	27	H5	18	16	C	86395	14	H5	18	16	C
86339	21	L4	23	3-23	C	86396	13	H5	18	16	B/C
86340~	25	H6			C	86397	10	H5	19	16	C
86341	9	H5	17	16	C	86398	3	H5	19	16	C
86342~	2	H6			C	86399~	7	L6			B/C
86343~	6	H6			C	86400	19	H5	19	16	C
86344	17	H5	17	15	C	86401	9	H5	18	16	C
86345	4	H5	19	16	C	86402	14	LL5	29	24	C
86346	3	L5	25	21	C	86403	7	H5	17	15	C
86347	3	L3	1-21	2-17	C	86404~	8	L6			B/C
86348	20	H6	17	15	C	86405	1	H5	19	16	C
86349	38	L6	24	20	C	86407	36	H5	19	17	C
86350~	19	H6			C	86408	1	L3	11-25	2-23	C
86351	10	H6	16	15	C	86409~	24	L6			C
86352	27	L5	23	20	A/B	86410	3	L4	25	8-24	B/C
86353	5	H5	17	15	C	86411	4	LL4	27	17-25	B
86354	23	H5	16	15	B/C	86412	1	H6	19	17	B/C
86355	7	H6	17	15	C	86413	14	H5	19	16	C
86356	9	H5	16	15	C	86414	4	H5	19	16	C
86357	3	L5	24	20	A/B	86415	3	H5	18	16	C
86358	5	H4	17	15-21	B/C	86416~	18	H6			C
86359~	3	L6			C	86417	2	L3	1-22	2-24	B
86360	181	L4	24	16-20	B/C	86418	43	H5	17	15	C
86361	6	H5	17	15	B/C	86419~	2	LL6			B
86362	6	H5	17	15	C	86420	13	H5	17	15	C
86363	3	H5	17	15	B/C	86421~	3	L6			C
86364~	20	H6			C	86422	8	H5	19	16	C
86365	5	H5	18	16	C	86423	11	H5	18	16	C
86366	26	H5	19	16	C	86424	7	H5	18	16	C
86367	11	L3	1-22	2-23	B	86425~	2	L6			C
86368	29	H5	18	16	C	86426~	3	L6			C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
LEW						LEW					
86427	2	H6	19	16	C	86485	52	H5	18	16	C
86428	6	H6	18	16	C	86486	10	H5	19	16	C
86429~	7	L6			B/C	86487	15	H5	17	15	C
86430	6	H5	18	16	C	86488	9	H5	19	16	C
86431	10	H5	17	15	C	86489	30	H5	18	16	C
86432	7	LL6	30	24	B	86490~	2209	L6			Be
86433~	6	H6			C	86491	15	H5	17	15	B/C
86434	22	H5	18	16	C	86492	25	H5	17	15	C
86435	5	H4	18	6-18	C	86493~	5	H6			C
86436	4	L3	6-26	2-22	C	86494	14	H6	18	16	C
86437	17	H5	18	16	C	86495	2	L3	1-22	3-17	B/C
86438	45	H5	17	15	C	86496	5	H5	18	16	C
86439	6	H6	18	16	C	86497	6	H5	17	15	C
86440	7	H5	17	15	C	86498	134	I			
86441	11	H5	18	16	C	86499	25	H5	18	16	C
86442	59	H5	18	16	C	86500	45	H5	19	17	C
86443	11	H5	18	16	C	86501	85	H5	18	16	C
86444	15	H5	19	17	C	86502	25	L5	23	20	B
86445~	9	H6			C	86503	22	H5	17	15	B/C
86446	10	H4	18	8-19	C	86504~	8	H6			B/C
86447~	10	L6			B/C	86505	44	L3	2-30	1-20	Ae
86449	4	LL5	30	24	A/B	86506	30	H5	19	17	B/C
86450	5	H5	19	16	C	86507	10	H5	18	16	C
86451	34	H5	18	16	C	86508	10	H5	18	16	B/C
86452	20	H5	18	16	C	86509	33	H5	18	16	C
86453	49	H5	18	16	C	86510	24	H5	18	16	C
86454	3	H5	18	16	C	86513	6	H5	18	16	B/C
86455	50	H5	18	16	C	86514	65	H5	18	16	C
86456	22	H5	18	16	C	86515	34	H5	18	16	B/C
86457	13	H5	18	16	C	86516	4	H5	19	16	B/C
86458	18	H5	18	16	C	86517	32	H5	17	15	B/C
86459	8	H5	18	16	C	86518	267	H5	18	16	B/Ce
86460	19	H5	18	16	C	86519	8	H5	17	15	C
86461	0.6	H5	19	16	C	86520	6	H5	17	15	C
86462	25	H5	18	16	C	86521	0.3	H5	18	16	B
86463	65	H5	18	16	C	86522~	43	H6			C
86464	19	H5	19	16	C	86523	7	H5	17	15	C
86465	26	H5	18	16	C	86524	23	L5	23	19	B/Ce
86466~	71	H6			C	86525	46	H5	17	15	C
86467	0.4	H5	18	16	C	86526	14	H3	13-22	8-14	B/C
86468	12	H5	18	16	C	86527	22	H5	17	15	C
86469	11	H5	19	16	C	86528~	50	L6			A/B
86470	59	H5	18	16	C	86529	1	H5	17	15	C
86471	83	H6	17	15	C	86530	2	H5	18	16	B/C
86472	30	H5	19	16	C	86531	21	L6	23	20	C
86473	21	H5	19	17	B/C	86532	4	H5	18	16	C
86474~	7	H6			C	86533	16	H5	17	15	C
86475	15	H5	17	15	C	86534	89	H5	18	16	B/C
86476	0.6	H5	18	15	C	86535	14	H6	18	16	C
86477	12	H5	17	15	B/C	86536	8	H5	18	16	C
86478~	2	L6			A/B	86537~	17	H6			C
86479	141	H5	17	15	C	86538	21	H5	17	15	C
86480	12	H5	17	15	C	86539	13	H6	18	16	C
86481	11	H6	17	15	C	86540	21	I			
86482	7	H5	18	16	C	86541~	13	L6			B
86483~	10	LL6			B/C	86542	25	L5	23	19	B/C
86484	24	H5	18	16	C	86543~	26	H6			B/C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
LEW						PCA					
86544	65	H6	18	16	C	82511	149	H4	17	14	B
86545	16	H5	18	16	C	82512	55	H6	18	16	B
86546	41	L6	23	19	C	82513	239	L5	24	20	A/B
86549	50	L3	5-20	1-29	B	82514	130	L4	23	11-22	B
						82515	7	H4	17	14	B
MBRA						82516	16	H6	18	16	B/C
76001	4108	H6	18	16	B	82517	41	H5	19	17	B/C
76002	13773	H6	18	16	B	82518	22	E4	0.8		B
						82519	125	L5	24	21	B
META						82520	23	H3	15-22	2-19	B/C
78001	624	H4	17	14-21	B/C	82521	1	H5	18	16	C
78002	542	L6	23	20	B	82522	46	H5	18	16	B/C
78003	1726	L6	24	21	B	82523	11	H6	19	16	A
78004§	30	L6			B	82524	114	H4	18	16	A/B
78005	172	L6	24	20	B	82525	40	L6	24	20	B
78006	410	H6	18	15	C	82526	25	H6	18	16	B
78007	175	H6	19	17	B/C	82527	3	H6	18	16	A
78008	125	Ur	22	13	B	82528	51	L6	25	21	B/C
78009§	29	H5			B						
78010	234	H5	19	17	Be	PGPA					
78011	116	H5	17	15	C	77006	19068	I			
78012	86	H5	17	16	B						
78013§	132	H6			B	QUE					
78014§	101	H6			C	86900	1532	M		21-64	C
78015§	37	L5			B						
78016§	114	H6			B/C	RKPA					
78017	47	H6	18	16	B/C	78001	235	L6	23	20	C
78018§	82	H5			B	78002	8483	H4	18	15	Be
78019§	91	H6			A/B	78003	1276	L6	23	20	Ce
78020	64	H6	18	16	C	78004	167	H4	17	14-21	A
78021§	23	L6			B/C	78005§	29	H5			B
78022§	49	H6			B/C						
78023	56	H6	18	16	B	79001	3006	L6	23	20	Be
78024§	22	H6			B/C	79002	204	L6	24	20	B
78025§	58	H6			C	79003	182	H6	18	16	B
78026	75	H6	18	15	C	79004	371	H5	18	16	B/C
78027	53	H6	18	16	B	79008	73	L3	1-29	2-28	B
78028	20657	L6	25	21	B	79009	55	H6	18	16	C
						79012	13	H6	18	16	B
MIL						79013	11	L5	23	20	B/C
85600	497	H5	18	15	C	79014	78	H5	18	16	B/C
						79015	10022	M		24	A/B
OTTA											
80301	36	H3	17-19	4-19	B/C	80201	813	H6	19	16	Be
						80202	545	L6	24	20	Be
PCA						80203	4	H6	19	17	C
82500	91	C4	31		Be	80204	15	Eu		52-57	A
82501	54	Eu		41-57	A	80205	54	H3	17-20	5-13	B
82502	890	Eu		36-61	A	80206	47	H6	19	17	C
82503	8308	L6	24	20	Ae	80207	18	L3	15-29	6-28	C
82504	3094	L5	23	20	A/B	80208	10	H6	19	17	B
82505	3086	L5	23	20	B	80209	10	L5	25	21	C
82506	5316	Ur	21	18	A/Be	80210	11	H5	19	16	B/C
82507	480	LL6	30	25	A	80211	2	H6	19	17	C
82508	389	L6	23	20	A/B	80213	19	H6	19	17	B/C
82509	286	L6	25	21	B	80214	5	H6	19	17	C
82510	254	L5	24	20	A	80215	9	L6	24	20	C

TABLE A.—Continued.

Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering	Specimen number	Weight (g)	Class and type	%Fa in olivine	%Fs in pyroxene	Degree of weathering
RKPA						RKPA					
80216	44	L4	23	20	B	80257	9	H5	17	15	B/C
80217	8	H5	18	15	C	80258	4	M		17-21	B/C
80218	7	H5	18	15	C	80259	20	E5		0-1	B/Ce
80219	21	L6	25	21	B	80260	8	H5	18	16	C
80220	124	H5	18	16	B/C	80261	62	L6	24	20	B
80221	52	H6	19	17	C	80262	32	H6	19	17	C
80222	7	LL6	28	23	B	80263	17	M		24	C
80223	25	H5	18	16	C	80264	24	L6	24	20	B
80224	8	Eu		54	A/B	80265	8	H6	19	17	C
80225	8	L6	25	21	C	80266	10	H6	19	17	B/C
80226	160	I				80267	24	H4	19	16	C
80227	8	H5	19	16	B/C	80268	3	L5	24	20	B/C
80228	11	L5	23	19	C						
80229	14	M		24	C	RKP					
80230	58	H5	18	16	B	86700	424	L3	17-27	14-23	B
80231	238	H6	18	16	C	86701	177	H6	18	16	B
80232	80	H4	18	16	B	86702	195	L6	24	20	C
80233	414	H5	18	16	B/C	86703	196	H6	19	17	C
80234	136	LL5	26	22	B	86704~	138	LL6			B/C
80235	261	LL6	30	24	A/B	86705	68	H5	18	16	B
80236	16	H5	18	16	B/C						
80237	22	H4	18	16	C	TIL					
80238	18	LL6	28	23	A/B	82400	221	L5	25	21	A/B
80239	6	Ur	16	15	B	82401	282	L6	25	21	A/B
80240	61	H5	18	16	C	82402	476	LL6	29	24	A/B
80241	0.6	C3V	1-6	1-8	B	82403	50	Eu		43-58	A
80242	7	L4	22	19	B/C	82404	322	L4	23	20	B
80243	3	H5	18	16	C	82405	1116	H6	19	17	B
80244	14	H5	18	16	C	82406	152	L4	23	19	B
80245	37	H5	18	16	B/C	82407	221	L4	23	20	B/C
80246	6	M		24	C	82408	80	LL3	1-29	2-21	B
80247	1	H5	18	16	C	82409	231	H5	18	16	B
80248	11	LL6	27	23	A/B	82410	19	Di		24	A
80249	10	H5	17	15	B/C	82411	180	L4	24	21	A/B
80250	4	H5	17	15	B/C	82412	35	H5	17	16	C
80251	29	H5	17	15	B	82413	18	H5	17	16	C
80252	11	L6	24	20	A/B	82414	15	H5	17	15	B
80253	5	LL5	27	22	A/B	82415	70	H5	17	15	A/B
80254	68	H6	19	17	C						
80255	7	H6	19	17	C	TYR					
80256	153	L3	20-25	10-26	B	82700	892	L4	24	15-23	Be

TABLE B.—Meteorites listed by class and source area in numerical sequence (fractions of grams in weight dropped unless total weight is less than 1 gram).

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
CHONDRITES									
ALHA77306	20	C2	A	A	LEW86004	2	C2	B	A
ALHA78261	5	C2	A	A	LEW86005	5	C2	A/Be	A
ALHA81002	14	C2	Ae	B	LEW86007	2	C2	A/Be	A
ALHA81004	5	C2	A/B	A	LEW86008	6	C2	B	A
ALHA81312	0.7	C2	A	A	LEW86009	6	C2	A/Be	A/B
ALH82100	24	C2	A	A					
ALH82131	1.0	C2	A	B	ALHA77307	181	C3	Ae	A
ALH83016	4	C2	A/B	B/C					
ALH83100	3019	C2	Be	B/C	ALHA77003	780	C3O	Ae	A
ALH83102	1786	C2	B/Ce	C	ALHA77029*	1	C3O	A/B	
ALH83106	22	C2	A	A/B	ALH82101	29	C3O	A	A/B
ALH84029	120	C2	Ae	B	ALH83026	0.1	C3O	B	A
ALH84030	6	C2	A	B/C	ALH83108	1519	C3O	A	A
ALH84031	12	C2	Ae	B	ALH85003	50	C3O	A/B	A
ALH84032	8	C2	A	A					
ALH84033	60	C2	Ae	B	ALHA81003	10	C3V	A/B	A/B
ALH84034	44	C2	A	A	ALHA81258	1	C3V	B	A/B
ALH84035	3	C2	Ae	A	ALH84028	736	C3V	Ae	A
ALH84036	3	C2	A	A	ALH84037	3	C3V	Be	A
ALH84039	33	C2	A/B	A	ALH85006	49	C3V	A	A
ALH84040	29	C2	Ae	B	LEW86006	0.8	C3V	B	A
ALH84041	1	C2	Ae	B	RKPA80241	0.6	C3V	B	B
ALH84042	51	C2	A	B					
ALH84043	17	C2	Ae	B	ALH82135	12	C4	A	A
ALH84044	147	C2	Ae	B	ALH84038	12	C4	Ae	A
ALH84045	11	C2	Ae	A/B	ALH85002	438	C4	A	A
ALH84046	2	C2	A	A	EET83311	15	C4	A/B	A/B
ALH84047	4	C2	A/Be	B	LEW86258	24	C4	B	A
ALH84048	13	C2	Ae	B	PCA82500	91	C4	Be	C
ALH84049	29	C2	Ae	B					
ALH84050	3	C2	Ae	B	ALH85085	12	Chon. (unique)	A/B	A/B
ALH84051	34	C2	A/Be	B	LEW85332	114	Chon. (unique)	B/C	B
ALH84053	5	C2	A	A	ALH85151	14	Chon. (Carlisle Lakes-like)	B	A/B
ALH84054	19	C2	Ae	A					
ALH84191	14	C2	A	B	ALH84170	39	E3	B	A
ALH85004	8	C2	B	C					
ALH85005	19	C2	A	A	ALHA81189	3	E4	C	B
ALH85007	82	C2	B	B	ALH82132	6	E4	Ce	B/C
ALH85008	32	C2	B	A/B	ALH84188	3	E4	C	B
ALH85009	47	C2	A	B	ALH84200	8	E4	B	B
ALH85010	3	C2	A/B	A	ALH84206	15	E4	A/B	A
ALH85011	11	C2	A/B	A	ALH84220	8	E4	C	B
ALH85012	4	C2	Be	B	ALH84235	6	E4	C	B/C
ALH85013	130	C2	A	A/B	ALH84250	10	E4	B	A
ALH85106	3	C2	B	A	ALH84254	2	E4	B	A
EET83224	9	C2	A/B	B	ALH85119	21	E4	Be	B/C
EET83226	33	C2	A/B	B	ALH85159	11	E4	B/C	B
EET83250	11	C2	Be	C	EET83254	8	E4	Ce	B/C
EET83334	3	C2	A	A	EET83307	5	E4	C	B
EET83355	66	C2	A/B	B	EET83322	14	E4	A/B	B
EET83389	19	C2	A/B	A/B	PCA82518	22	E4	B	A
GRO85202	27	C2	A/Be	C	ALHA77156*	18	E4	B	
LEW85306	6	C2	A	A	ALHA77295*	141	E4	B	
LEW85307	2	C2	A	A					
LEW85309	54	C2	A/Be	B/C	RKPA80259	20	E5	B/Ce	B
LEW85311	200	C2	Be	B/C					
LEW85312	32	C2	B	B/C					

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA81021	695	E6	A	B	ALHA80131	20	H4	B	B
ALHA81260	124	E6	A/Be	A/B	ALHA81022	913	H4	B/C	A
ALH83018	4	E6	B/C	A	ALHA81041	729	H4	C	C
ALHA77299	261	H3	A	A	ALHA81043	106	H4	B/C	C
ALH82110	39	H3	B/C	B	ALHA81044	387	H4	C	C
ALH83042	0.5	H3	B	A	ALHA81045	90	H4	C	B/C
ALH85121	55	H3	B	B/C	ALHA81046	17	H4	C	B/C
EET83248	39	H3	B	A	ALHA81047	81	H4	B/C	B/C
EET83267	28	H3	B	C	ALHA81048	191	H4	B/C	B/C
LEW85383	18	H3	C	A	ALHA81049	9	H4	B/C	B
LEW86102	22	H3	C	A	ALHA81050	26	H4	C	C
LEW86105	6	H3	C	A	ALHA81051	43	H4	B/C	B
LEW86526	14	H3	B/C	A	ALHA81052	29	H4	C	B
OTTA80301	36	H3	B/C	B	ALHA81056	1	H4	B	A
PCA82520	23	H3	B/C	A/B	ALHA81057	8	H4	B	A
RKPA80205	54	H3	B	B	ALHA81058	66	H4	C	C
ALHA77004	2230	H4	C	C	ALHA81068	24	H4	B	A
ALHA77009	236	H4	C	A	ALHA81073	3	H4	B/C	A
ALHA77010	296	H4	C	A	ALHA81074	8	H4	B	B
ALHA77056*	12	H4	A/B		ALHA81092	16	H4	B	A
ALHA77190	387	H4	C	C	ALHA81095	59	H4	B/C	C
ALHA77191	642	H4	C	B/C	ALHA81097	80	H4	B	A
ALHA77192	845	H4	C	C	ALHA81104	184	H4	C	C
ALHA77208	1733	H4	C	C	ALHA81105	93	H4	C	B/C
ALHA77221	229	H4	C	A	ALHA81109	1	H4	B	A
ALHA77222*	125	H4	A/B		ALHA81114	79	H4	B/C	B/C
ALHA77223	208	H4	C	C	ALHA81117	33	H4	B	B/C
ALHA77224	787	H4	C	C	ALHA81140	14	H4	B/C	A
ALHA77225	5878	H4	Ce	C	ALHA81142	1	H4	B/C	B/C
ALHA77226	15323	H4	Ce	C	ALHA81147	2	H4	B	A
ALHA77232	6494	H4	C	C	ALHA81149	9	H4	B	B
ALHA77233	4087	H4	C	B	ALHA81157	12	H4	B/C	B
ALHA77262	862	H4	B/Ce	B	ALHA81177	17	H4	B/C	B
ALHA77286	246	H4	C	B	ALHA81199	16	H4	C	B
ALHA78029‡	4	H4	B		ALHA81200	9	H4	B/C	A
ALHA78033‡	5	H4	B		ALHA81206	4	H4	B/C	A
ALHA78051	120	H4			ALHA81212	11	H4	B/C	B
ALHA78053	179	H4	C	B	ALHA81231	9	H4	B/C	B
ALHA78057	9	H4			ALHA81234	5	H4	C	A
ALHA78077	331	H4	C	B	ALHA81267	27	H4	C	B/C
ALHA78084	14280	H4	B/Ce	B	ALHA81279	27	H4	C	B/C
ALHA78120	44	H4			ALHA81290	2	H4	B	A
ALHA78134	458	H4	B/C	B/C	ALHA81309	0.6	H4	C	A
ALHA78140‡	17	H4	B		ALH82126	140	H4	B/C	A
ALHA78157‡	63	H4	B		ALH82128	15	H4	B/C	A
ALHA78168‡	34	H4	B		ALH82133	20	H4	B/C	A/B
ALHA78172‡	29	H4	B		ALH82136	4	H4	B	B
ALHA78193	13	H4	B/C	A	ALH83019	3	H4	B/C	A
ALHA78196	11	H4	B/C	B	ALH84004	9000	H4	Be	B
ALHA78223	6	H4	B	B	ALH84059	857	H4	B/C	B
ALHA79023	68	H4	B/C	C	ALH84084	332	H4	B	A
ALHA79035	38	H4	B	B	ALH84103	137	H4	B	A
ALHA79039	108	H4	B	B	ALH84230	2	H4	B	A
ALHA80106	432	H4	C	B	ALH84232	10	H4	C	B
ALHA80121	39	H4	B/C	C	ALH85153	0.4	H4	B	A
ALHA80128	138	H4	B	B/C	EET82602	1824	H4	B	B
					EET82609	326	H4	B/C	A/B
					EET82616	2	H4	B/C	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
EET83207	1238	H4	B	B	ALHA77063*	3	H5	B	
EET83211	543	H4	B/Ce	B/C	ALHA77064	6	H5	B	B
EET86802	30	H4	A	B/C	ALHA77066*	5	H5	A	
LEW85351	12	H4	B/C	A	ALHA77070*	18	H5	B	
LEW85366	3	H4	C	B	ALHA77071	11	H5	B	B
LEW85370	11	H4	B/C	A	ALHA77073*	10	H5	A/B	
LEW85398	38	H4	C	A	ALHA77074	12	H5	B	B
LEW85445	11	H4	B/C	A	ALHA77076*	2	H5	B	
LEW85468	15	H4	B/C	A	ALHA77078*	24	H5	B	
LEW86033	22	H4	B/C	A	ALHA77079*	8	H5	A	
LEW86067	9	H4	C	A	ALHA77082*	12	H5	A/B	
LEW86114	9	H4	B/C	A	ALHA77084*	44	H5	A/B	
LEW86119	44	H4	C	A	ALHA77085*	46	H5	B	
LEW86123	12	H4	B/C	A	ALHA77086	19	H5	C	B
LEW86165	18	H4	C	A	ALHA77087*	31	H5	B	
LEW86171	18	H4	Ce	A	ALHA77088	51	H5	C	B
LEW86176	6	H4	C	A	ALHA77091*	4	H5	B/C	
LEW86318	7	H4	Ce	A/B	ALHA77092*	45	H5	A	
LEW86358	5	H4	B/C	A	ALHA77094*	7	H5	B	
LEW86377	2	H4	C	A	ALHA77096*	2	H5	A	
LEW86379	9	H4	C	A	ALHA77098*	8	H5	B	
LEW86380	32	H4	B/C	A	ALHA77100*	18	H5	A/B	
LEW86390	30	H4	C	A	ALHA77101*	4	H5	B	
LEW86435	5	H4	C	A	ALHA77102	12	H5	B	B
LEW86446	10	H4	C	A	ALHA77104*	6	H5	A	
META78001	624	H4	B/C	B	ALHA77106*	8	H5	A/B	
PCA82511	149	H4	B	B	ALHA77108*	0.7	H5	A/B	
PCA82515	7	H4	B	A/B	ALHA77112*	22	H5	A	
PCA82524	114	H4	A/B	B	ALHA77113*	2	H5	B	
RKPA78002	8483	H4	Be	A/B	ALHA77114*	45	H5	B	
RKPA78004	167	H4	A	A	ALHA77118	8	H5	C	B
RKPA80232	80	H4	B	A	ALHA77119	6	H5	C	B
RKPA80237	22	H4	C	B	ALHA77120*	4	H5	A/B	
RKPA80267	24	H4	C	A	ALHA77122*	5	H5	B	
					ALHA77124	4	H5	C	A
ALH84006	16000	H4,5	B/Ce	B	ALHA77125	19	H5	A/B	
					ALHA77126*	25	H5	A/B	
EET83221	314	H4,6	C	C	ALHA77129*	2	H5	B	
					ALHA77130*	25	H5	A	
ALHA77007*	99	H5	B		ALHA77132*	115	H5	A/B	
ALHA77012	180	H5	Ce	A	ALHA77136*	4	H5	A/B	
ALHA77014	309	H5	C	B/C	ALHA77138*	2	H5	A	
ALHA77016*	78	H5	B		ALHA77139*	66	H5	A/B	
ALHA77017*	78	H5	B		ALHA77142*	3	H5	A/B	
ALHA77018*	52	H5	B/C		ALHA77143*	39	H5	A/B	
ALHA77021	17	H5	C	A	ALHA77151*	17	H5	A	
ALHA77022*	16	H5	A		ALHA77152*	18	H5	A	
ALHA77023*	21	H5	B		ALHA77153*	12	H5	A	
ALHA77025	19	H5	C	B	ALHA77158*	20	H5	B	
ALHA77038*	19	H5	A/B		ALHA77161*	6	H5	B	
ALHA77039*	8	H5	A/B		ALHA77168*	25	H5	B	
ALHA77042*	20	H5	A/B		ALHA77171*	24	H5	A/B	
ALHA77045*	18	H5	A		ALHA77173*	26	H5	B	
ALHA77051*	15	H5	A		ALHA77174*	32	H5	A	
ALHA77054*	10	H5	B		ALHA77177	368	H5	C	A
ALHA77058*	4	H5	B		ALHA77181*	33	H5	B	
ALHA77061	13	H5	B	A	ALHA77182	1135	H5	C	B
ALHA77062	17	H5	B	B	ALHA77184*	128	H5	B	

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA77186*	122	H5	A/B		ALHA78098†	2	H5		
ALHA77187*	52	H5	A/B		ALHA78102	337	H5	B/C	B
ALHA77188*	109	H5	A/B		ALHA78107	198	H5	C	A
ALHA77193*	7	H5	A		ALHA78108	173	H5	B/C	B
ALHA77195*	5	H5	A		ALHA78110	161	H5	B/C	B
ALHA77201*	15	H5	A		ALHA78111	127	H5	B/C	A
ALHA77202*	3	H5	B		ALHA78116†	128	H5	B	B
ALHA77205*	3	H5	B		ALHA78117‡	4	H5	A	
ALHA77207*	5	H5	A/B		ALHA78121†	30	H5		
ALHA77213*	8	H5	A		ALHA78123‡	18	H5	B	
ALHA77220*	69	H5	B		ALHA78128	155	H5	C	B/C
ALHA77227*	16	H5	A		ALHA78129‡	128	H5	B	
ALHA77228*	19	H5	B		ALHA78136‡	52	H5	A	
ALHA77235*	5	H5	A/B		ALHA78139†	17	H5		
ALHA77237*	4	H5	A		ALHA78141	24	H5		
ALHA77240*	25	H5	A		ALHA78146	17	H5		
ALHA77242*	56	H5	B		ALHA78150	16	H5		
ALHA77245*	33	H5	A/B		ALHA78154‡	12	H5	B	
ALHA77247*	44	H5	A/B		ALHA78159	23	H5		
ALHA77253*	24	H5	A/B		ALHA78160†	16	H5		
ALHA77259	294	H5	C	B	ALHA78163‡	10	H5	B	
ALHA77264	11	H5	A/B	A	ALHA78164	25	H5		
ALHA77265*	18	H5	B		ALHA78173‡	20	H5	B	
ALHA77266*	108	H5	B		ALHA78174‡	13	H5	B	
ALHA77268	272	H5	C	C	ALHA78178‡	7	H5	B	
ALHA77274	288	H5	C	A	ALHA78182	10	H5		
ALHA77275*	25	H5	A		ALHA78190	20	H5		
ALHA77279*	175	H5	A		ALHA78194	25	H5		
ALHA77287	230	H5	C	A	ALHA78197	20	H5		
ALHA77291*	6	H5	A		ALHA78199	13	H5		
ALHA77294	1351	H5	Ae	A	ALHA78201	10	H5		
ALHA77300	235	H5	C	B	ALHA78203	11	H5		
ALHA78001‡	85	H5	B		ALHA78205	9	H5		
ALHA78004†	36	H5			ALHA78209	12	H5	B/C	B
ALHA78005‡	28	H5	B		ALHA78217‡	8	H5	B	
ALHA78008	7	H5			ALHA78219‡	8	H5	B	
ALHA78010‡	1	H5	B		ALHA78221	5	H5	B	A
ALHA78012	38	H5			ALHA78225	5	H5	B	A
ALHA78018‡	18	H5	B		ALHA78227	2	H5	B/C	B
ALHA78021	17	H5			ALHA78233	1	H5	B/C	B
ALHA78023	10	H5			ALHA78241	7	H5		
ALHA78025‡	8	H5	A		ALHA78245	4	H5		
ALHA78027†	29	H5			ALHA78247	3	H5		
ALHA78028	4	H5			ALHA78253‡	7	H5	B	
ALHA78031	5	H5			ALHA78255‡	3	H5	A	
ALHA78047†	130	H5	B	B	ALHA78257‡	2	H5	B	
ALHA78049‡	96	H5	B		ALHA78259‡	6	H5	A	
ALHA78052†	97	H5	C	B	ALHA79004	35	H5	B/C	B
ALHA78075	281	H5	B/C	B	ALHA79006	41	H5	B/C	B
ALHA78079	5	H5			ALHA79008	12	H5	B	B
ALHA78080	25	H5			ALHA79009	76	H5	Ce	A
ALHA78081†	18	H5			ALHA79010	25	H5	B/C	B
ALHA78085	219	H5	Be	B	ALHA79011	14	H5	B/C	A
ALHA78088†	5	H5			ALHA79012	192	H5	C	B
ALHA78090†	8	H5			ALHA79013	28	H5	C	B
ALHA78092†	16	H5			ALHA79014	11	H5	B	A
ALHA78094†	4	H5			ALHA79015	64	H5	B	B
ALHA78096†	7	H5			ALHA79021	29	H5	B	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA79025	1208	H5	C	A	ALHA81125	10	H5	B	A
ALHA79026	572	H5	B	B	ALHA81126	22	H5	B	A
ALHA79029	506	H5	C	B/C	ALHA81128	16	H5	B/C	A
ALHA79031	3	H5	C	B	ALHA81129	32	H5	A/B	A
ALHA79032	3	H5	C	B	ALHA81130	30	H5	B	B
ALHA79036	20	H5	B	B	ALHA81132	5	H5	B	A
ALHA79038	50	H5	C	B	ALHA81133	21	H5	B	A
ALHA79040	13	H5	B	A	ALHA81135	10	H5	B	A
ALHA79041	20	H5	B	B	ALHA81136	1	H5	B	A/B
ALHA79042	11	H5	B	A	ALHA81138	4	H5	B	A
ALHA79046	90	H5	B	B	ALHA81139	7	H5	B/C	B
ALHA79047	19	H5	B	B	ALHA81141	1	H5	B/C	B
ALHA79048	37	H5	B	B	ALHA81143	13	H5	B/C	A
ALHA79050	27	H5	C	B	ALHA81144	3	H5	B	A
ALHA79051	24	H5	C	A	ALHA81148	13	H5	B	A
ALHA79053	86	H5	B/C	B	ALHA81152	10	H5	B	A
ALHA79054	36	H5	B	A	ALHA81155	5	H5	A/B	A
ALHA80111	42	H5	B	A	ALHA81158	2	H5	B/C	A
ALHA80123	28	H5	C	A	ALHA81161	122	H5	C	C
ALHA80124	12	H5	B	B	ALHA81163	82	H5	C	B/C
ALHA80127	47	H5	B	A	ALHA81164	20	H5	B	A
ALHA80129	93	H5	B	A	ALHA81165	6	H5	B	A
ALHA80132	153	H5	B	B	ALHA81166	26	H5	B	A
ALHA81015	5489	H5	Be	B	ALHA81168	8	H5	C	B
ALHA81019	1051	H5	B/Ce	B	ALHA81169	6	H5	B	B
ALHA81020	1353	H5	Be	A	ALHA81170	59	H5	B	A/B
ALHA81033	252	H5	C	C	ALHA81171	24	H5	B/C	B
ALHA81034	255	H5	B	B	ALHA81173	26	H5	A/B	A
ALHA81036	252	H5	C	A	ALHA81174	33	H5	B	B/C
ALHA81039	206	H5	A/B	B	ALHA81175	13	H5	A/B	B
ALHA81042	534	H5	C	C	ALHA81176	95	H5	B	A
ALHA81062	0.5	H5	C	A	ALHA81178	30	H5	B/C	B/C
ALHA81063	5	H5	B/C	B	ALHA81179	14	H5	B	A
ALHA81064	191	H5	C	A/B	ALHA81182	5	H5	B	A/B
ALHA81067	228	H5	C	B	ALHA81183	104	H5	C	B/C
ALHA81070	4	H5	B/C	A	ALHA81186	23	H5	B	A/B
ALHA81071	2	H5	B	A	ALHA81188	9	H5	A/B	A
ALHA81072	3	H5	B/C	A	ALHA81192	9	H5	A/B	A
ALHA81075	16	H5	B	A	ALHA81194	17	H5	B	B
ALHA81077	4	H5	B	A	ALHA81195	5	H5	B	A/B
ALHA81080	17	H5	A/B	A	ALHA81197	68	H5	B/C	B/C
ALHA81081	5	H5	B	A	ALHA81201	7	H5	B/C	A
ALHA81082	6	H5	B	A	ALHA81202	5	H5	C	A
ALHA81083	7	H5	B	A	ALHA81207	14	H5	C	B
ALHA81084	16	H5	B	A	ALHA81209	14	H5	B/C	A
ALHA81088	4	H5	B	A	ALHA81211	7	H5	B	A
ALHA81089	11	H5	B	A	ALHA81213	3	H5	B/C	A
ALHA81090	10	H5	B	A	ALHA81215	11	H5	A	A
ALHA81091	12	H5	B	B	ALHA81216	2	H5	C	A
ALHA81100	155	H5	B	A	ALHA81218	6	H5	C	B
ALHA81108	69	H5	B	B	ALHA81219	24	H5	B	A
ALHA81110	3	H5	B/C	A	ALHA81220	3	H5	B/C	A/B
ALHA81113	111	H5	B/C	C	ALHA81226	3	H5	C	A
ALHA81115	155	H5	C	A/B	ALHA81227	11	H5	B	B
ALHA81116	2	H5	B	A	ALHA81228	8	H5	B/C	A
ALHA81118	85	H5	B/C	A	ALHA81230	13	H5	B	B
ALHA81120	14	H5	B/C	B	ALHA81232	5	H5	B	A/B
ALHA81124	9	H5	B	A	ALHA81233	25	H5	C	B/C

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA81236	41	H5	A/B	A/B	ALH83029	96	H5	B/C	A
ALHA81237	27	H5	B	B	ALH83030	49	H5	B/C	B/C
ALHA81238	24	H5	C	B	ALH83031	10	H5	B	A
ALHA81239	32	H5	B	B	ALH83034	6	H5	B	B
ALHA81240	41	H5	C	C	ALH83035	1	H5	B	A
ALHA81241	34	H5	B	A/B	ALH83036	24	H5	A	A/B
ALHA81242	20	H5	B/C	A	ALH83037	2	H5	B/C	A/B
ALHA81244	5	H5	B	A	ALH83039	6	H5	B	A/B
ALHA81245	4	H5	B/C	A/B	ALH83040	78	H5	B/C	A
ALHA81246	3	H5	C	A	ALH83044	5	H5	A	A
ALHA81249	10	H5	B/C	A	ALH83046	33	H5	A/B	A
ALHA81252	2	H5	B	A	ALH83047	20	H5	B/C	A
ALHA81255	12	H5	B	B	ALH83049	6	H5	B	B
ALHA81256	28	H5	C	A	ALH83051	16	H5	A/B	A
ALHA81263	6	H5	B	B	ALH83053	63	H5	C	C
ALHA81265	8	H5	B/C	A	ALH83055	18	H5	B/C	A
ALHA81269	5	H5	B/C	A	ALH83056	1	H5	A/B	A
ALHA81270	4	H5	C	A/B	ALH83057	63	H5	B	B
ALHA81274	19	H5	A/B	A	ALH83059	4	H5	B/C	A
ALHA81275	11	H5	B	A	ALH83060	9	H5	C	B
ALHA81276	42	H5	C	B	ALH83061	34	H5	B/C	A/B
ALHA81277	7	H5	B	A	ALH83062	77	H5	B/C	B
ALHA81281	46	H5	B	B	ALH83064	12	H5	C	A/B
ALHA81283	0.6	H5	B/C	A	ALH83065	54	H5	C	A
ALHA81284	10	H5	B/C	A	ALH83066	46	H5	C	B
ALHA81286	28	H5	B	B	ALH83068	0.8	H5	C	A
ALHA81287	78	H5	C	B/C	ALH83072	2	H5	C	A
ALHA81293	2	H5	B	A/B	ALH83073	49	H5	C	B
ALHA81294	9	H5	B	A	ALH83074	6	H5	C	A
ALHA81295	105	H5	C	B/C	ALH83104	2	H5	B	A
ALHA81296	13	H5	B/C	B	ALH83107	38	H5	B/C	A
ALHA81297	20	H5	B	A	ALH84003	3089	H5	A/B	A
ALHA81300	10	H5	A/B	A	ALH84055	6901	H5	Be	B
ALHA81301	12	H5	B/C	A	ALH84060	339	H5	B	A
ALHA81302	4	H5	B/C	A	ALH84064	1889	H5	B	A
ALHA81305	1	H5	B/C	A	ALH84067	391	H5	C	B/C
ALHA81306	7	H5	B	A	ALH84068	1114	H5	B	A
ALHA81308	19	H5	B/C	B	ALH84069	1136	H5	A	A
ALHA81314	3	H5	B	A	ALH84073	631	H5	B	A
ALH82103	2529	H5	B	B	ALH84074	758	H5	A/B	B
ALH82108	14	H5	B/C	A	ALH84075	789	H5	C	B/C
ALH82109	47	H5	B/C	A/B	ALH84076	369	H5	B/C	A
ALH82112	28	H5	C	A	ALH84077	276	H5	B	A
ALH82114	41	H5	A/B	A	ALH84078	283	H5	B/C	A
ALH82115	48	H5	A/B	A	ALH84085	554	H5	B/C	B/C
ALH82119	24	H5	B/C	B	ALH84088	298	H5	B	A
ALH82120	7	H5	B	A	ALH84089	304	H5	B/C	A
ALH82122	142	H5	B	A	ALH84091	215	H5	B/C	A
ALH82129	14	H5	B/C	A	ALH84094	208	H5	C	B
ALH82134	28	H5	B/C	A	ALH84098	261	H5	B/C	A
ALH82141	0.6	H5	C	A	ALH84099	150	H5	B/C	B
ALH82144	7	H5	B	A	ALH84100	110	H5	B	A
ALH83003	322	H5	A/B	A	ALH84111	132	H5	B	A/B
ALH83005	228	H5	C	B	ALH84117	72	H5	B	A
ALH83006	230	H5	B/C	C	ALH84121	141	H5	C	B/C
ALH83012	203	H5	B/C	B	ALH84124	114	H5	C	B/C
ALH83020	3	H5	B	B	ALH84128	2	H5	C	B
ALH83025	78	H5	C	B	ALH84131	108	H5	C	B/C

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALH84133	70	H5	B	A	ALH85025	713	H5	C	A/B
ALH84135	31	H5	B/C	A	ALH85038	125	H5	B/C	A
ALH84137	145	H5	B/C	C	ALH85042	128	H5	B/C	A
ALH84138	20	H5	B	A	ALH85043	205	H5	B	A
ALH84139	157	H5	A	A	ALH85048	17	H5	C	A/B
ALH84144	54	H5	C	A/B	ALH85051	5	H5	B/C	A
ALH84145	19	H5	B	B	ALH85054	55	H5	C	A/B
ALH84146	33	H5	B	B/C	ALH85055	6	H5	C	A
ALH84148	168	H5	C	C	ALH85056	7	H5	C	A
ALH84149	12	H5	C	C	ALH85067	1	H5	B	A
ALH84152	6	H5	B/C	A	ALH85068	4	H5	C	B
ALH84155	114	H5	B/C	A	ALH85071	19	H5	C	B
ALH84156	28	H5	B/C	A	ALH85074	3	H5	C	A
ALH84157	89	H5	B/C	A	ALH85077	12	H5	B/C	A
ALH84158	54	H5	B/C	A	ALH85086	12	H5	B/C	A
ALH84161	83	H5	C	B/C	ALH85088	0.4	H5	C	A
ALH84162	42	H5	C	B/C	ALH85089	1	H5	B/C	B
ALH84163	135	H5	C	A	ALH85091	31	H5	B/C	A
ALH84167	151	H5	C	B	ALH85097	61	H5	B/C	B
ALH84172	3	H5	B/C	B	ALH85098	7	H5	C	A
ALH84175	35	H5	C	B	ALH85099	7	H5	B/C	A
ALH84178	0.4	H5	B	A	ALH85100	58	H5	B	A
ALH84179	46	H5	B/C	B/C	ALH85102	13	H5	B	A
ALH84183	28	H5	B	B	ALH85104	99	H5	B/C	B
ALH84184	42	H5	B	B	ALH85107	37	H5	B/C	A
ALH84185	5	H5	C	A	ALH85110	22	H5	B	B/C
ALH84192	4	H5	C	A	ALH85111	13	H5	C	B
ALH84194	4	H5	C	A/B	ALH85114	11	H5	C	A
ALH84196	10	H5	B/C	A	ALH85120	8	H5	C	B
ALH84199	27	H5	C	A	ALH85122	61	H5	B	B
ALH84201	6	H5	B/C	A	ALH85125	19	H5	B/C	A/B
ALH84202	88	H5	C	B	ALH85126	47	H5	B/C	B
ALH84213	7	H5	B	A	ALH85133	91	H5	B	A/B
ALH84216	5	H5	B/C	A/B	ALH85134	10	H5	C	A
ALH84217	3	H5	C	A	ALH85141	11	H5	C	A
ALH84221	16	H5	C	A	ALH85142	51	H5	B/C	B
ALH84222	10	H5	C	A	ALH85143	18	H5	C	A
ALH84223	11	H5	C	A	ALH85144	18	H5	B	A
ALH84225	9	H5	C	B	ALH85145	46	H5	C	A/B
ALH84226	28	H5	B	A	ALH85146	40	H5	A/B	A
ALH84227	12	H5	C	B/C	ALH86601	309	H5	B	B/C
ALH84228	10	H5	B/C	B	ALH86603	104	H5	A/B	A
ALH84236	32	H5	B	B	ALH86606	4	H5	B/C	A
ALH84237	8	H5	C	B	ALH86611	9	H5	C	A
ALH84239	15	H5	B	A	ALH86612	2	H5	C	A
ALH84240	26	H5	C	A	DOM85500	60	H5	B	A/B
ALH84241	17	H5	C	B	DOM85501	126	H5	C	A
ALH84245	19	H5	B	A	DOM85507	190	H5	C	B
ALH84246	2	H5	A/B	B	EETA79007	200	H5	B	B
ALH84248	5	H5	B	B	EET82603	8210	H5	Be	A
ALH84249	23	H5	B/C	A/B	EET82604	1571	H5	B/C	B
ALH84251	34	H5	B/C	B	EET82614	8	H5	A/B	A
ALH84253	7	H5	B/C	A	EET83200	779	H5	B/C	B
ALH84259	23	H5	C	B/C	EET83203	546	H5	B/C	B/C
ALH84260	15	H5	B	A	EET83208	263	H5	B/C	B
ALH84263	5	H5	C	A	EET83223	219	H5	B	B
ALH85021	647	H5	Be	B	EET83256	5	H5	B	A
ALH85024	388	H5	B/C	A/B	EET83262	24	H5	A	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
EET83278	72	H5	B	A	LEW85389	4	H5	C	A/B
EET83282	79	H5	B/C	B	LEW85393	51	H5	Be	B
EET83285	3	H5	B	B	LEW85395	17	H5	B/C	A
EET83287	46	H5	B	B	LEW85404	34	H5	B	B
EET83292	9	H5	B/C	B	LEW85405	63	H5	B/C	A/B
EET83293	19	H5	B	A/B	LEW85406	7	H5	C	A/B
EET83300	115	H5	C	B	LEW85407	19	H5	C	A
EET83303	12	H5	B/C	A	LEW85409	29	H5	B/C	A
EET83305	167	H5	B	B/C	LEW85414	26	H5	C	A
EET83324	143	H5	B/C	B	LEW85416	6	H5	C	A
EET83326	113	H5	C	B	LEW85422	27	H5	C	A
EET83331	0.3	H5	B/C	A	LEW85423	11	H5	B/C	A
EET83338	27	H5	C	B	LEW85426	16	H5	B/C	A
EET83346	22	H5	B	B	LEW85433	57	H5	C	A/B
EET83347	37	H5	C	A	LEW85435	21	H5	C	A/B
EET83349	28	H5	C	B	LEW85447	16	H5	C	A
EET83351	81	H5	B	B	LEW85448	34	H5	C	A
EET83369	39	H5	C	A	LEW85450	27	H5	B/C	A
EET83372	169	H5	B	C	LEW85453	5	H5	C	A
EET83377	152	H5	C	B/C	LEW85455	8	H5	C	A
EET83388	35	H5	C	A	LEW85456	19	H5	C	A
EET83400	113	H5	C	A	LEW85458	17	H5	B/C	A
EET83402	50	H5	C	B	LEW85459	32	H5	B/C	A/B
EET83403	12	H5	C	A	LEW85460	6	H5	C	A
EET84303	58	H5	C	A	LEW85464	24	H5	C	A
GRO85200	3822	H5	B/C	A	LEW85466	14	H5	C	A
GRO85203	1450	H5	B	B	LEW86020	361	H5	C	B
GRO85206	2420	H5	B/Ce	B	LEW86026	22	H5	B/C	A
GRO85210	247	H5	B	A	LEW86029	17	H5	C	A
GRO85211	355	H5	B	A	LEW86031	74	H5	C	A/B
LEW85314	14	H5	C	A/B	LEW86032	1	H5	B/C	A
LEW85316	34	H5	C	B/C	LEW86035	78	H5	B/C	B
LEW85318	152	H5	C	B	LEW86036	9	H5	B/C	A
LEW85319	11491	H5	B/Ce	B	LEW86037	6	H5	B/Ce	A
LEW85320	110224	H5	Be	B	LEW86039	41	H5	B/C	A
LEW85324	514	H5	B	B	LEW86041	23	H5	B/C	A
LEW85326	225	H5	C	A	LEW86044	19	H5	C	A
LEW85327	439	H5	B/C	B	LEW86045	5	H5	C	B
LEW85334	177	H5	B/C	A	LEW86046	5	H5	C	B
LEW85336	60	H5	B/C	A	LEW86047	69	H5	C	B
LEW85338	99	H5	B	B/C	LEW86049	15	H5	C	B
LEW85341	76	H5	C	A	LEW86050	11	H5	B/C	A
LEW85342	7	H5	C	A	LEW86051	2	H5	B/C	A
LEW85344	3	H5	C	A	LEW86053	4	H5	B/C	A
LEW85345	32	H5	B/C	A	LEW86055	41	H5	B/C	A
LEW85347	31	H5	C	A	LEW86058	22	H5	B/C	A
LEW85352	9	H5	C	A	LEW86059	2	H5	B/C	A
LEW85355	6	H5	C	A/B	LEW86060	23	H5	C	A
LEW85357	61	H5	B/C	B	LEW86062	13	H5	C	A
LEW85358	14	H5	C	B	LEW86063	7	H5	C	A
LEW85364	4	H5	C	A	LEW86068	6	H5	C	A
LEW85367	6	H5	C	A	LEW86071	8	H5	B/C	A
LEW85371	55	H5	C	A	LEW86072	12	H5	C	A
LEW85372	9	H5	C	A	LEW86074	19	H5	B/C	A/B
LEW85375	37	H5	C	A	LEW86076	24	H5	B/C	A
LEW85379	26	H5	C	A	LEW86077	9	H5	B/C	A
LEW85382	10	H5	B/C	A/B	LEW86078	37	H5	B/C	A
LEW85387	4	H5	C	A	LEW86079	7	H5	B/C	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW86080	14	H5	C	A	LEW86199	32	H5	C	A
LEW86081	28	H5	C	A	LEW86200	3	H5	C	A
LEW86083	199	H5	Ce	A	LEW86206	36	H5	C	A
LEW86086	104	H5	C	B	LEW86208	7	H5	C	A
LEW86087	11	H5	C	A	LEW86209	12	H5	C	A
LEW86088	38	H5	C	A	LEW86215	123	H5	C	A
LEW86091	67	H5	C	A	LEW86217	20	H5	C	A/B
LEW86092	21	H5	B	A	LEW86223	13	H5	C	A
LEW86093	15	H5	C	A	LEW86225	103	H5	C	B
LEW86094	15	H5	C	A	LEW86226	49	H5	C	A
LEW86095	14	H5	C	A/B	LEW86228	29	H5	C	A
LEW86096	71	H5	C	A	LEW86230	2	H5	C	A/B
LEW86099	28	H5	C	A	LEW86232	19	H5	C	A
LEW86100	24	H5	C	A	LEW86233	10	H5	C	A
LEW86103	9	H5	C	A	LEW86234	14	H5	C	A/B
LEW86104	34	H5	C	A	LEW86235	7	H5	C	A
LEW86106	6	H5	C	A	LEW86237	14	H5	C	A/B
LEW86107	47	H5	C	A	LEW86240	7	H5	C	A
LEW86108	4	H5	C	A	LEW86242	13	H5	C	A
LEW86109	17	H5	C	A	LEW86243	6	H5	C	A/B
LEW86111	33	H5	C	A	LEW86244	5	H5	C	A
LEW86112	18	H5	Ce	A	LEW86245	3	H5	C	A
LEW86116	17	H5	C	A	LEW86247	4	H5	C	B
LEW86118	30	H5	C	A	LEW86250	142	H5	C	A
LEW86121	8	H5	B/C	A	LEW86254	9	H5	C	A
LEW86122	9	H5	C	A	LEW86255	25	H5	C	A
LEW86125	14	H5	C	A	LEW86256	22	H5	C	A
LEW86126	7	H5	C	A	LEW86257	4	H5	C	B
LEW86128	15	H5	C	A	LEW86259	8	H5	C	A
LEW86129	7	H5	B/C	B	LEW86261	14	H5	C	A
LEW86130	3	H5	C	A	LEW86262	10	H5	C	A
LEW86131	10	H5	C	A	LEW86263	15	H5	C	A
LEW86136	13	H5	C	B	LEW86265	2	H5	C	A
LEW86142	14	H5	C	A	LEW86266	41	H5	C	A
LEW86143	23	H5	C	A	LEW86271	20	H5	C	A
LEW86147	13	H5	C	B	LEW86272	16	H5	C	A
LEW86148	2	H5	B/C	A	LEW86275	35	H5	C	B/C
LEW86150	7	H5	B	A	LEW86286	45	H5	B/Ce	B
LEW86151	13	H5	C	A	LEW86292	33	H5	Ce	B
LEW86152	15	H5	C	A/B	LEW86302	40	H5	C	A
LEW86153	31	H5	C	A	LEW86305	40	H5	C	B
LEW86154	9	H5	B	A	LEW86312	102	H5	Be	A
LEW86155	18	H5	B/C	A	LEW86314	41	H5	C	A
LEW86156	24	H5	B/C	A	LEW86319	3	H5	C	A
LEW86159	8	H5	C	A	LEW86320	3	H5	C	A
LEW86164	26	H5	C	A	LEW86321	33	H5	C	B
LEW86167	13	H5	C	A	LEW86322	18	H5	C	A
LEW86172	7	H5	C	A	LEW86323	5	H5	C	A
LEW86174	27	H5	C	A/B	LEW86324	8	H5	C	A
LEW86180	11	H5	C	A	LEW86325	20	H5	C	A
LEW86187	11	H5	C	A	LEW86326	7	H5	C	A
LEW86188	6	H5	C	B/C	LEW86327	44	H5	C	A
LEW86189	10	H5	C	A	LEW86329	5	H5	C	A
LEW86191	11	H5	C	A	LEW86332	14	H5	C	A
LEW86192	11	H5	C	A	LEW86336	8	H5	C	A
LEW86194	10	H5	C	A/B	LEW86337	26	H5	C	B
LEW86197	18	H5	C	B	LEW86338	27	H5	C	A/B
LEW86198	15	H5	B/C	A	LEW86341	9	H5	C	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW86344	17	H5	C	A	LEW86454	3	H5	C	A
LEW86345	4	H5	C	A	LEW86455	50	H5	C	A
LEW86353	5	H5	C	A	LEW86456	22	H5	C	A
LEW86354	23	H5	B/C	A	LEW86457	13	H5	C	A
LEW86356	9	H5	C	A	LEW86458	18	H5	C	A
LEW86361	6	H5	B/C	A	LEW86459	8	H5	C	A
LEW86362	6	H5	C	B	LEW86460	19	H5	C	A/B
LEW86363	3	H5	B/C	A	LEW86461	0.6	H5	C	A
LEW86365	5	H5	C	A	LEW86462	25	H5	C	A
LEW86366	26	H5	C	A	LEW86463	65	H5	C	A
LEW86368	29	H5	C	A	LEW86464	19	H5	C	A
LEW86369	7	H5	C	A	LEW86465	26	H5	C	A
LEW86370	9	H5	C	A	LEW86467	0.4	H5	C	A
LEW86371	147	H5	C	B	LEW86468	12	H5	C	A
LEW86373	30	H5	C	A/B	LEW86469	11	H5	C	A
LEW86374	32	H5	C	A	LEW86470	59	H5	C	A
LEW86375	11	H5	C	B	LEW86472	30	H5	C	A
LEW86376	41	H5	C	A/B	LEW86473	21	H5	B/C	A
LEW86383	11	H5	C	A	LEW86475	15	H5	C	A
LEW86384	6	H5	C	A	LEW86476	0.6	H5	C	A
LEW86385	34	H5	C	A	LEW86477	12	H5	B/C	A
LEW86387	26	H5	C	A	LEW86479	141	H5	C	A
LEW86388	24	H5	C	A	LEW86480	12	H5	C	A
LEW86389	2	H5	C	A	LEW86482	7	H5	C	A
LEW86391	15	H5	C	A	LEW86484	24	H5	C	A
LEW86393	70	H5	C	B	LEW86485	52	H5	C	A
LEW86394	3	H5	C	A	LEW86486	10	H5	C	A
LEW86395	14	H5	C	A	LEW86487	15	H5	C	A
LEW86396	13	H5	B/C	A	LEW86488	9	H5	C	A
LEW86397	10	H5	C	A	LEW86489	30	H5	C	B
LEW86398	3	H5	C	A	LEW86491	15	H5	B/C	A
LEW86400	19	H5	C	A	LEW86492	25	H5	C	A
LEW86401	9	H5	C	A	LEW86496	5	H5	C	B/C
LEW86403	7	H5	C	A	LEW86497	6	H5	C	A
LEW86405	1	H5	C	A	LEW86499	25	H5	C	A
LEW86407	36	H5	C	A/B	LEW86500	45	H5	C	A
LEW86413	14	H5	C	A	LEW86501	85	H5	C	B
LEW86414	4	H5	C	B	LEW86503	22	H5	B/C	A
LEW86415	3	H5	C	B	LEW86506	30	H5	B/C	A/B
LEW86418	43	H5	C	C	LEW86507	10	H5	C	A
LEW86420	13	H5	C	A	LEW86508	10	H5	B/C	A/B
LEW86422	8	H5	C	A	LEW86509	33	H5	C	A
LEW86423	11	H5	C	A	LEW86510	24	H5	C	B
LEW86424	7	H5	C	A	LEW86513	6	H5	B/C	B
LEW86430	6	H5	C	A/B	LEW86514	65	H5	C	A
LEW86431	10	H5	C	A	LEW86515	34	H5	B/C	A
LEW86434	22	H5	C	A/B	LEW86516	4	H5	B/C	A
LEW86437	17	H5	C	A	LEW86517	32	H5	B/C	A
LEW86438	45	H5	C	A	LEW86518	267	H5	B/Ce	B
LEW86440	7	H5	C	A	LEW86519	8	H5	C	A
LEW86441	11	H5	C	A	LEW86520	6	H5	C	B
LEW86442	59	H5	C	A	LEW86521	0.3	H5	B	A
LEW86443	11	H5	C	A	LEW86523	7	H5	C	A
LEW86444	15	H5	C	A	LEW86525	46	H5	C	A
LEW86450	5	H5	C	A	LEW86527	22	H5	C	A
LEW86451	34	H5	C	A	LEW86529	1	H5	C	A
LEW86452	20	H5	C	A	LEW86530	2	H5	B/C	A
LEW86453	49	H5	C	A/B	LEW86532	4	H5	C	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW86533	16	H5	C	A	ALHA77157*	88	H6	A/B	
LEW86534	89	H5	B/C	A/B	ALHA77183	288	H6	C	A
LEW86536	8	H5	C	A	ALHA77200*	0.9	H6	C	
LEW86538	21	H5	C	A	ALHA77209*	32	H6	B	
LEW86545	16	H5	C	A	ALHA77212*	17	H6	A/B	
META78009§	29	H5	B	A	ALHA77239*	19	H6	B	
META78010	234	H5	Be	A	ALHA77246*	42	H6	B	
META78011	116	H5	C	A	ALHA77248*	96	H6	B/C	
META78012	86	H5	B	B	ALHA77258	597	H6	B/Ce	A/B
META78018§	82	H5	B	A	ALHA77271	610	H6	C	A
MIL85600	497	H5	C	A	ALHA77285	271	H6	C	B
PCA82517	41	H5	B/C	B	ALHA77288	1880	H6	C	B
PCA82521	1	H5	C	A	ALHA78002‡	11	H6	A	
PCA82522	46	H5	B/C	B	ALHA78035	2	H6		
RKPA78005§	29	H5	B	B	ALHA78065‡	7	H6	B	
RKPA79004	371	H5	B/C	B	ALHA78067	8	H6		
RKPA79014	78	H5	B/C	B	ALHA78069‡	4	H6	B	
RKPA80210	11	H5	B/C	B	ALHA78076	276	H6	B	B
RKPA80217	8	H5	C	A	ALHA78086†	9	H6		
RKPA80218	7	H5	C	A	ALHA78115	848	H6	B	A
RKPA80220	124	H5	B/C	B/C	ALHA78122	5	H6		
RKPA80223	25	H5	C	B	ALHA78124	28	H6		
RKPA80227	8	H5	B/C	A	ALHA78135†	131	H6	B	B
RKPA80230	58	H5	B	B	ALHA78137	70	H6		
RKPA80233	414	H5	B/C	B	ALHA78145‡	34	H6	A	
RKPA80236	16	H5	B/C	B	ALHA78152	5	H6		
RKPA80240	61	H5	C	A	ALHA78169‡	22	H6	B	
RKPA80243	3	H5	C	A	ALHA78184	8	H6		
RKPA80244	14	H5	C	B	ALHA78189	23	H6		
RKPA80245	37	H5	B/C	B	ALHA78191	20	H6		
RKPA80247	1	H5	C	B	ALHA78207	8	H6		
RKPA80249	10	H5	B/C	A	ALHA78211	11	H6	B	B
RKPA80250	4	H5	B/C	A	ALHA78213	10	H6	B	B
RKPA80251	29	H5	B	B	ALHA78215	6	H6	B/C	B
RKPA80257	9	H5	B/C	B	ALHA78229	2	H6	B	B
RKPA80260	8	H5	C	B	ALHA78231	2	H6	B/C	B
RKP86705	68	H5	B	C	ALHA78249	4	H6		
TIL82409	231	H5	B	A	ALHA79002	223	H6	C	B
TIL82412	35	H5	C	B	ALHA79005	60	H6	B	B
TIL82413	18	H5	C	B	ALHA79016	1146	H6	B/C	B
TIL82414	15	H5	B	A	ALHA79019	12	H6	B	A
TIL82415	70	H5	A/B	A	ALHA79020	4	H6	B/C	B
ALH82102	48	H5	B/C	A	ALHA79024	22	H6	C	B
					ALHA79028	16	H6	B	B
ALHA78147†	31	H5,6			ALHA79034	13	H6	B	A
					ALHA79037	15	H6	B	B
ALHA76006	1137	H6	Ce	B	ALHA79049	54	H6	C	B
ALHA76008	1150	H6	B/C	B	ALHA79055	15	H6	B/C	B
ALHA77046*	8	H6	A/B		ALHA80118	2	H6	B	A
ALHA77111*	52	H6	C		ALHA80122	50	H6	B/C	B
ALHA77131*	26	H6	A/B		ALHA80126	35	H6	A/B	A
ALHA77133*	19	H6	A		ALHA80130	5	H6	B/C	A
ALHA77134*	19	H6	A		ALHA81035	256	H6	C	A/B
ALHA77144	8	H6	B	A	ALHA81037	320	H6	B	A
ALHA77146*	18	H6	A/B		ALHA81038	229	H6	C	B
ALHA77147*	19	H6	A/B		ALHA81054	2	H6	B	B
ALHA77148	13	H6	C	B	ALHA81055	5	H6	B	A
ALHA77149*	26	H6	A/B		ALHA81076	10	H6	B	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA81078	6	H6	B/C	B	ALH84113	212	H6	B/C	B
ALHA81079	7	H6	C	A	ALH84114	120	H6	B	B
ALHA81086	6	H6	B	B	ALH84115	195	H6	B/C	B
ALHA81093	271	H6	A/B	A/B	ALH84118	114	H6	B	B
ALHA81094	152	H6	C	B	ALH84147	54	H6	C	A
ALHA81096	83	H6	B	B	ALH84150	20	H6	B/C	A
ALHA81102	196	H6	B/C	A/B	ALH84151	112	H6	B	A
ALHA81103	136	H6	B/C	B/C	ALH84153	243	H6	B/C	A
ALHA81111	210	H6	B/C	B	ALH84159	101	H6	C	A/B
ALHA81112	150	H6	B/C	A	ALH84171~	37	H6	C	A
ALHA81127	15	H6	B/C	B	ALH84176	5	H6	C	B/C
ALHA81134	15	H6	B/C	B	ALH84180	47	H6	B	A
ALHA81137	9	H6	B/C	A/B	ALH84186~	20	H6	B	B/C
ALHA81146	24	H6	C	B	ALH84187	26	H6	C	B/C
ALHA81154	1	H6	B	B	ALH84189~	9	H6	C	B
ALHA81160	12	H6	C	B	ALH84204~	24	H6	C	B
ALHA81180	17	H6	C	B	ALH84208	21	H6	C	B
ALHA81193	13	H6	B	A	ALH84211	49	H6	B/C	A
ALHA81196	9	H6	B	A	ALH84214~	5	H6	B/C	A
ALHA81204	7	H6	B	A	ALH84215	9	H6	B/C	A
ALHA81210	0.6	H6	B	A	ALH84224	7	H6	B	A/B
ALHA81223	10	H6	A/B	A	ALH84242	17	H6	C	B
ALHA81224	14	H6	B/C	A	ALH84243~	49	H6	Ce	A
ALHA81225	14	H6	B	A	ALH84252	3	H6	B/C	A
ALHA81248	5	H6	C	A/B	ALH84257~	19	H6	B	B
ALHA81250	17	H6	B	B	ALH84262	15	H6	C	B
ALHA81253	10	H6	A/B	B	ALH85018	812	H6	B	A
ALHA81254	9	H6	C	A	ALH85020	744	H6	B	B
ALHA81268	18	H6	C	B/C	ALH85023	439	H6	B/C	A
ALHA81271	28	H6	B	B	ALH85028	326	H6	C	B
ALHA81273	43	H6	C	B/C	ALH85030	620	H6	B/C	A
ALHA81288	20	H6	B	A	ALH85031	201	H6	B/C	A
ALHA81291	4	H6	B	A	ALH85032	424	H6	C	A
ALHA81298	16	H6	B	B	ALH85036	231	H6	C	A
ALHA81303	4	H6	B/C	A	ALH85037	141	H6	B/Ce	B
ALHA81310	0.7	H6	B	A	ALH85041	168	H6	C	B/C
ALHA81317	0.4	H6	C	A	ALH85044	105	H6	C	B
ALH82113	61	H6	A/B	A	ALH85052	17	H6	A/B	A
ALH82116	18	H6	B	B	ALH85069	5	H6	B	B
ALH82124	26	H6	C	A/B	ALH85072~	4	H6	C	B
ALH82127	5	H6	A/B	A	ALH85081	12	H6	B	B/C
ALH82138	5	H6	B	A/B	ALH85094~	9	H6	C	A
ALH82143	3	H6	C	A/B	ALH85108	15	H6	C	A
ALH83013	246	H6	A/B	A	ALH85109~	21	H6	Ce	A
ALH83024	6	H6	B/C	A	ALH85117~	28	H6	B/C	A/B
ALH83028~	16	H6	B	A	ALH85127	10	H6	C	A/B
ALH83050	10	H6	A/B	B	ALH85128~	16	H6	C	A
ALH83071	5	H6	B/C	A	ALH85130	100	H6	B	A/B
ALH83103~	52	H6	B	A	ALH85136	75	H6	B	B
ALH84071	798	H6	B	B	ALH85139	26	H6	B	B
ALH84082	557	H6	C	A	ALH85140	9	H6	B/C	A
ALH84083	420	H6	B/C	B/C	ALH85148~	4	H6	A	A
ALH84093	114	H6	B	B	ALH85156	32	H6	C	A
ALH84101	221	H6	C	B	ALH86607	3	H6	C	A
ALH84105	261	H6	C	C	BOW85800	141	H6	C	A
ALH84108	215	H6	B	B	BTNA78005	82	H6	B	B
ALH84109	246	H6	B/C	A/B	DOM85508	14	H6	C	A
ALH84110	319	H6	B/C	A	EET82610	42	H6	B	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
EET82615	29	H6	B	A	LEW86017	688	H6	B	A/B
EET83201	1060	H6	B/C	A	LEW86028	26	H6	B	A
EET83215	510	H6	B/C	C	LEW86030	13	H6	C	A
EET83263	10	H6	C	B/C	LEW86052	2	H6	B/C	A
EET83270	2	H6	C	B	LEW86066~	18	H6	C	B
EET83275~	86	H6	B	A	LEW86089	85	H6	C	A
EET83281	51	H6	C	B	LEW86120~	33	H6	C	A
EET83288~	38	H6	C	B	LEW86137~	6	H6	C	A
EET83295	28	H6	B	A/B	LEW86139~	4	H6	C	A
EET83299	6	H6	C	B/C	LEW86149	19	H6	C	A
EET83310	64	H6	C	A	LEW86160~	15	H6	C	A
EET83320	56	H6	C	B	LEW86163~	15	H6	C	A
EET83321	11	H6	C	A	LEW86168~	18	H6	C	A
EET83360~	40	H6	C	A	LEW86170~	4	H6	B/C	A/B
EET83362~	10	H6	B/C	A	LEW86177	19	H6	C	A
EET83367	107	H6	C	B	LEW86178~	13	H6	C	A
EET83373	159	H6	C	A	LEW86181	31	H6	C	B
EET83374	96	H6	C	A	LEW86182~	19	H6	C	A
EET83382	12	H6	B	B	LEW86183~	23	H6	C	A
EET83385~	4	H6	B/C	A	LEW86190~	28	H6	C	B
EET83393~	30	H6	B/C	B	LEW86196~	19	H6	B/C	A
EET83394~	54	H6	C	A	LEW86201~	18	H6	C	A
EET83397	32	H6	C	B/C	LEW86202	12	H6	C	A
EET84306	4	H6	C	A/B	LEW86204~	22	H6	C	A
GRO85218	7	H6	C	A	LEW86205~	17	H6	C	A/B
LEW85301~	13	H6	B/C	A	LEW86212~	6	H6	C	A
LEW85315	10	H6	C	A	LEW86218~	6	H6	C	A
LEW85322	582	H6	C	A	LEW86221~	18	H6	C	A
LEW85329	170	H6	A/B	A	LEW86236~	1	H6	C	A
LEW85330	67	H6	B/C	A	LEW86239~	25	H6	C	B
LEW85331	54	H6	C	A	LEW86241	33	H6	C	A
LEW85335	107	H6	C	A/B	LEW86249	45	H6	C	A
LEW85337~	57	H6	C	A	LEW86252~	33	H6	C	A
LEW85348	31	H6	C	B	LEW86253~	10	H6	B/C	A
LEW85359	18	H6	C	B	LEW86281	56	H6	C	A/B
LEW85362	15	H6	C	A	LEW86287~	42	H6	C	A/B
LEW85368	18	H6	C	A	LEW86295~	44	H6	B	A
LEW85373~	45	H6	Ce	B	LEW86328~	7	H6	C	A
LEW85374	10	H6	B	A	LEW86333~	9	H6	C	A
LEW85377~	31	H6	C	A/B	LEW86335~	3	H6	C	A
LEW85378~	66	H6	C	A/B	LEW86340~	25	H6	C	A
LEW85381~	22	H6	C	A	LEW86342~	2	H6	C	A
LEW85384~	6	H6	C	B	LEW86343~	6	H6	C	A
LEW85391	9	H6	C	A	LEW86348	20	H6	C	A
LEW85392	28	H6	C	A	LEW86350~	19	H6	C	B
LEW85399~	8	H6	C	A	LEW86351	10	H6	C	A
LEW85400	6	H6	B/C	A	LEW86355	7	H6	C	A
LEW85402~	66	H6	C	B	LEW86364~	20	H6	C	A
LEW85408~	3	H6	B	A	LEW86381~	7	H6	C	B
LEW85410~	2	H6	C	A	LEW86382	22	H6	C	A
LEW85411~	4	H6	C	A	LEW86412	1	H6	B/C	B
LEW85412	71	H6	C	A	LEW86416~	18	H6	C	A/B
LEW85418	37	H6	C	A	LEW86427	2	H6	C	A
LEW85446~	42	H6	C	A	LEW86428	6	H6	C	A
LEW85462	23	H6	C	A	LEW86433~	6	H6	C	A
LEW85469~	8	H6	C	A	LEW86439	6	H6	C	A
LEW85470	19	H6	C	B	LEW86445~	9	H6	C	A
LEW86015	780	H6	C	B/C	LEW86466~	71	H6	C	A/B

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW86471	83	H6	C	A	ALHA77011	292	L3	C	A
LEW86474~	7	H6	C	A	ALHA77013*	23	L3	B	
LEW86481	11	H6	C	A	ALHA77015	411	L3	Ce	B
LEW86493~	5	H6	C	A/B	ALHA77031*	0.5	L3	B/C	
LEW86494	14	H6	C	A	ALHA77033	9	L3	C	B
LEW86504~	8	H6	B/C	A	ALHA77034*	2	L3	B/C	
LEW86522~	43	H6	C	A	ALHA77036*	8	L3	B	
LEW86535	14	H6	C	A	ALHA77043*	11	L3	B/C	
LEW86537~	17	H6	C	A	ALHA77047*	20	L3	C	
LEW86539	13	H6	C	A	ALHA77049*	7	L3	B/C	
LEW86543~	26	H6	B/C	A	ALHA77050*	84	L3	B/C	
LEW86544	65	H6	C	A	ALHA77052*	112	L3	B/C	
MBRA76001	4108	H6	B	B	ALHA77115*	154	L3	B/C	
MBRA76002	13773	H6	B	B	ALHA77140	79	L3	Ce	B
META78006	410	H6	C	B	ALHA77160	70	L3	C	B
META78007	175	H6	B/C	B	ALHA77163*	24	L3	B/C	
META78013§	132	H6	B	B	ALHA77164	38	L3	C	C
META78014§	101	H6	C	A	ALHA77165	31	L3	C	C
META78016§	114	H6	B/C	B	ALHA77166*	139	L3	C	
META78017	47	H6	B/C	A	ALHA77167	611	L3	C	B/C
META78019§	91	H6	A/B	B	ALHA77170*	12	L3	B/C	
META78020	64	H6	C	A	ALHA77175*	23	L3	B/C	
META78022§	49	H6	B/C	A	ALHA77176*	55	L3	B	
META78023	56	H6	B	A	ALHA77178*	6	L3	B/C	
META78024§	22	H6	B/C	B	ALHA77185*	28	L3	A/B	
META78025§	58	H6	C	B/C	ALHA77197*	20	L3	A/B	
META78026	75	H6	C	A	ALHA77211*	27	L3	B/C	
META78027	53	H6	B	B	ALHA77214	2111	L3	C	C
PCA82512	55	H6	B	A	ALHA77215	820	L3	B	B/C
PCA82516	16	H6	B/C	B	ALHA77216	1470	L3	A/B	B/C
PCA82523	11	H6	A	B	ALHA77217	413	L3	B	B/C
PCA82526	25	H6	B	A	ALHA77241*	144	L3	C	
PCA82527	3	H6	A	A	ALHA77244*	40	L3	B/C	
RKPA79003	182	H6	B	A	ALHA77249	504	L3	C	C
RKPA79009	55	H6	C	B	ALHA77252	343	L3	B	C
RKPA79012	13	H6	B	B	ALHA77260	744	L3	C	C
RKPA80201	813	H6	Be	A	ALHA77303*	79	L3	B/C	
RKPA80203	4	H6	C	A	ALHA78013	4	L3		
RKPA80206	47	H6	C	B	ALHA78015	35	L3		
RKPA80208	10	H6	B	A	ALHA78017‡	3	L3	B	
RKPA80211	2	H6	C	B	ALHA78037‡	0.5	L3	B	
RKPA80213	19	H6	B/C	B	ALHA78038	363	L3	C	C
RKPA80214	5	H6	C	B	ALHA78041‡	118	L3	B	
RKPA80221	52	H6	C	B/C	ALHA78046	70	L3		
RKPA80231	238	H6	C	B/C	ALHA78119‡	103	L3	A	
RKPA80254	68	H6	C	B/C	ALHA78133	60	L3		
RKPA80255	7	H6	C	B	ALHA78149‡	23	L3	B	
RKPA80262	32	H6	C	B	ALHA78162‡	33	L3	B	
RKPA80265	8	H6	C	B	ALHA78170	21	L3	B	
RKPA80266	10	H6	B/C	B	ALHA78176‡	8	L3	B	
RKP86701	177	H6	B	A	ALHA78180‡	8	L3	B	
RKP86703	196	H6	C	B/C	ALHA78186	3	L3		
TIL82405	1116	H6	B	A	ALHA78188	0.9	L3	C	B
					ALHA78235‡	19	L3	B	
					ALHA78236	14	L3		
ALHA77081	9	} "H(?)" (Acapulco- like)	B	A	ALHA78238	10	L3		
ALHA81261	12		A/B	A	ALHA78239‡	16	L3	B	
ALHA81315	2		A/B	A	ALHA78243	2	L3		

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA79001	32	L3	C	A	LEW86207	18	L3	C	A/B
ALHA79045	115	L3	C	B	LEW86213	28	L3	Ce	A
ALHA80133	4	L3	B	B	LEW86246	2	L3	C	A
ALHA81024	798	L3	C	B	LEW86270	4	L3	B/C	B
ALHA81025	379	L3	C	B	LEW86307	5	L3	B	A
ALHA81030	1852	L3	B/C	B/C	LEW86347	3	L3	C	A
ALHA81031	1595	L3	C	B/C	LEW86367	11	L3	B	A
ALHA81032	727	L3	C	A	LEW86408	1	L3	C	A
ALHA81053	3	L3	C	B	LEW86417	2	L3	B	A
ALHA81060	28	L3	C	B	LEW86436	4	L3	C	A
ALHA81061	24	L3	B/C	A	LEW86495	2	L3	B/C	A
ALHA81065	13	L3	B/C	B	LEW86505	44	L3	Ae	A/B
ALHA81066	9	L3	C	B	LEW86549	50	L3	B	A/B
ALHA81069	7	L3	B/C	A	RKPA79008	73	L3	B	B
ALHA81085	16	L3	C	B	RKPA80207	18	L3	C	B
ALHA81087	8	L3	B/C	B	RKPA80256	153	L3	B	A
ALHA81121	88	L3	B	B	RKP86700	424	L3	B	B
ALHA81145	21	L3	B	B					
ALHA81156	20	L3	B/C	B/C	ALHA79022	31	L3,4	A/B	B
ALHA81162	59	L3	C	C					
ALHA81190	48	L3	C	A/B	ALHA77230	2473	L4	C	B
ALHA81191	30	L3	C	B/C	ALHA77304	650	L4	B	B
ALHA81214	4	L3	B/C	A	ALHA78044	164	L4	B/C	B
ALHA81229	40	L3	C	B/C	ALHA78070	10	L4		
ALHA81243	15	L3	C	B	ALHA81040	195	L4	B/C	A
ALHA81259	10	L3	C	B	ALHA81119	107	L4	B	B
ALHA81272	23	L3	C	B	ALHA81184	17	L4	A/B	A
ALHA81280	55	L3	C	B	ALH83001	1569	L4	B	A
ALHA81292	13	L3	C	A/B	ALH83023	4	L4	B	A
ALHA81299	0.5	L3	C	A/B	ALH84195	2	L4	B	A
ALH83008	272	L3	B	A	ALH85033	250	L4	A	A
ALH83010	395	L3	B	A	ALH85053	0.5	L4	C	A
ALH83017	0.6	L3		A	ALH85058	0.3	L4	A/B	A
ALH83038	87	L3	C	A/B	DOM85504	121	L4	B/C	A
ALH84120	129	L3	A/B	A	EET82611	13	L4	B	B
ALH84205	25	L3	B	B	EET82613	4	L4	B	A
ALH85045	145	L3	A/B	A	EET83318	55	L4	A/B	A
ALH85062	167	L3	B/Ce	A/B	EET83329	68	L4	B	A
ALH85070	13	L3	A/B	A	GRO85212	342	L4	B	A/B
ALH85155	18	L3	A/B	A	LEW85317	9	L4	A/B	A
EET82601	150	L3	B/C	A	LEW85333	48	L4	B	A
EET83260	15	L3	B/C	A	LEW85343	78	L4	A	A
EET83274	83	L3	B	A	LEW85350	24	L4	B/C	A
EET83395	65	L3	B	A	LEW85365	8	L4	C	A
EET83399	203	L3	C	A	LEW85390	1	L4	C	A/B
LEW85339	29	L3	A/B	A	LEW85443	10	L4	B	A/B
LEW85396	60	L3	C	A	LEW86014	662	L4	C	A
LEW85401	4	L3	B/C	A	LEW86024	249	L4	A/B	A
LEW85434	19	L3	C	A	LEW86034	6	L4	C	A
LEW85437	9	L3	C	A	LEW86040	49	L4	C	A
LEW85452	9	L3	C	A	LEW86061	9	L4	B	A
LEW86018	502	L3	Be	B	LEW86098	53	L4	C	A
LEW86021	326	L3	Ce	A	LEW86138	47	L4	C	A
LEW86022	352	L3	B/Ce	B	LEW86251	23	L4	C	A
LEW86127	12	L3	B	A	LEW86264	5	L4	C	A
LEW86134	29	L3	B/C	A/B	LEW86267	18	L4	C	A
LEW86144	11	L3	B/C	A/B	LEW86339	21	L4	C	A
LEW86158	9	L3	B	A	LEW86360	181	L4	B/C	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW86410	3	L4	B/C	A	LEW85417	9	L5	B/C	A
PCA82514	130	L4	B	A	LEW85427	15	L5	B	A
RKPA80216	44	L4	B	B	LEW85451	15	L5	B/C	A
RKPA80242	7	L4	B/C	B	LEW86065	9	L5	C	A
TIL82404	322	L4	B	B	LEW86124	8	L5	B/C	A
TIL82406	152	L4	B	A	LEW86222	9	L5	B	A
TIL82407	221	L4	B/C	A	LEW86224	7	L5	B/C	A
TIL82411	180	L4	A/B	A	LEW86260	12	L5	C	A/B
TYR82700	892	L4	Be	A	LEW86346	3	L5	C	A
					LEW86352	27	L5	A/B	A
ALHA77002	235	L5	B	A/B	LEW86357	3	L5	A/B	A
ALHA77117*	21	L5	A/B		LEW86392	6	L5	B	A
ALHA77127*	4	L5	B		LEW86502	25	L5	B	A
ALHA77218*	45	L5	A		LEW86524	23	L5	B/Ce	A
ALHA77254	246	L5	A/B	A	LEW86542	25	L5	B/C	A
ALHA77267*	104	L5	A		META78015§	37	L5	B	A
ALHA78142†	32	L5			PCA82504	3094	L5	A/B	B
ALHA81018	2237	L5	B	B	PCA82505	3086	L5	B	B
ALHA81023	418	L5	B	A/B	PCA82510	254	L5	A	A
ALHA81153	4	L5	B	A	PCA82513	239	L5	A/B	A
ALHA81198	0.5	L5	B/C	A	PCA82519	125	L5	B	A
ALH82104	399	L5	A	A/B	RKPA79013	11	L5	B/C	B
ALH82107	9	L5	B/C	A	RKPA80209	10	L5	C	B
ALH82117	4	L5	B	B	RKPA80228	11	L5	C	B
ALH82137	11	L5	B	A	RKPA80268	3	L5	B/C	B
ALH83002	367	L5	B	A	TIL82400	221	L5	A/B	B
ALH83011	213	L5	C	B					
ALH83045	2	L5	B/C	A	ALHA76001	20151	L6	A	A
ALH83048	2	L5	B/C	A	ALHA76003	10495	L6	A	A
ALH83069	78	L5	A	A	ALHA76007	410	L6	B	A
ALH84005	12000	L5	A/B	A	ALHA76009	407000	L6	B	B
ALH84063	760	L5	A/B	A	ALHA77001	252	L6	B	B
ALH84177	7	L5	B	B	ALHA77008*	93	L6	A	
ALH84209	6	L5	C	A/B	ALHA77019*	60	L6	B/C	
ALH84258	3	L5	B	A	ALHA77026*	20	L6	B/Ce	
ALH85092	26	L5	A/B	A/B	ALHA77027*	4	L6	B/C	
ALH85118	48	L5	B/Ce	A	ALHA77069*	0.8	L6	B/C	
ALH85123	15	L5	B	B	ALHA77089*	8	L6	B	
ALH85150	13	L5	B	B	ALHA77150	58	L6	C	B
ALH86610	0.8	L5	A		ALHA77155	305	L6	A/B	A
EETA79009	140	L5	B	B	ALHA77159*	17	L6	A/B	
EET83240	248	L5	B	A/B	ALHA77162*	29	L6	A	
EET83242	282	L5	B	B	ALHA77180	191	L6	C	A
EET83269	8	L5	A/B	A/B	ALHA77198*	7	L6	B	
EET83277	53	L5	A/B	A	ALHA77231	9270	L6	A/Be	A/B
EET83291	5	L5	B/C	B	ALHA77251*	69	L6	B	
EET83308	137	L5	B	A	ALHA77261	412	L6	B	B
EET83340	15	L5	B	B	ALHA77269	1045	L6	Be	A
EET83386	38	L5	A/B	A	ALHA77270	589	L6	A/B	B
EET83398	67	L5	B	B/C	ALHA77272	674	L6	B/C	B
GRO85214	260	L5	B	B	ALHA77273	492	L6	B	B
GRO85215	35	L5	B	A	ALHA77277	143	L6	A/B	A
GRO85216	13	L5	B	A	ALHA77280	3226	L6	Be	B/C
GRO85217	34	L5	B/C	A	ALHA77281	1231	L6	B	B
LEW85340	103	L5	B	A	ALHA77282	4127	L6	B	B
LEW85363	44	L5	B	A	ALHA77284	376	L6	A/B	B
LEW85385	13	L5	B/C	A	ALHA77292	200	L6	B	A
LEW85394	15	L5	C	A	ALHA77293*	110	L6	B	

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALHA77296	963	L6	A/Be	A	ALHA81106	48	L6	B	B
ALHA77297	952	L6	A	B	ALHA81107	140	L6	B	A
ALHA77301*	55	L6	A		ALHA81122	21	L6	B	B
ALHA77305	6444	L6	B/C	B	ALHA81131	13	L6	A/B	B
ALHA78003	125	L6	C	B	ALHA81150	2	L6	C	A
ALHA78039	299	L6	B	B	ALHA81159	10	L6	B/C	A
ALHA78042	214	L6	B	A	ALHA81167	59	L6	B/C	B
ALHA78043	680	L6	B	B	ALHA81172	33	L6	C	B
ALHA78045	397	L6	B/C	B	ALHA81181	15	L6	B	A
ALHA78048	191	L6	A/B	B	ALHA81203	4	L6	C	A
ALHA78050	1045	L6	B	B	ALHA81205	3	L6	B	A
ALHA78055‡	14	L6	B		ALHA81217	5	L6	C	B/C
ALHA78059‡	9	L6	B		ALHA81221	9	L6	C	A/B
ALHA78074	200	L6	B	B	ALHA81235	7	L6	C	B
ALHA78078	290	L6	A/B	A	ALHA81247	104	L6	A/B	B
ALHA78101	121	L6			ALHA81257	29	L6	B	A
ALHA78103	590	L6	B	B	ALHA81262	55	L6	A/B	B
ALHA78104	672	L6	B	A	ALHA81266	12	L6	A/B	B
ALHA78105	942	L6	B	A	ALHA81278	1	L6	B	A
ALHA78106	465	L6	A/B	A	ALHA81282	31	L6	A/B	A
ALHA78112	2485	L6	B	B	ALHA81289	4	L6	A	A
ALHA78114	808	L6	B/C	B	ALHA81304	42	L6	A/B	B
ALHA78125†	19	L6	B	B	ALHA81307	57	L6	B	B/C
ALHA78126	607	L6	B	B	ALHA81311	0.9	L6	B	A
ALHA78127	195	L6	B/C	B	ALH82105	363	L6	A/B	A
ALHA78130	2733	L6	B/C	B	ALH82111	63	L6	A/B	A
ALHA78131	269	L6	B/C	A	ALH82118	111	L6	A/B	B
ALHA78156	9	L6			ALH82121	2	L6	A	B
ALHA78171‡	23	L6	B		ALH82123	111	L6	B	A
ALHA78251	1312	L6	B	A	ALH82125	178	L6	C	B
ALHA79007	142	L6	A/B	B	ALH82139	0.2	L6	B	A
ALHA79018	121	L6	B/C	A/B	ALH82140	0.3	L6	C	A
ALHA79027	133	L6	B	A	ALH82142	20	L6	C	B/C
ALHA79033	281	L6	B	A	ALH83004	814	L6	B	A
ALHA79043	62	L6	C	B	ALH83021~	42	L6	B	A
ALHA79052	23	L6	B/C	B	ALH83027~	3	L6	B	A
ALHA80101	8725	L6	Be	B	ALH83033	21	L6	B/C	B
ALHA80103	536	L6	B	A	ALH83041~	0.3	L6	C	A
ALHA80105	445	L6	B	B	ALH83043~	3	L6	B	A/B
ALHA80107	178	L6	B	B	ALH83052	53	L6	C	B
ALHA80108	125	L6	B	B	ALH83058~	29	L6	A	A
ALHA80110	168	L6	B	B	ALH83063~	17	L6	A/B	A
ALHA80112	331	L6	B	B	ALH83067	96	L6	A/B	A
ALHA80113	313	L6	B	B/C	ALH83101	639	L6	A	A
ALHA80114	233	L6	B	B	ALH83105~	0.7	L6	A	A
ALHA80115	306	L6	B	A	ALH84002	7554	L6	Be	A/B
ALHA80116	191	L6	B/C	B	ALH84056	2140	L6	Be	A/B
ALHA80117	89	L6	B	A	ALH84057	368	L6	B/Ce	A
ALHA80119	34	L6	B	B	ALH84058	2003	L6	B	A
ALHA80120	60	L6	B	B	ALH84061	676	L6	B	A
ALHA80125	139	L6	B/C	B	ALH84062	958	L6	A/B	A
ALHA81016	3850	L6	Be	A	ALH84065	1642	L6	A/B	A
ALHA81017	1434	L6	B	A	ALH84066	356	L6	B	A
ALHA81026	516	L6	B	A	ALH84070	3952	L6	A/B	A
ALHA81027	3835	L6	C	A/B	ALH84072	721	L6	Be	A
ALHA81028	80	L6	B	B	ALH84079	750	L6	A/B	A
ALHA81029	153	L6	C	A	ALH84080	287	L6	B	A
ALHA81099	152	L6	A/B	A	ALH84087	315	L6	A/B	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ALH84090	202	L6	Ce	A	ALH85063~	13	L6	B	B
ALH84092	214	L6	A/B	B	ALH85064~	4	L6	C	B
ALH84095	277	L6	A/B	A	ALH85065~	10	L6	B	A
ALH84097	389	L6	B	A	ALH85075~	36	L6	B	A/B
ALH84102	214	L6	B	B	ALH85076~	78	L6	Be	B
ALH84104	201	L6	B	B	ALH85078	1	L6	C	B/C
ALH84106~	95	L6	B/C	A	ALH85080~	54	L6	B	B
ALH84112	146	L6	A/B	B	ALH85082~	19	L6	A/B	B
ALH84127~	84	L6	B	B	ALH85083~	93	L6	A/B	B
ALH84129	38	L6	A	A	ALH85087~	11	L6	A/B	B
ALH84130~	45	L6	B/C	B	ALH85090~	11	L6	B/C	A
ALH84132	158	L6	B	A	ALH85093~	11	L6	B	A/B
ALH84134	113	L6	B	A	ALH85095~	33	L6	B	A
ALH84140	164	L6	C	B	ALH85096~	3	L6	A	A
ALH84141	130	L6	B	B	ALH85101~	8	L6	B	B
ALH84142~	78	L6	A/B	B	ALH85103~	87	L6	A	B
ALH84143~	74	L6	B	B	ALH85105~	12	L6	A/B	B
ALH84160~	54	L6	B	A	ALH85112~	23	L6	A/B	B/C
ALH84164	101	L6	A/B	A	ALH85113~	40	L6	A/B	B
ALH84166~	39	L6	B	B/C	ALH85115~	22	L6	B	C
ALH84169	98	L6	B/C	C	ALH85124~	63	L6	B	B
ALH84173	2	L6	C	B	ALH85131~	34	L6	B	B
ALH84174~	32	L6	B	B	ALH85132~	49	L6	A/B	A/B
ALH84181~	33	L6	A/B	B	ALH85147~	3	L6	B	A
ALH84182	14	L6	B	B	ALH85149~	17	L6	B/C	A/B
ALH84193~	9	L6	A/B	C	ALH85157~	20	L6	B	A
ALH84197~	8	L6	B	A	ALH86600	411	L6	B	B
ALH84203~	9	L6	A/B	B	ALH86602	265	L6	B	A
ALH84207~	4	L6	B	A	ALH86604	13	L6	B/C	A
ALH84210~	9	L6	C	B/C	ALH86605~	12	L6	A/B	A
ALH84212~	7	L6	B/C	A/B	ALH86608~	10	L6	B/C	A
ALH84218~	33	L6	A/B	A/B	ALH86609~	8	L6	A/B	A
ALH84219~	10	L6	C	A	BTNA78001	161	L6	B	B
ALH84229~	7	L6	B	A	BTNA78002	4301	L6	B	A
ALH84231~	43	L6	B	B	DOM85502	302	L6	B	B
ALH84234~	4	L6	A	B	DOM85503	720	L6	A	B
ALH84238~	2	L6	B	B	DOM85509~	76	L6	B/C	B
ALH84244~	34	L6	B	A	DOM85510~	32	L6	B/C	A
ALH84247~	50	L6	A/B	B	EETA79003	436	L6	B	B
ALH84256~	3	L6	B	B	EETA79010	287	L6	B	C
ALH84261~	5	L6	A	A	EET82605	625	L6	B	A
ALH84264	138	L6	A	A	EET82606	982	L6	B	B
ALH85014	75	L6	A	A	EET82607	165	L6	B/C	A
ALH85016	1412	L6	A/B	A	EET82612	32	L6	A	A
ALH85017	2361	L6	A	A	EET83202	1213	L6	A/B	B
ALH85022	952	L6	B	A	EET83205	471	L6	A/B	B
ALH85026	817	L6	A	A	EET83206	462	L6	B	A
ALH85027	370	L6	B	A	EET83209	520	L6	B/C	A
ALH85029	389	L6	A/B	A	EET83210	426	L6	A/B	B
ALH85034	344	L6	A	A/B	EET83214	1398	L6	B	A
ALH85039	140	L6	A	A	EET83216	790	L6	B	A
ALH85040~	96	L6	B	A/B	EET83217	375	L6	B	B
ALH85046	149	L6	B	A/B	EET83218	192	L6	B	A
ALH85047~	4	L6	B	A	EET83219	243	L6	B	A
ALH85049~	5	L6	B/C	A	EET83220	331	L6	B	A
ALH85050~	0.9	L6	A	A/B	EET83222	317	L6	B	B
ALH85060~	0.5	L6	B	A	EET83237	883	L6	B	A/B
ALH85061~	2	L6	A/B	B	EET83238	382	L6	A	A/B

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
EET83239	282	L6	C	A/B	EET83368	51	L6	C	A
EET83241	203	L6	B	A/B	EET83370~	24	L6	C	B
EET83243	288	L6	A	A	EET83371~	170	L6	B	A
EET83244	384	L6	B	A	EET83375~	267	L6	B	B
EET83252	184	L6	B/C	A	EET83378~	212	L6	B	A
EET83253	44	L6	B	A	EET83379~	177	L6	B	A
EET83255~	39	L6	B	A	EET83383~	117	L6	B	A
EET83257~	14	L6	B	A	EET83384~	22	L6	B	A
EET83258~	47	L6	A/B	A	EET83387~	81	L6	C	B
EET83259	4	L6			EET83392~	164	L6	B	B
EET83261~	54	L6	A	A	EET83396~	198	L6	A/B	A
EET83264~	17	L6	B	A	EET84301	75	L6	B	B
EET83265~	55	L6	B	A	EET84304	152	L6	B	A
EET83266~	56	L6	B	A	EET84307	5	L6	C	A
EET83268	19	L6	C	A	EET84308	9	L6	B	A
EET83271	67	L6	A/B	A	EET86800~	116	L6	A	B/C
EET83272~	35	L6	B	A	EET86801	83	L6	B	A
EET83276	49	L6	B	B	GEO85700	2409	L6	B	A
EET83279~	36	L6	B	A	GEO85701	439	L6	A	A
EET83280~	29	L6	B/C	A	GRO85204	1755	L6	A	A/B
EET83284~	53	L6	B	A	GRO85205	1000	L6	A/B	A
EET83286~	34	L6	B	B	GRO85207	2372	L6	A/B	A
EET83289	8	L6	B	B	GRO85208	1357	L6	A	A
EET83294~	82	L6	B	B	GRO85209	1126	L6	A	A
EET83296~	63	L6	A/B	A	GRO85213	4364	L6	B	A
EET83297~	18	L6	B/C	A	LEW85321	527	L6	B/C	A
EET83298	9	L6	C	A	LEW85323	874	L6	Be	A
EET83301~	87	L6	B	A	LEW85325	537	L6	B/C	A
EET83302~	130	L6	A/B	A	LEW85346~	30	L6	B	B
EET83304~	37	L6	A/B	B	LEW85349	17	L6	C	A
EET83306	42	L6	B	A	LEW85354~	12	L6	B/C	A
EET83312	93	L6	B	B	LEW85356~	8	L6	B/C	A
EET83314~	24	L6	B	A	LEW85360~	13	L6	B	B
EET83315~	113	L6	B/C	B	LEW85361	4	L6	C	B
EET83316~	51	L6	B/C	A	LEW85380~	14	L6	B	A
EET83317	119	L6	B	A	LEW85388~	4	L6	B/C	A
EET83319~	7	L6	C	B	LEW85397	57	L6	C	A
EET83323	140	L6	B	B	LEW85403~	12	L6	A/B	B
EET83325~	93	L6	C	B	LEW85413~	14	L6	B	A
EET83328~	88	L6	B/C	A	LEW85419	39	L6	C	A
EET83330~	49	L6	B	A	LEW85420	12	L6	B/Ce	A
EET83335	227	L6	A/B	A	LEW85424~	4	L6	B/C	A
EET83336~	130	L6	B/C	B	LEW85425	3	L6	C	A/B
EET83339~	73	L6	B	B	LEW85428~	21	L6	B/C	A
EET83342	149	L6	B	B	LEW85430	13	L6	C	A
EET83343	125	L6	B	A	LEW85431~	30	L6	C	A
EET83344~	87	L6	C	A	LEW85432~	2	L6	B	A
EET83345	12	L6	C	A	LEW85436	9	L6	C	A
EET83348	299	L6	A/B	A	LEW85439~	3	L6	C	A
EET83350~	89	L6	A/B	A	LEW85442~	29	L6	B/C	A/B
EET83353~	54	L6	A/B	B	LEW85444~	2	L6	C	A
EET83354	8	L6	C	B	LEW85449~	12	L6	C	A
EET83356~	18	L6	B	B	LEW85454~	8	L6	C	A
EET83358~	26	L6	B/C	A	LEW85457~	20	L6	B/C	A
EET83363	185	L6	B	A/B	LEW85461~	21	L6	B/C	A
EET83364	205	L6	A/B	A	LEW85463~	12	L6	C	A
EET83365~	158	L6	B	B/C	LEW85465~	57	L6	B	A
EET83366~	189	L6	B	A	LEW85471	239	L6	C	A

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW85472	67	L6	B/C	A	LEW86421~	3	L6	C	A
LEW86011	3398	L6	A/B	A	LEW86425~	2	L6	C	A
LEW86012	2157	L6	A	B/C	LEW86426~	3	L6	C	A
LEW86013	1812	L6	B	B	LEW86429~	7	L6	B/C	A/B
LEW86016	525	L6	A/B	A/B	LEW86447~	10	L6	B/C	A
LEW86019	432	L6	B	A/B	LEW86478~	2	L6	A/B	A
LEW86023	322	L6	B	A	LEW86490~	2209	L6	Be	B/C
LEW86025	190	L6	Ce	B	LEW86528~	50	L6	A/B	A/B
LEW86038~	19	L6	C	A/B	LEW86531	21	L6	C	A
LEW86042	5	L6	B	B	LEW86541~	13	L6	B	A
LEW86043	14	L6	B/C	A	LEW86546	41	L6	C	A
LEW86048~	6	L6	C	B	META78002	542	L6	B	A
LEW86054~	2	L6	B/C	A	META78003	1726	L6	B	B
LEW86056~	7	L6	B/C	A	META78004§	30	L6	B	A
LEW86064~	24	L6	C	A	META78005	172	L6	B	B
LEW86073~	38	L6	B/C	A	META78021§	23	L6	B/C	B
LEW86075~	4	L6	B/C	A	META78028	20657	L6	B	B
LEW86084~	53	L6	C	A	PCA82503	8308	L6	Ae	B
LEW86085~	197	L6	C	A	PCA82508	389	L6	A/B	B
LEW86090~	23	L6	C	A	PCA82509	286	L6	B	A
LEW86097~	2	L6	C	B	PCA82525	40	L6	B	B
LEW86110~	34	L6	C	A	PCA82528	51	L6	B/C	B
LEW86113~	7	L6	B/C	A	RKPA78001	235	L6	C	B
LEW86115~	33	L6	C	A	RKPA78003	1276	L6	Ce	B
LEW86132~	12	L6	C	A/B	RKPA79001	3006	L6	Be	C
LEW86133~	8	L6	A	A	RKPA79002	204	L6	B	B
LEW86135~	10	L6	C	A	RKPA80202	545	L6	Be	A
LEW86140~	9	L6	B	A	RKPA80215	9	L6	C	B
LEW86141~	5	L6	C	A	RKPA80219	21	L6	B	A
LEW86166~	21	L6	C	A	RKPA80225	8	L6	C	A
LEW86169~	26	L6	B/C	A	RKPA80252	11	L6	A/B	A
LEW86173~	2	L6	C	A	RKPA80261	62	L6	B	A
LEW86175~	2	L6	B	A/B	RKPA80264	24	L6	B	B
LEW86179~	5	L6	B/C	A	RKP86702	195	L6	C	A/B
LEW86184	16	L6	C	A	TIL82401	282	L6	A/B	A
LEW86186~	47	L6	Ce	B					
LEW86193~	8	L6	C	A	ALHA76004	305	LL3	A	A
LEW86195~	42	L6	A/B	A	ALHA77278	313	LL3	A	A
LEW86203~	61	L6	B/C	A	ALHA78138‡	11	LL3	B	
LEW86231~	18	L6	B/C	A	ALHA79003	5	LL3	B	B
LEW86238~	29	L6	B	A/B	ALHA81251	158	LL3	B/C	B
LEW86268~	22	L6	B/C	A	ALH83007	285	LL3	B	A
LEW86269~	22	L6	C	A	ALH84086	234	LL3	A/B	A
LEW86273	30	L6	B	A	ALH84126	41	LL3	B	B
LEW86274~	36	L6	B/C	A	EET83213	2727	LL3	Be	A
LEW86282~	62	L6	B	A	TIL82408	80	LL3	B	A/B
LEW86288~	11	L6	C	A					
LEW86289~	18	L6	B/C	B	ALHA81316	0.7	LL4	B	B
LEW86309~	14	L6	B	B	LEW86386	3	LL4	B	A
LEW86311~	67	L6	B	A	LEW86411	4	LL4	B	A
LEW86317~	62	L6	B	A					
LEW86330~	21	L6	C	A	ALHA77060*	64	LL5	A	
LEW86349	38	L6	C	A	ALHA78109	233	LL5	A/B	A
LEW86359~	3	L6	C	A	ALHA81151	5	LL5	B/C	A
LEW86372~	12	L6	C	A	DOM85505	31	LL5	B	B
LEW86399~	7	L6	B/C	A	DOM85506	59	LL5	A/B	B
LEW86404~	8	L6	B/C	A	EET83361	6	LL5	A/B	A
LEW86409~	24	L6	C	A	LEW86145	4	LL5	B/C	B

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
LEW86402	14	LL5	C	A/B	ALH85152~	36	LL6	A/B	B
LEW86449	4	LL5	A/B	A	ALH85154~	5	LL6	A/B	A
RKPA80234	136	LL5	B	B	ALH85158~	3	LL6	B	B
RKPA80253	5	LL5	A/B	A	EET82608	95	LL6	A/B	A
BTNA78004	1079	LL6	B	A	EET83204	377	LL6	A	A
ALHA77041*	17	LL6	A		EET83273~	147	LL6	A/B	A
ALHA78062	11	LL6			EET83290	1	LL6	B	A
ALHA78063‡	77	LL6	A		EET83341~	65	LL6	B	B
ALHA78082‡	24	LL6	A		EET83352~	20	LL6	B/C	B
ALHA78153	152	LL6	B/C	B	EET83357~	35	LL6	B/C	A
ALHA81123	2	LL6	B	A	EET83359~	66	LL6	C	A
ALHA81185	65	LL6	A/B	A/B	EET83380~	119	LL6	B	A
ALHA81285	20	LL6	C	A	EET83391~	91	LL6	A/B	A
ALH83022~	5	LL6	B	A	EET83401~	112	LL6	A/B	A
ALH83032~	3	LL6	B	A	EET84305	10	LL6	A/B	B
ALH83054~	17	LL6	A	A	LEW85386~	14	LL6	A/B	B/C
ALH83070	216	LL6	A	A	LEW85415	3	LL6	A	A
ALH84052	11	LL6	A/B	A	LEW85429	7	LL6	C	A
ALH84081	612	LL6	A	B	LEW85438~	3	LL6	A/B	A
ALH84096	294	LL6	A/B	A	LEW85467~	5	LL6	B/C	A
ALH84107	134	LL6	A	B	LEW86057~	55	LL6	B/C	A
ALH84116	56	LL6	B	A	LEW86069~	0.6	LL6	C	A
ALH84119	34	LL6	A	A	LEW86070~	19	LL6	A/B	A/B
ALH84122~	81	LL6	A/B	A	LEW86082~	8	LL6	B	A
ALH84123~	97	LL6	B	B	LEW86101~	28	LL6	B	A
ALH84125~	76	LL6	A	A/B	LEW86117~	13	LL6	B	A
ALH84154	88	LL6	A	A	LEW86161~	29	LL6	B	A
ALH84168	14	LL6	B	A	LEW86162~	2	LL6	A	A
ALH84198	5	LL6	A/B	A	LEW86185	5	LL6	C	A
ALH84255	11	LL6	A	A	LEW86334	6	LL6	A	A
ALH85019	633	LL6	A	A	LEW86378~	4	LL6	C	A
ALH85035	420	LL6	C	B	LEW86419~	2	LL6	B	A
ALH85057~	0.8	LL6	A	A	LEW86432	7	LL6	B	A
ALH85059~	9	LL6	A	A	LEW86483~	10	LL6	B/C	A
ALH85066	8	LL6	B	A/B	PCA82507	480	LL6	A	A/B
ALH85073~	16	LL6	A/B	A	RKPA80222	7	LL6	B	B
ALH85079~	83	LL6	A/B	B	RKPA80235	261	LL6	A/B	B
ALH85084~	18	LL6	B	A/B	RKPA80238	18	LL6	A/B	A
ALH85129~	127	LL6	A/B	A	RKPA80248	11	LL6	A/B	A
ALH85135~	12	LL6	B/C	A	RKP86704~	138	LL6	B/C	A
ALH85137~	7	LL6	A/B	B/C	TIL82402	476	LL6	A/B	A
ALH85138~	18	LL6	B	A/B	ALH84027	8	LL7?	B	B

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
ACHONDRITES									
ALHA81187	40	A	B/C	B	EET83212	402	Eu (polymict)	B	B
ALH84190	8	A	C	B	EET83227	1973	Eu (polymict)	B	B
EET84302	60	A	B/C	B	EET83228	1206	Eu (polymict)	B	B
ALH84025	5	Brachinite	A/Be	A	EET83229	313	Eu (polymict)	B	B
LEW86010	7	An	A/B	A/B	EET83231	66	Eu (polymict)	B	A/C
ALHA78113	299	Au	A/Be	A	EET83232	211	Eu (polymict)	B	A/B
ALH83009	2	Au	A/B	A	EET83234	181	Eu (polymict)	B	B
ALH83015	3	Au	A/B	A	EET83235	255	Eu (polymict)	B	B
ALH84007	706	Au	Ae	A/B	EET83251	261	Eu (polymict)	B	A/B
ALH84008	302	Au	A/B	A	EET83283	57	Eu (polymict)	B	B
ALH84009	336	Au	A	A	ALHA81313	0.5	Eu		
ALH84010	303	Au	A	B	ALH85001	212	Eu	A/B	A/B
ALH84011	138	Au	A	A/B	EET83236	6	Eu	B	A
ALH84012	225	Au	A	A	LEW85300	210	Eu	A/B	A
ALH84013	160	Au	A/B	A/B	LEW85302	115	Eu	A/B	A/B
ALH84014	49	Au	A/B	A/B	LEW85303	408	Eu	A/B	A
ALH84015	264	Au	A	B	LEW85305	41	Eu	A	A
ALH84016	150	Au	A	A	LEW85353	25	Eu	B	A/B
ALH84017	80	Au	A	B/C	LEW86001	291	Eu	Be	A
ALH84018	82	Au	A	B	RKPA80204	15	Eu	A	A
ALH84019	93	Au	A	A/B	ALHA81001	53	Eu (polymict?)	Ae	B
ALH84020	191	Au	A/B	A	ALHA81009	229	Eu (polymict?)	A	A
ALH84021	36	Au	A	C	LEW86003	2	Eu (brecciated)	B	A
ALH84022	13	Au	A	A	TIL82403	50	Eu (brecciated)	A	A
ALH84023	262	Au	A	A	LEW86002	33	Eu (unbrecciated)	A/B	A
ALH84024	194	Au	A	A	PCA82501	54	Eu (unbrecciated)	A	A
ALHA77256	676	Di	A/B	A	PCA82502	890	Eu (unbrecciated)	A	A
ALH84001	1931	Di	A/B	B	RKPA80224	8	Eu (unbrecciated)	A/B	A
ALH85015	3	Di	A	A	ALHA78006	8	Ho	A	A
EETA79002	2843	Di	B	B	EETA79006	716	Ho	B	B
EET83246	48	Di	A/B	A/B	EET82600	247	Ho	Ae	B
EET83247	22	Di	B/C	B	EET83376	79	Ho	A/B	A/B
TIL82410	19	Di	A	B	LEW85313	191	Ho	B	B
ALHA81208	2	Di/M	Ce	B	LEW85441	11	Ho	B	A/B
ALHA76005	1425	Eu (polymict)	A	A	ALHA81005	31	Lunar	A/B	A
ALHA77302	236	Eu (polymict)	A	A	ALHA77005	483	Sh	A	A
ALHA78040	212	Eu (polymict)	A	A	EETA79001	7942	Sh	Ae	A
ALHA78132	656	Eu (polymict)	A	A	ALHA77257	1996	Ur	Ae	B
ALHA78158	15	Eu (polymict)	A	A	ALHA78019	30	Ur	B/C	C
ALHA78165	21	Eu (polymict)	A	A	ALHA78262	26	Ur	B/C	A
ALHA79017	310	Eu (polymict)	A	A	ALHA81101	119	Ur	A/B	B
ALHA80102	471	Eu (polymict)	A	B	ALH82106	35	Ur	B	A
ALHA81006	255	Eu (polymict)	A	A/B	ALH82130	45	Ur	B	A
ALHA81007	164	Eu (polymict)	A/B	A	ALH83014	1	Ur	B	A
ALHA81008	44	Eu (polymict)	A/B	A/B	ALH84136	84	Ur	B	A/B
ALHA81010	219	Eu (polymict)	A	A	EET83225	44	Ur	B/C	B
ALHA81011	406	Eu (polymict)	A/B	A	EET83309	61	Ur	C	B
ALHA81012	37	Eu (polymict)	A/B	A	LEW85328	107	Ur	B/C	A
EETA79004	390	Eu (polymict)	B	B	LEW85440	44	Ur	B	A/B
EETA79005	451	Eu (polymict)	A	B	LEW86216	6	Ur	C	A
EETA79011	86	Eu (polymict)	B	B	META78008	125	Ur	B	B
					PCA82506	5316	Ur	A/Be	A
					RKPA80239	6	Ur	B	B

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
IRONS									
LEW86211	163	Anomalous (Ungrouped)			EET83230	530	Ataxite (Ungrouped)		
LEW86498	134	Anomalous (Ungrouped)			ILD83500	2523	Ataxite (Ungrouped)	e	
EET83245	59	IIAB (anom)			ALHA81014	188	Ungrouped		
EET83390	15	IIE (anom)			LEW85369	6	Ungrouped		
DRPA78001	15200	IIB			ALHA78252	2789	IVA		
DRPA78002	7188	IIB	e		ALHA76002	1510	IA		
DRPA78003	144	IIB	e		ALHA77250	10555	IA		
DRPA78004	134	IIB			ALHA77263	1669	IA		
DRPA78005	18600	IIB	e		ALHA77283	10510	IA		
DRPA78006	389	IIB			ALHA77289	2186	IA		
DRPA78007	11800	IIB			ALHA77290	3784	IA		
DRPA78008	59400	IIB			PGPA77006	19068	IA		
DRPA78009	138100	IIB			RKPA80226	160	IA		
ALHA78100	85	IIA			ALH84165	95	IIIAB		
ALHA81013	17727	IIA			GRO85201	1401	IIIAB		
EET83333	189	IAB			EET84300	72	IAB		
LEW86540	21	IIICD					(silicate incl.)		
ALHA77255	765	Ataxite (Ungrouped)			ALH84233	14	Ungrouped (silicate incl.)	e	
ALHA80104	882	Ataxite (Ungrouped)			LEW86220	25	IAB (silicate incl.)		

TABLE B.—Continued.

Specimen number	Weight (g)	Class and type	Degree of		Specimen number	Weight (g)	Class and type	Degree of	
			weathering	fracturing				weathering	fracturing
STONY-IRONS									
ALHA77219	637	M	B	B	RKPA79015	10022	M	A/B	A
ALHA81059	540	M	C	B/C	RKPA80229	14	M	C	B/C
ALHA81098	71	M	C	B/C	RKPA80246	6	M	C	C
LEW86210	9	M	C	A	RKPA80258	4	M	B/C	B
QUE86900	1532	M	C	A	RKPA80263	17	M	C	B

TABLE C.—ANSMET meteorite subtotals through 1986.

Class and type	Number	Class weight (g)
CHONDRITE subtotals:		
C2	62	6391
C3	1	181
C3O	6	2379
C3V	7	801
C4	6	592
Chon. (unique)	3	140
E3	1	39
E4	17	301
E5	1	20
E6	3	823
H3	13	595
H4	132	84989
H4,5	1	16000
H4,6	1	314
H5	932	213553
H5,6	1	31
H6	355	51543
H? Acapulco-like	3	23
L3	133	19896
L3,4	1	31
L4	47	9497
L5	74	26108
L6	472	635221
LL3	10	4159
LL4	3	8
LL5	11	561
LL6	79	7347
LL7?	1	8
TOTAL	2376	1081551
ACHONDRITE subtotals:		
A	4	113
An	1	7
Au	21	3888
Di	7	5542
Di/M	1	2
Eu	45	12965
Ho	6	1252
Lunar	1	31
Sh	2	8425
Ur	16	8045
TOTAL	104	40270
IRON subtotals:		
Irons	37	328080
STONY-IRON subtotals:		
Mesosiderites	10	12852
TOTALS	2527	1462753