CHARACTERIZATION OF THE 1980–81 VICTORIA LAND METEORITE COLLECTIONS

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***Abstract*:** In the 1980–81 field season a U. S. party collected 32 meteorite specimens in the Allan Hills (ALH) area, 67 near Reckling Peak (RKP), and 1 near Outpost Nunatak (OTT). These specimens have been classified as follows: irons, 2; mesosiderites, 4; eucrites, 3; ureilite, 1: chondrites, 90. The chondrites belong to the following classes and types: C3, 1; H3, 2; H4, 7; H5, 25; H6, 18; L3, 3; L4, 2; L5, 3; L6, 22; LL5, 2; LL6, 4; E5, 1. The mesosiderites are paired with RKPA-79015 (originally classified as an iron with silicate inclusions); 15 L6 chondrites from the Allan Hills appear to be pieces of a single meteorite; several of the L6 chondrites from Reckling Peak are paired with RKPA78001; 13 H6 chondrites from Reckling Peak appear to be pieces of a single meteorite. Additional pairings are possible on further examination.

1. Introduction

In the 1980–81 austral summer a six-man party continued the search for Antarctic meteorites on the ice cap in Victoria Land. The operation has been briefly described by SCHULTZ *et al.* (1981). Collections were made in the vicinity of the Allan Hills, near Reckling Peak (about 60 km northeast of the Allan Hills), and near Outpost Nunatak (about 60 km north of the Reckling Peak area). SCHULTZ *et al.* collected 103 specimens, of which three proved to be terrestrial rock fragments. The remaining 100 specimens are meteoritic, and have been classified as follows: irons, 2; mesosiderites, 4; eucrites, 3; ureilite 1; chondrites, 90. The meteorites are enumerated in Table 1, and brief descriptions of some of the individual specimens follow.

2. Irons

ALHA80104 is an irregularly shaped individual, $11 \times 7 \times 4$ cm, 882 g (Fig. 1). One prominent rounded surface appears to have been ablation-shaped, and a second fairly large and comparatively smooth surface appears to have been the under side while the specimen was exposed at the surface of the ice. The meteorite is covered with a fairly uniform dark reddish brown iron oxide, and no fusion crust seems to remain. There are several deep linear incisions into the body of the meteorite that are possibly due to either preferential ablation or weathering of schreibersite inclusions exposed at the surface.

A microetched surface area of approximately 7 cm^2 was examined (Fig. 2). A heat-

Table 1. Victoria Land meteorites, 1980–81.

Class and type: C=carbonaceous chondrite; E=enstatite chondrite; Eu=eucrite; H=high-iron chondrite; L=low-iron chondrite; LL=low-iron low-metal chondrite; M=mesosiderite; Ur=ureilite. Type is indicated by the digit following the letter.

Olivine and pyroxene (orthopyroxene or low-Ca clinopyroxene) compositions are in mole per cent Fe_2SiO_4 (Fa) and $FeSiO_3$ (Fs).

Degree of weathering: A=minor; metal grains have inconspicuous rust halos, limonite stain along cracks is minor. B=moderate; metal grains show large rust halos, internal cracks show extensive limonite stain. C=severe; specimen is uniformly stained brown, no metal survives.

Sample number	Weight (grams)	Class & type	Olivine Fa	Pyroxene Fs	Degree of weathering
ALHA80101	8725	L6	24	20	B
80102	471	Eu		34–52	A
80103	535	L6	24	20	B
80104	882	Iron			B
80105	445	L6	24	20	B
80106	432	H4	19	16–19	C
80107	177	L6	24	20	B
80108	124	L6	24	20	B
80110	167	L6	24	20	B
80111	42	H5	18	16	B
80112	330	L6	24	20	B
80113	312	L6	24	20	B
80114	232	L6	24	20	B
80115	306	L6	24	20	B
80116	191	L6	24	20	B/C
80117	89	L6	24	20	B
80118	2.4	H6	17	15	B
80119	33	L6	24	20	B
80120	60	L6	24	20	B
80121	39	H4	19	17	B/C
80122	49	H6	18	16	B/C
80123	27	H5	18	16	C
80124	11	H5	18	16	B
80125	139	L6	24	20	B/C
80126	34	H6	19	17	A/B
80127	47	H5	18	16	B
80128	138	H4	18	15–20	B
80129	93	H5	18	15	B
80130	5.3	H6	18	16	B/C
80131	19	H4	19	16–22	B
80132	152	H5	18	16	B
80133	3.6	L3	1–35	5–30	B
RKPA80201	813	H6	19	16	B
80202	544	L6	24	20	B
80203	3.8	H6	19	17	C
80204	15	Eu		52–57	A
80205	53	H3	17–20	5–13	B
80206	46	H6	19	17	C
80207	17	L3	15–29	6–28	C
80208	10	H6	19	17	B

Table 1 (continued).

Sample number	Weight (grams)	Class & type	Olivine Fa	Pyroxene Fs	Degree of weathering
RKPA80209	9.7	L5	25	21	C
80210	10	H5	19	16	B/C
80211	2.1	H6	19	17	C
80213	19	H6	19	17	B/C
80214	4.9	H6	19	17	C
80215	9.0	L6	24	20	C
80216	44	L4	23	20	B
80217	7.8	H5	18	15	C
80218	6.7	H5	18	15	C
80219	21	L6	25	21	B
80220	124	H5	18	16	B/C
80221	51	H6	19	17	C
80222	6.9	LL6	28	23	B
80223	25	H5	18	16	C
80224	8.0	Eu		54	A/B
80225	8.3	L6	25	21	C
80226	160	Iron			B
80227	7.7	H5	19	16	B/C
80228	11	L5	23	19	C
80229	14	M		24	C
80230	58	H5	18	16	B
80231	238	H6	18	16	C
80232	80	H4	18	16	B
80233	413	H5	18	16	B/C
80234	136	LL5	26	22	B
80235	261	LL6	30	24	A/B
80236	15	H5	18	16	B/C
80237	22	H4	18	16	C
80238	18	LL6	28	23	A/B
80239	5.6	Ur	16	15	B
80240	61	H5	18	16	C
80241	0.6	C3	1–6	1–8	B
80242	7.3	L4	22	19	B/C
80243	3.4	H5	18	16	C
80244	14	H5	18	16	C
80245	36	H5	18	16	B/C
80246	5.8	M		24	C
80247	1.1	H5	18	16	C
80248	11	LL6	27	23	A/B
80249	9.7	H5	17	15	B/C
80250	3.9	H5	17	15	B/C
80251	29	H5	17	15	B
80252	11	L6	24	20	A/B
80253	4.6	LL5	27	22	A/B
80254	68	H6	19	17	C
80255	6.7	H6	19	17	C
80256	153	L3	20–25	10–26	B
80257	8.5	H5	17	15	B/C
80258	4.3	M		17–21	B/C

Table 1 (continued).

Sample number	Weight (grams)	Class & type	Olivine Fa	Pyroxene Fs	Degree of weathering
RKPA80259	20	E5		0–1	B/C
80260	7.5	H5	18	16	C
80261	61	L6	24	20	B
80262	32	H6	19	17	C
80263	16	M		24	C
80264	23	L6	24	20	B
80265	7.8	H6	19	17	C
80266	9.8	H6	19	17	B/C
80267	24	H4	19	16	C
80268	3.4	L5	24	20	B/C
OTTA80301	35	H3	17–19	4–19	B/C

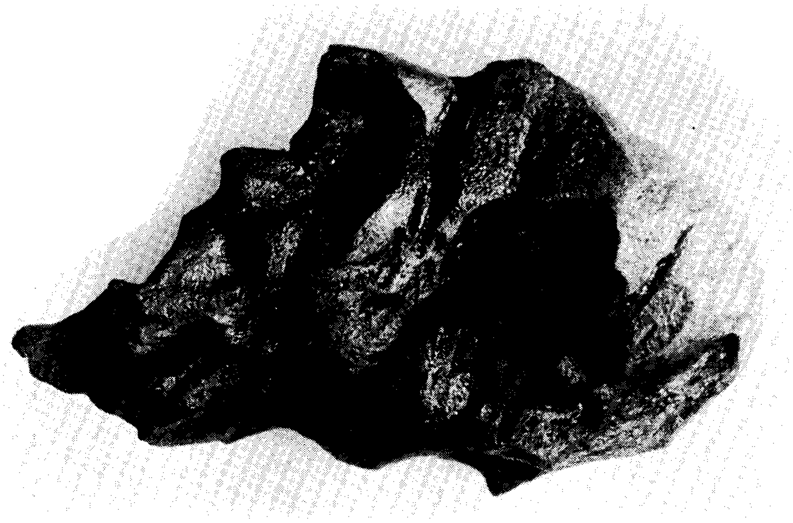


Fig. 1. ALHA80104 is free of fusion crust and uniformly coated with terrestrially-developed iron oxide. Several narrow grooves on the surface probably resulted from melting of schreibersite during atmospheric heating. Length, 11 cm.

altered zone is present over part of the external surface of the specimen. The metallographic matrix is a martensitic plessite. Kamacite spindles less than 0.1 mm wide, and generally less than ten times their width in length, are moderately uniformly distributed in a Widmanstätten pattern orientation. The kamacite spindles frequently enclose small schreibersites. Three large schreibersite areas enclosed in swathing kamacite as wide as 0.2 mm are present. The largest such area is 8 mm long. Weathering has penetrated 0.5 cm into the mass in one area. Chemical data and a more thorough metallographic examination will be required to classify this meteorite precisely.

RKPA80226 is slightly smaller than a hen's egg and is more irregularly shaped, $4.3 \times 3.2 \times 2.8$ cm, 160 g (Fig. 3). The top surface is covered with pits 2 to 3 mm in length, and it is uniformly and gently convex. Distribution of pits seems to have been controlled in part by the internal Widmanstätten structure. This surface, as is also the case with the bottom surface, has been strongly affected by terrestrial weathering.

Fig. 2. Polished and etched surface of ALHA80104 cut perpendicular to surface in Fig. 1 and slightly to left of center. Large structures are schreibersite surrounded by swathing kamacite. The bulk of the meteorite is a martensitic plessite containing small spindles of kamacite in a Widmanstätten orientation. Width of polished surface, 6 cm.

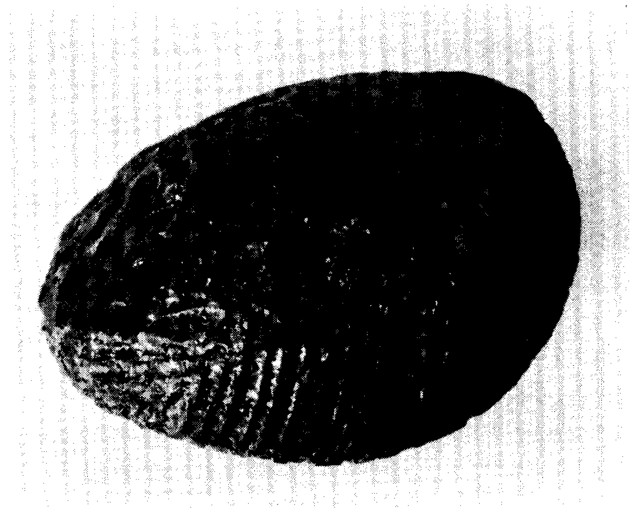


Fig. 3. RKPA80226 is a terrestrially eroded octahedrite. The top surface is pitted and of uniform curvature. The Widmanstätten pattern stands out in relief over part of the lower surface. Length, 4.3 cm.

The bottom surface is less uniform in shape and more convex. Part of this surface has a pattern of pits similar to that on the top. However, much of this bottom surface is dominated by a pattern of parallel ridges approximately 1 mm apart standing out in relief, an expression of the internal Widmanstätten structure of the material.

A microetched median slice of approximately 6 cm^2 was examined. A heat-altered zone surrounds the slice and is as deep as 3.5 mm in one area. A well developed Widmanstätten structure is present with a kamacite band width in the 1.2 mm range. The length-width ratio for these lamellae is about 7. Some Neumann bands are present in the kamacite, as are rhabdites, grain boundary schreibersites, and subgrain boundaries. No epsilon structure or troilite was observed. Taenite bands occupy much of the kamacite grain boundaries, and taenite-kamacite and plessite fields are present. The plessite areas are mainly pearlitic, suggesting the possibility that the specimen is heat-altered. It is an octahedrite, but additional information will be required for a specific classification.

3. Mesosiderites

Four small pieces of a mesosiderite were collected in the Reckling Peak area (RKPA-80229, 14 g; 80246, 5.8 g; 80258, 4.3 g; 80263, 16 g). They are paired with a larger mass (RKPA79015, 10022 g) and are described elsewhere in this publication (CLARKE and MASON, 1982).

4. Eucrites

Three eucrite specimens were collected: ALHA80102 (471 g); RKPA80204 (15 g); RKPA80224 (8.0 g).

ALHA80102 ($12.5\times 8\times 5.5$ cm) is covered with shiny black fusion crust except on one surface. Many vugs, ranging in size from <1 mm to >1 cm, are present, which is typical of Allan Hills polymict eucrites. A thin section (Fig. 4) shows a breccia of angular fragments, up to 1 mm across, of pigeonite and plagioclase and a few lithic clasts, in a matrix of comminuted pyroxene and plagioclase. The lithic clasts consist of pyroxene and plagioclase and range in texture from doleritic to gabbroic. Accessory ilmenite was noted. No evidence of weathering was seen. Microprobe analyses show pigeonite ranging in composition from $Wo_6Fs_{34}En_{60}$ to $Wo_{12}Fs_{52}En_{36}$; a few grains of ferroaugite, averaging $Wo_{33}Fs_{30}En_{37}$, were analyzed. Plagioclase ranges in composition from An_{76} to An_{94}, with an average of An_{87}. The meteorite is a polymict eucrite, and resembles the other polymict eucrites collected at the Allan Hills.

RKPA80204 ($3\times 2\times 2$ cm) is partly covered with black fusion crust. Two texturally distinct lithologies were noted on the surface: one is massive and fine-grained with rounded yellow clasts, the other appears to be coarser-grained, with abundant light and dark grains. Thin (1 mm) black veins extend into both textures. Abundant vugs give the exterior a rough surface. The thin section (Fig. 5) shows clasts (up to 6 mm in maximum dimension) of subophitic intergrowths of pigeonite and plagioclase, separated by veins of coarser-grained pigeonite and plagioclase. The plagioclase laths in the clasts range up to 0.5 mm in length. The pigeonite and plagioclase grains in the veins average about 0.3 mm in maximum dimensions. Microprobe analyses show pigeonite with a limited range of composition ($Wo_4Fs_{57}En_{39}$–$Wo_{13}Fs_{52}En_{35}$). Plagioclase ranges in composition from An_{85} to An_{94}, with a mean of An_{92}. Accessory ilmenite and titanian chromite (TiO_2 10–13%) are present. The relative uniformity of composition of pyroxene and plagioclase indicates that this specimen may be classified as a monomict eucrite.

RKPA80224 is a small specimen ($3.5\times 1.5\times 1.0$ cm) partly coated with shiny black fusion crust. The thin section (Fig. 6) shows an ophitic intergrowth of pigeonite and

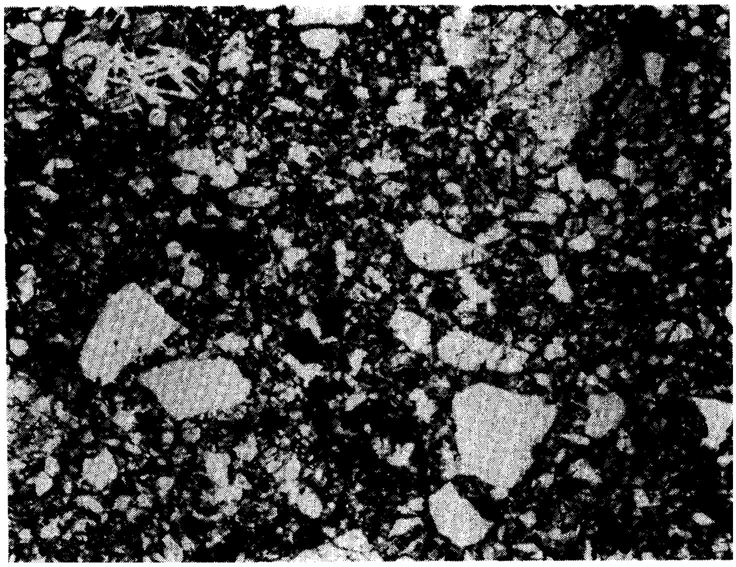


Fig. 4. ALHA80102, a polymict eucrite; angular clasts of plagioclase (white) and pigeonite (light gray) in a comminuted groundmass. (In this and the following photomicrographs the area shown is 3.0 ×3.5 mm).

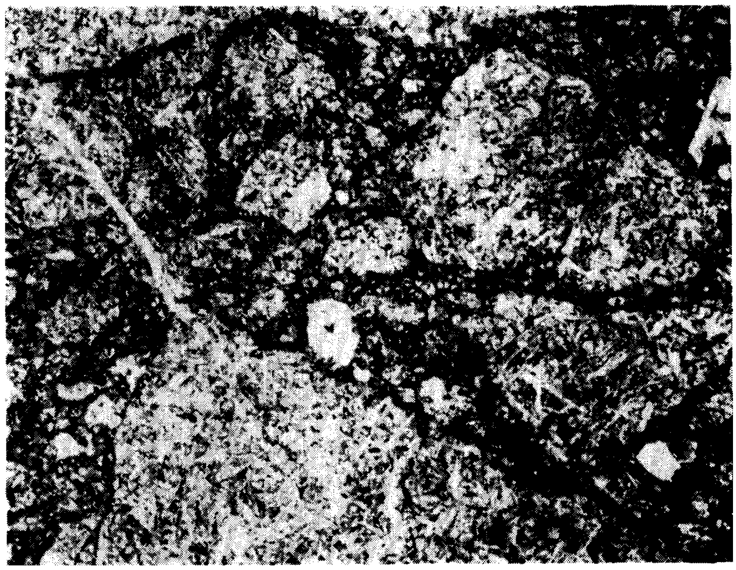


Fig. 5. RKPA80204, a brecciated monomict eucrite; laths of plagioclase (white) in granular pigeonite (gray).

Fig. 6. RKPA80224, an unbrecciated monomict eucrite; plagioclase (white) enclosed in pigeonite (gray).

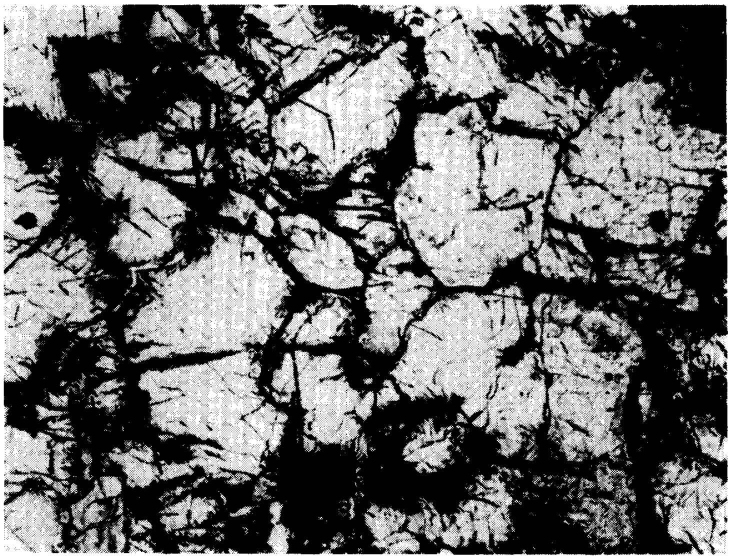


Fig. 7. RKPA80239, a ureilite; subhedral to anhedral grains of olivine and pyroxene (white) rimmed with carbonaceous material (black).

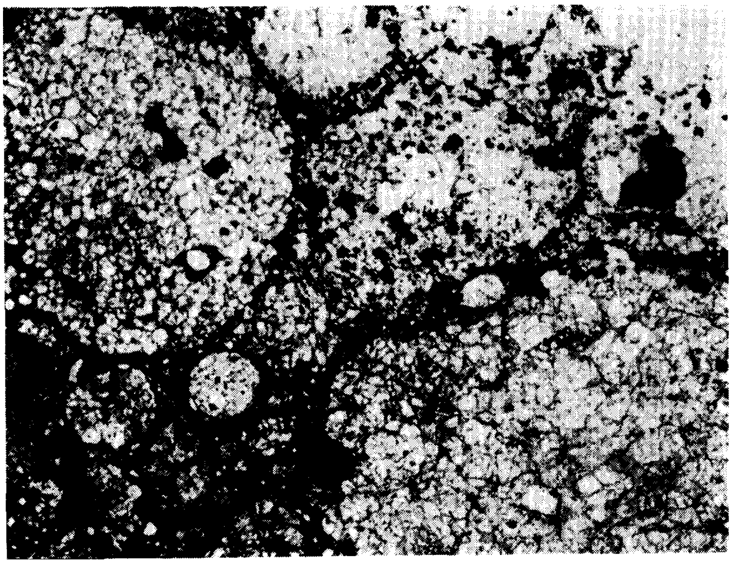


Fig. 8. RKPA80241, a C3V chondrite; large chondrules in a dark (probably carbonaceous) groundmass.

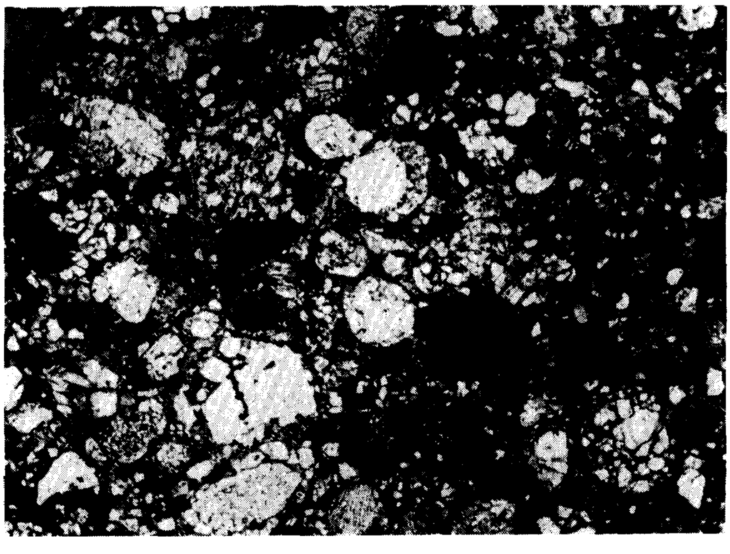


Fig. 9. RKPA80205, an H3 chondrite; chondrules, chondrule fragments, and troilite and nickel-iron (black) in granular groundmass.

plagioclase, with accessory amounts of tridymite and opaque minerals; the average grain size of pyroxene and plagioclase is about 1 mm. The pyroxene and plagioclase crystals are somewhat granulated and show undulose extinction. A little limonitic staining is present in one area. Microprobe analyses show pigeonite with an average composition of $Wo_{10}Fs_{54}En_{36}$; some grains show exsolution lamellae of augite with composition $Wo_{44}Fs_{26}En_{30}$. Plagioclase ranges in composition from An_{85} to An_{91}, with a mean of An_{89}. The opaque minerals are troilite, ilmenite and titanian chromite (TiO_2 13–15%). The meteorite is a monomict eucrite.

5. Ureilite

The only ureilite in the 1980–81 collection (and the first from the Reckling Peak area) is RKPA80239, a 5.6 g specimen. Thin patchy fusion crust is present on all surfaces; areas devoid of fusion crust are crystalline, reddish-brown in color, and rough in texture. The thin section (Fig. 7) shows an aggregate of subhedral to anhedral grains (0.3–1.5 mm across) of olivine with minor amounts of pyroxene. The grains are rimmed with black carbonaceous material. Trace amounts of troilite and nickel-iron are present, the latter largely altered to translucent brown limonite concentrated along grain boundaries. Microprobe analyses show olivine of uniform composition (Fa_{16}) with notably high CaO content (0.3–0.4%); the pyroxene is a pigeonite of composition $Wo_5Fs_{15}En_{80}$. This meteorite appears to be relatively lightly shocked compared to most ureilites.

6. Carbonaceous Chondrite

One small specimen, tentatively classified as a C3V chondrite, was collected: RKPA80241 (0.6 g).

The thin section of RKPA80241 (Fig. 8) shows a close-packed aggregate of chondrules (up to 2.5 mm across) and irregular granular aggregates, set in a small amount of black (probably carbonaceous) matrix. A minor amount of nickel-iron is present, in several forms: as small grains dispersed through some chondrules, concentrated around the margins of some chondrules, and as rare globules up to 0.8 mm across in the matrix. The silicate material consists largely of olivine and polysynthetically twinned clinopyroxene. Well preserved fusion crust, up to 1.2 mm thick, rims part of the section. Weathering is extensive, with brown limonitic staining pervasive throughout the section. Microprobe analyses show olivine and pyroxene with variable composition; for 30 olivine analyses the Fa range is 0.7–5.5 (except for one of Fa_{36}), and the mean is Fa_3; for 15 pyroxene analyses the range is Wo 0.3–1.5, En 90–98, Fs 1–8, with a mean of $Wo_{0.7}En_{95}Fs_4$.

7. Enstatite Chondrite

One enstatite chondrite, RKPA80259 ($2.5\times1.5\times1.5$ cm) was collected. Most of the stone is covered with thin iridescent fusion crust. In thin section chondrules are rare and barely discernable, the meteorite consisting largely of fine-grained enstatite (mean grain size approximately 0.05 mm), with some nickel-iron and troilite. Weathering is very extensive, with much red-brown limonite throughout the section. The silicate material is blackened by the presence of finely dispersed troilite, probably the result of an episode of severe shock. Microprobe analyses showed that the enstatite is almost pure $MgSiO_3$, with minor amounts of Al_2O_3 (0.1–0.3%), FeO (0.1–0.5%), and CaO (0.5–0.8%). The meteorite is classified as an E5 chondrite.

8. H3 Chondrites

Two H3 chondrites were collected, RKPA80205 (53 g) and OTTA80301 (35 g).

Dull brownish-black fusion crust covers part of RKPA80205; a weathering rind, 1 mm thick, is present, but the interior is only moderately weathered. The thin section (Fig. 9) shows a closely packed mass of chondrules (0.2–2.4 mm diameter), chondrule fragments, and irregular crystalline aggregates, with interstitial nickel-iron and troilite and small amount of dark fine-grained matrix. A considerable variety of chondrules is present; many are granular to porphyritic olivine with transparent to turbid intergranular glass; others consist of granular polysynthetically twinned clinopyroxene with or without olivine, fine-grained pyroxene, or barred olivine. Minor brown limonitic staining is present throughout the section. Microprobe analyses show olivine ranging in composition from Fa_{17} to Fa_{20}, with a mean of Fa_{18}; the pyroxene is low-calcium (CaO 0.1–0.2%) clinobronzite, ranging in composition from Fs_5 to Fs_{13}, with a mean of Fs_8.

OTTA80301 is almost completely covered with brown and black fusion crust, pitted in some areas. The thin section (Fig. 10) shows a closepacked aggregate of chondrules and some irregular granular enclaves; the matrix consists of fine-grained silicates with a moderate amount of nickel-iron and a lesser amount of troilite. Chondrules range up to 1.1 mm across, and show a variety of types, the commonest being granular olivine and olivine-pyroxene (polysynthetically twinned clinobronzite), porphyritic olivine, and fine-grained pyroxene. Some intergranular glass in the chondrules is clear and transparent, but much of it is turbid and partly devitrified. Minor brown limonitic staining is present around nickel-iron grains. Microprobe analyses show olivine and pyroxene with variable composition: olivine, Fa_{17-19}, average Fa_{18}; pyroxene, Fs_{4-19}, average Fs_{10}.

9. L3 Chondrites

Three L3 chondrites were collected, ALHA80133 (3.6 g), RKPA80207 (17 g), and RKPA80256 (153 g). Although the RKP stones are from the same area, they are sufficiently different that they are unlikely to be paired.

ALHA80133 is a shiny reddish-brown specimen without fusion crust; the interior is highly weathered. The thin section (Fig. 11) shows a close-packed mass of chondrules and chondrule fragments with a small amount of dark fine-grained matrix. Chondrules range from 0.3 to 1.5 mm in diameter, and show a diversity of type, the commonest being granular olivine and olivine-pyroxene, barred olivine, and fine-grained pyroxene. Transparent pale brown glass is present in some of the granular chondrules.

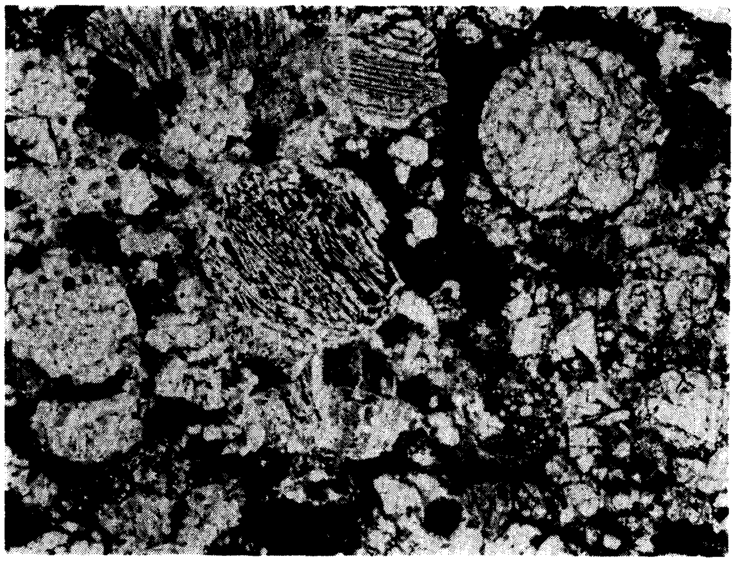


Fig. 10. OTTA80301, an H3 chondrite; chondrules, chondrule fragments, and troilite and nickel-iron (black) in fine-grained groundmass.

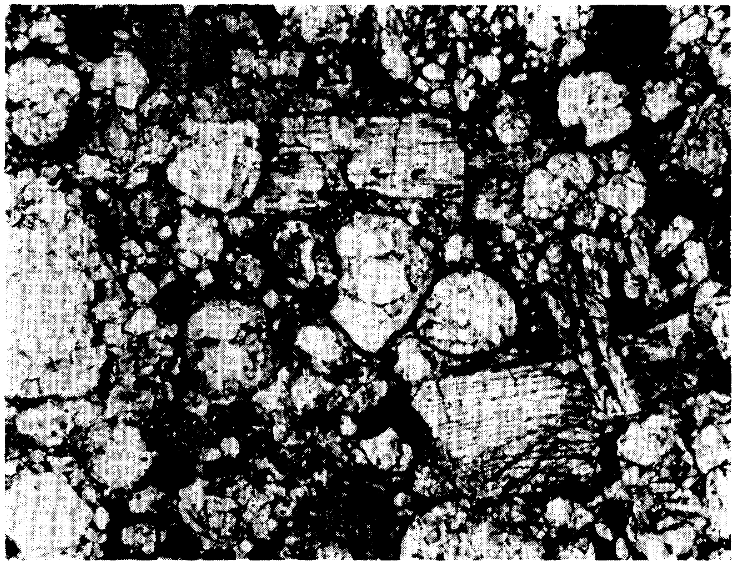


Fig. 11. ALHA80133, an L3 chondrite; chondrules, chondrule fragments, and mineral grains in a dark (probably carbonaceous) groundmass.

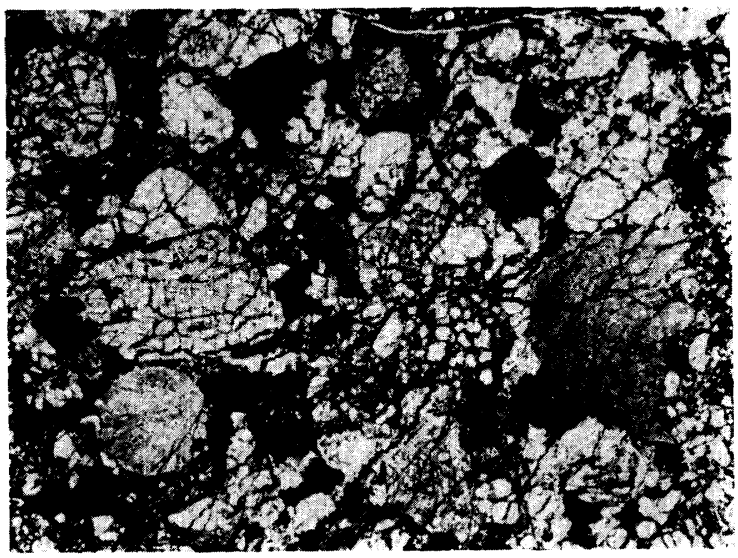
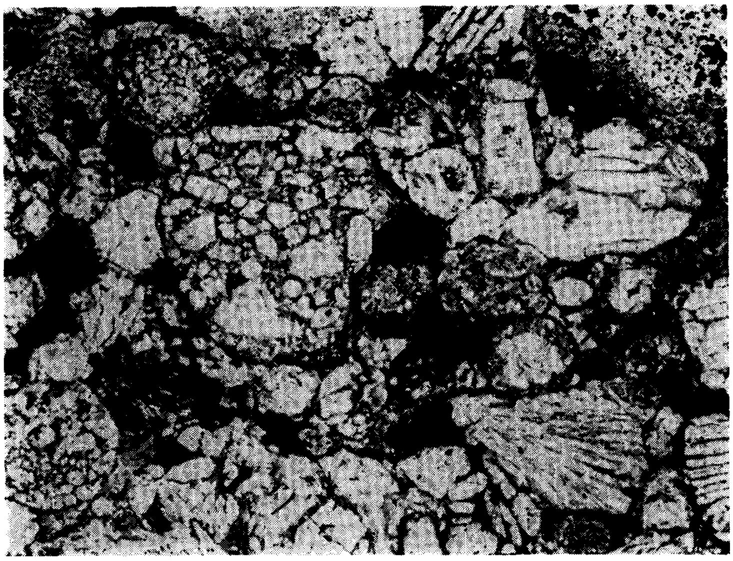


Fig. 12. RKPA80207, an L3 chondrite; chondrules and chondrule fragments in a granular groundmass of olivine and pyroxene (white to gray) and troilite and nickel-iron (black).



Fjg. 13. RKPA80256, an L3 chondrite; a close-packed aggregate of chondrules with troilite and nickel-iron (black) in fine-grained groundmass.

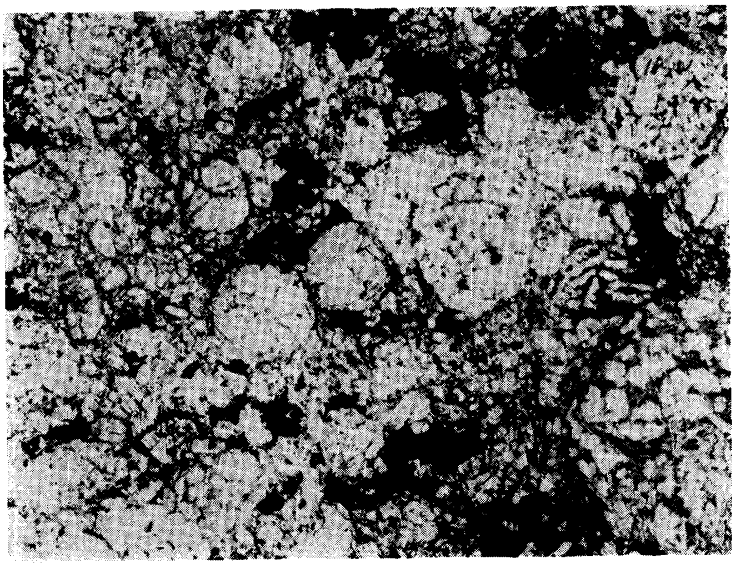


Fig. 14. RKPA80237, an H4 chondrite; chondrules in a granular groundmass of olivine and pyroxene (white to gray) and troilite and nickel-iron (black).

Fig. 15. RKPA80216, an L4 chondrite; chondrules and chondrule fragments in a granular groundmass of olivine and pyroxene (gray) and nickel-iron and troilite (black). Note barred chondrule within barred chondrule.

Much of the pyroxene is polysynthetically twinned clinobronzite. Weathering is extensive, with brown limonitic staining throughout the section. Microprobe analyses show olivine and pyroxene have highly variable composition: olivine, $Fa_{0.5}$–Fa_{35}, mean Fa_{14}; pyroxene, Fs_5–Fs_{30}, mean Fs_{14}. This specimen was originally classified as a C3 chondrite, but Dr. E. R. D. SCOTT (personal communication) has identified it as an L3 chondrite, paired with ALHA77011 and many other L3 chondrites from the Allan Hills.

Dull black fusion crust covers one surface of RKPA80207. In thin section (Fig. 12) chondrules are abundant, ranging from 0.3 to 1.5 mm in diameter; a wide variety is present, the commonest being granular olivine and olivine-pyroxene, and fine-grained pyroxene. The granular chondrules have intergranular glass, sometimes pale brown and transparent, but commonly turbid and partly devitrified. Irregular granular clasts and chondrule fragments are also present. Most of the pyroxene is polysynthetically twinned. The matrix consists of fine-grained olivine and pyroxene, with minor subequal amounts of nickel-iron and troilite. Veinlets of limonite and brown limonitic staining pervade the section. Microprobe analyses show olivine ranging in composition from Fa_{15} to Fa_{29}, with a mean of Fa_{20}; pyroxene ranging from Fs_6 to Fs_{28}, with a mean of Fs_{13}.

RKPA80256 is almost totally covered with brownish-black fusion crust. Chondrules and white and gray clasts up to 5 mm across are visible on exposed surfaces. The thin section (Fig. 13) shows a closely packed mass of chondrules (0.3–1.8 mm diameter) and irregular crystalline aggregates. Some of the chondrules have prominent dark rims. The sparse matrix is dark and fine-grained, with a small amount of coarser nickel-iron and troilite scattered throughout. A notable variety of chondrules is present; many are granular or porphyritic olivine and olivine-pyroxene with transparent to turbid interstitial glass. The pyroxene is polysynthetically twinned clinobronzite. There is a little limonitic staining in association with metal grains. Microprobe analyses show olivine ranging in composition from Fa_{20} to Fa_{25}, with a mean of Fa_{22}; the pyroxene is low-calcium (CaO=0.1–0.8%), with a composition range from Fs_{10} to Fs_{26} and a mean of Fs_{18}.

10. H4 Chondrites

Four H4 chondrites were collected at Allan Hills (ALHA80106, 80121, 80128, 80131) and three from the Reckling Peak area (RKPA80232, 80237, 80267). All these meteorites are moderately to extensively weathered. In thin section (Fig 14) they all show the typical features of type 4 chondrites: well-developed chondrules, the commonest being granular and porphyritic olivine and olivine-pyroxene, barred olivine, and fine-grained radiating pyroxene (much of the pyroxene is polysynthetically-twinned clinobronzite); the groundmass consists of fine-grained olivine and pyroxene, with minor amounts of nickel-iron and troilite. The Allan Hills specimens have olivine of essentially uniform composition (Fa_{18-19}) and somewhat variable pyroxene (Fs_{15-22}); the Reckling Peak specimens have olivine (Fa_{18-19}) and pyroxene (Fs_{16}) of essentially uniform composition. The Allan Hills specimens are possibly paired, as are those from Reckling Peak; further research is necessary to establish this.

11. L4 Chondrites

Two L4 chondrites were collected, both from the Reckling Peak area: RKPA80216, 80242. They resemble each other closely in mineralogy, texture and degree of weathering, and are possibly paired. In thin section (Fig. 15) chondritic structure is well developed, with a variety of chondrule types; irregular granular aggregates, possibly chondrule fragments, are also present. The chondrules are set in a fine-grained matrix consisting largely of olivine and pyroxene, with minor subequal amounts of nickel-iron and troilite. Some of the pyroxene, especially in the chondrules, is polysynthetically twinned. Olivine and pyroxene are essentially uniform in composition: olivine, Fa_{22-23}; pyroxene, Fs_{19-20}.

12. H5 Chondrites

A large number of H5 chondrites were collected: 6 from the Allan Hills and 19 from the Reckling Peaks (see Table 1 for numbers). All the Allan Hills specimens except ALHA80123 are very similar in texture, mineralogical composition, and degree of weathering, and are tentatively paired (Fig. 16). ALHA80123 is more severely weathered, and may be a different fall. The Reckling Peak H5 chondrites also resemble each other in texture, mineralogical composition, and degree of weathering. RKPA80220 and 80223 have been tentatively paired, as have RKPA80250 and 80251; further research will probably extend these pairings.

13. L5 Chondrites

Three L5 chondrites have been identified, all from the Reckling Peak area: RKPA-80209, 80228, 80268. They are all rather similar in texture (Fig. 17), mineralogical composition, and degree of weathering. However, there is no positive evidence for pairing, and this question must remain open pending further investigation.

14. LL5 Chondrites

Two LL5 chondrites were collected, both from the Reckling Peak area: RKPA-80234, 80253. Although they show some similarities, there are sufficient differences to indicate that they are probably not paired; RKPA80253 is practically unweathered, whereas RKPA80234 is considerably weathered, with extensive brown limonitic staining. Both specimens show the marked brecciation characteristic of many LL chondrites (Fig. 18). Chondrules are more abundant and generally larger in 80253 than in 80234. Some of the breccia fragments in 80253 may be of higher or lower type than 5.

15. H6 Chondrites

Four H6 chondrites were collected at the Allan Hills site, and 14 from the Reckling Peak area (see Table 1 for numbers). Three of the Allan Hills specimens (80122, 80126, 80130) are very similar and are probably pieces of single meterorite; ALHA-

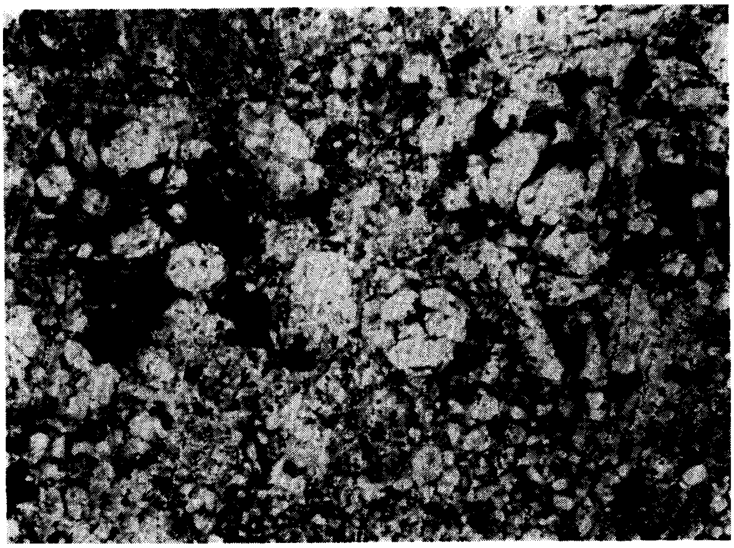


Fig. 16. ALHA80111, an H5 chondrite; chondrules tend to merge with the granular groundmass.

Fig. 17. RKPA80209, an L5 chondrite; note well-developed fusion crust.

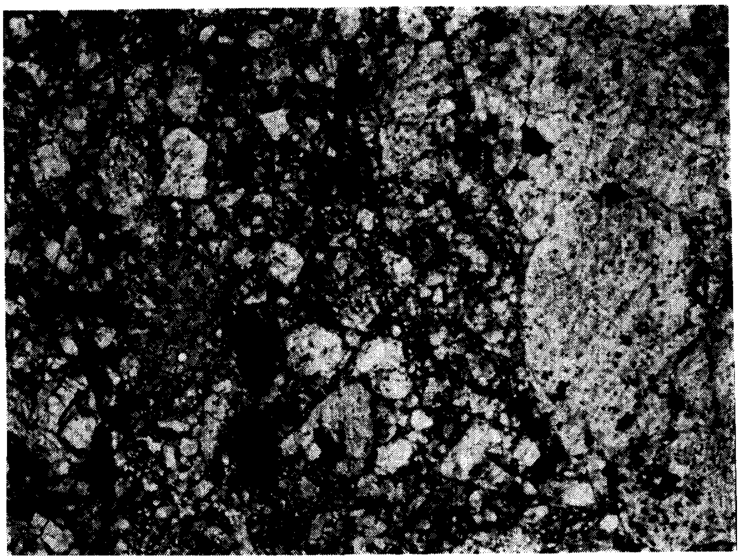


Fig. 18. RKPA80253, an LL5 chondrite; chondrules are sparse and poorly defined, and the meteorite shows considerable brecciation.

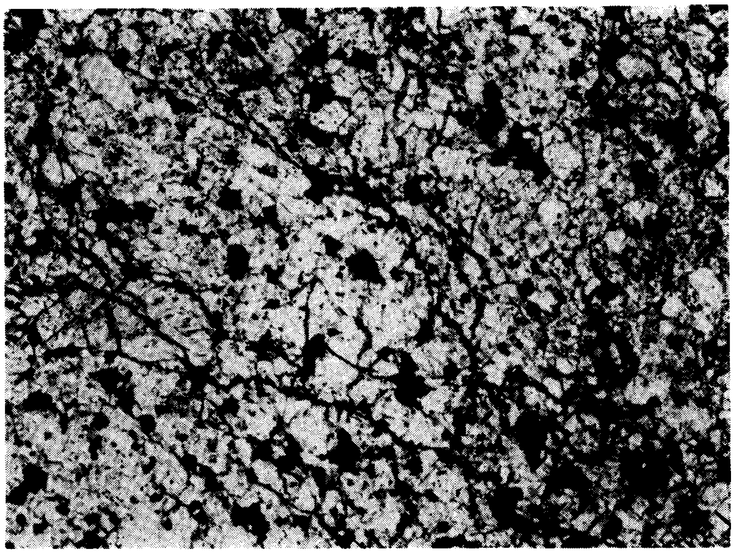


Fig. 19. RKPA80203, an H6 chondrite; chondrules are barely visible, the minerals are granulated, and the meteorite is seamed with limonite veinlets.

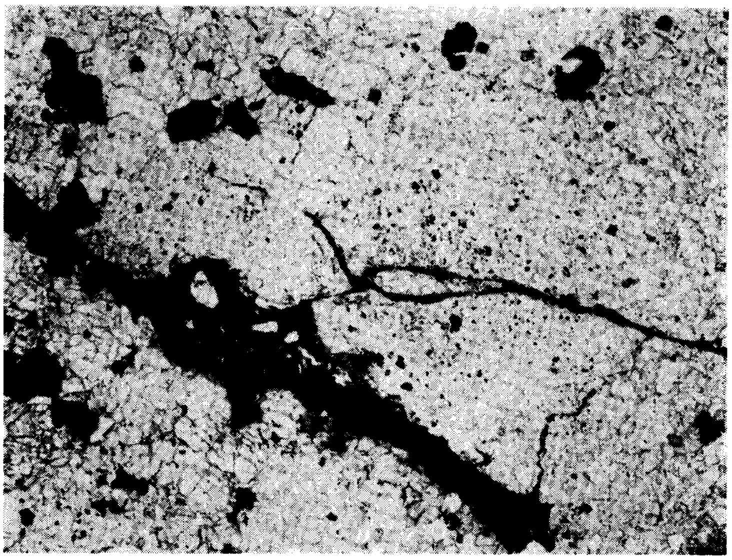


Fig. 20. RKPA80202, an L6 chondrite; chondrules are poorly defined, and the specimen has dark glassy veinlets containing clear isotropic material tentatively identified as ringwoodite and majorite.

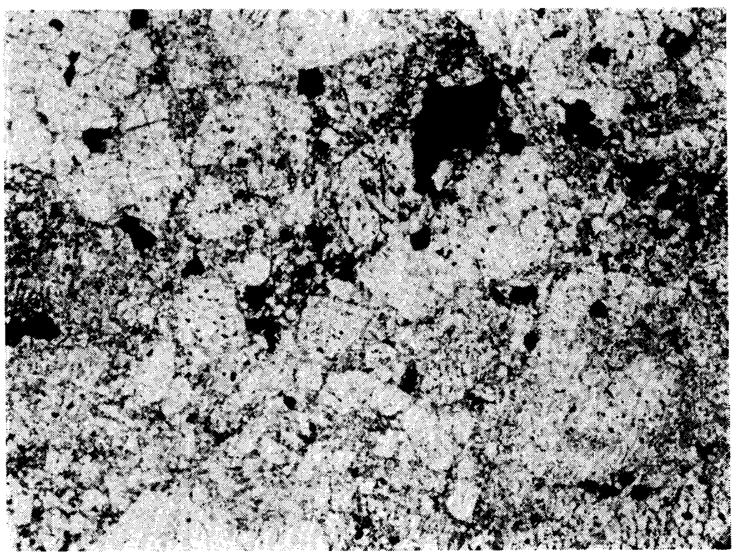


Fig. 21. RKPA80238, an LL6 chondrite; chondrules are sparse and fragmented, and the meteorite shows the brecciated structure typical of many LL chondrites.

80118 is less weathered and may be a different fall. All the Reckling Peak specimens except RKPA80201 are paired because of their similar and characteristic texture. Specifically, they appear to have been considerably fracture and the minerals partly granulated; this feature has been made more prominent by extensive weathering, which has developed numerous thin limonite veinlets throughout the specimens (Fig. 19).

16. L6 Chondrites

Fifteen L6 specimens were collected at the Allan Hills, and seven from the Reckling Peak area (see Table 1 for numbers). Macroscopic examination indicated that the Allan Hills specimens might be paired as fragments of a single meteorite, and this has been supported by evidence from the thin sections, which shows that they are identical in texture, mineral compositions, and degree of weathering. All the Reckling Peak specimens except RKPA80215 are identical in texture, mineral compositions, and degree of weathering, and most of them have dark glassy veinlets containing clear isotropic material tentatively identified as ringwoodite and majorite (Fig. 20); these specimens are probably all pieces of a single meteorite and can be paired with RKPA78001, 78003, 79001, and 79002. RKPA80215 is much more weathered than these L6 specimens, and appears to be more heavily shocked, the mineral grains being comminuted and traversed by shock veinlets of troilite.

17. LL6 Chondrites

Four LL6 chondrites were collected, all from the Reckling Peak area: RKPA-80222, 80235, 80238, 80248. RKPA80222, 80238, and 80248 were paired on the basis of macroscopic examination, and this has been confirmed by the evidence from the thin sections. They show the brecciated structure characteristic of many LL chondrites (Fig. 21). Chondritic structure is barely discernable, the specimens consisting of a granular aggregate of olivine and pyroxene, with minor amounts of plagioclase and troilite, and a little nickel-iron; some of the nickel-iron is present as unusually large grains, up to 3 mm. A small amount of limonitic staining is present around the metal grains. RKPA80235 differs in being unbrecciated, having less troilite and nickel-iron (without limonitic staining), and having somewhat higher Fa and Fs contents in olivine and pyroxene (Fa_{30} *vs.* Fa_{25}, Fs_{24} *vs.* Fs_{23}).

Acknowledgment

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