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Abstract–The Meteoritical Bulletin 94 reports over 900 (119 non-Antarctic and 803 Antarctic) newly approved meteorite names and their recovery histories, macroscopic descriptions, petrography, mineral compositions, and geochemistry. Meteorites reported include lunar, Martian, howardites, eucrites, diogenites, mesosiderites, aubrites, irons, angrites, ureilites, acapulcoites, lodranites and H, L, LL, R, CO, and CV chondrites. Eight of the meteorites in this bulletin are falls, including 4 from India (Jodiya, Kaprada, Kavapura, Mahadevpur), 1 from Mali (Chergach), Turkey (Didim), Libya (Werdama), and the U.S. (Berthoud).

From the editor, Michael K. Weisberg

This is the Meteoritical Bulletin 94. The Meteoritical Bulletin reports newly approved meteorite names and their recovery histories, macroscopic descriptions, petrography, mineral compositions, and geochemistry. Herein are reports of 119 non-Antarctic and 803 Antarctic (from ANSMET) newly approved meteorite names in detailed written descriptions and table format. The meteorites span a wide range of achondrites including lunar, 4 Martian, eucrites, mesosiderites, aubrites, irons, angrites, ureilites, acapulcoites, and lodranites. Chondrites reported in the bulletin include H, L, LL, R, CO and CV. The bulletin also contains descriptions of eight newly approved falls including 4 from India, 1 from Mali, Turkey, Libya, and the U.S.

Meteoritical Bulletin 94 marks the first bulletin published by me as editor; I took over the editorship as of April. I very much look forward to serving the meteoritical community as editor of the bulletin. My goals will be to help improve the procedures for new submissions and their review and maintain the high level of meteorite reporting as achieved by previous editors.

AFRICA

Algeria

Acfer 370 **27°40.35′N, 4°21.40′E**

Acfer, Algeria
Find: November 2002
Ungrouped chondrite

History: A small single meteorite, weighing 129 g, was found during an expedition for meteorite recovery in the Acfer area of the Algerian Sahara. The sample was recovered by the late Filiberto Ercolani.

Physical characteristics: The hand-size sample has been split into two end cuts weighing 67 and 62 g, respectively, both displaying no fusion crust.

Petrography: (Moggi Cecchi, V., Pratesi G., *MSP*) The thin section displays chondrules and chondrule fragments set in a fine-grained interchondrule matrix. Chondrules range in size from 150 to >2000 μm (mean = 460 μm). Chondrule types are PO, POP, PP, GOP, RP, BO, and C. Chondrule fragments are common. Mineral fragments (mainly orthopyroxene) are rare.

A partially devitrified glass is present in some chondrules. Matrix is composed of olivine, orthopyroxene, Fe,Ni alloys, troilite, and Fe-oxides. Opaque phases can be found in two extremely different occurrences: in large (100–300 μm) aggregates of kamacite and taenite associated with troilite, minor schreibersite and weathering products and as extremely fine-grained spots inside PP chondrules. Modal abundances of the components are: chondrules and chondrule fragments 75 vol%, mineral fragments 5%, silicate matrix 5%, metal 10%, troilite 3%, schreibersite 1%.

Geochemistry: Olivine (inside and outside chondrules) $Fa_{5.65}$ (mean on 20 analyses, PMD = 3.82%); low-Ca pyroxene $Fs_{6.94–22.63}$ (mean = 15.64 on 20 analyses); clinopyroxenes $Fs_{11.5}En_{48.9}Wo_{32.6}$. Oxygen isotopes (Greenwood, R., *OU*): $\delta^{17}O = 2.673‰$, $\delta^{18}O = 4.172‰$, $\Delta^{17}O = 0.504‰$ (mean of 3 runs on 1 g of the bulk sample).

Classification: Ungrouped type 3 chondrite with textural affinities to an H3 chondrite but low Fa mol% (Folco et al. 2004; Bridges et al. 1999); shock stage S3; weathering W2.

Type specimens: All the specimens, including the main mass (67 g) and one thin section are on deposit at *MSP* (Museo di Scienze Planetarie).

Ethiopia

Bouri **10°16′N; 40°34′E**

Middle Awash, Ethiopia
Find: Fall 1996
Ordinary Chondrite (H4)

History: Over 30 fragments scattered over 100 m radius were collected from the surface of Pliocene sediments, with which they bear no apparent relationship, and none were found in situ. The meteorite fragments were discovered and collected by Prof. Tim White of the Department of Integrative Biology, University of California at Berkeley, in the fall of 1996 and subsequently, in the framework of the Middle Awash Project (see Asfaw et al. 2002). A total of 9.1 kg with one piece weighing more than 5 kg was collected and none is left in the field. All meteorite fragments are stored at the National Museum of Ethiopia (*NME*) in Addis Ababa.

Dr. Giday WoldeGabriel took a fragment weighing about 40 g to the United States for characterization. Recently Dr. Tamrat Endale took an additional fragment (35 g) for analysis at CEREGE, France.

Results from Los Alamos National Laboratory: Preliminary petrographic analysis indicates thermally metamorphosed, strongly fractured, and altered coarse mafic minerals embedded in highly weathered metallic oxide. The bulk chemistry is SiO_2 (34.7 wt%), iron oxide (Fe_2O_3T = >33 wt%), and MgO (22 wt%). Neutron activation analysis yielded Ni (13,747 ppm) and Cr (3516 ppm).

Physical characteristics: The exterior of the specimen is weathered but shows a glassy fusion crust. The interior is black-brown with visible metal and chondrules. Magnetic susceptibility is $\log\chi = 4.68$ (10^{-9} m^3/kg), in agreement with a weathered H.

Petrography: (M. Bourot-Denise, *MNHNP*, J. Gattacceca, *CEREGE*) microscopic observation of a polished section reveals a chondrite texture. Chromite-plagioclase assemblages are present. Metallic copper is found associated with taenite-kamacite grains. Weathering grade is estimated to be W4 in the MNHNP sample and W6 in the Los Alamos sample examined by M. Killgore.

Mineral compositions and geochemistry: Olivine is homogeneous ($Fa_{20.1} \pm 0.4$%,) and low Ca pyroxene displays the typical scatter for a type 4 chondrite (Fs 14.8 ± 3.8%).

Classification: H4, W4, S4.

Type specimens: The type specimens include a 15 g piece on deposit at *CEREGE* and the main mass of ≥9 kg at the National Museum of Ethiopia (*NME*), Addis Ababa.

Libya

Werdama **32° 47.839′N, 21° 47.228′E**

Werdama village, Al-Beda, Al-Jabal Al-Akhdar, Libya
Fall: 21 May 2006, 7:30 a.m. local time (UT + 2)
Ordinary chondrite (H5)

History (M. Abu Anbar, *TantaU*; R. Kryza, *UTWroc*, T. Przylibski, *WTWroc*, and G. El Bahariya, *TantaU*): A bombing sound and cloud of dust was observed in the village during the infall on an apple farm. A crater of 30 × 20 cm and ~10 cm deep. No exact information about the meteorite finder. (probably, the owner of the apple farm). Geologist Mohamed Abu Anbar, *TantaU* got a few pieces for research from the finder during his visit to the site, shortly after the fall.

Physical characteristics: Reportedly, five pieces were found, with estimated total mass about 4–5 kg. The diameter of the stone was about 25 cm and it had a light gray color, a brown to black fusion crust ~1 mm thick.

Petrography: (R. Kryza, *UWroc*; T. Przylibski, *UTWroc*) The stone shows a low degree of shock: locally, opaque minerals are fractured and the cracks rarely continue into the neighboring silicates. The matrix (10 vol%) has a fine, inequigranular texture. The main component is olivine, subordinate low-Ca pyroxene and Ca pyroxene. Secondary feldspar grains, 20–90 μm large, are minor. Occasionally apatite is found. Opaque minerals vary between 2 and 15 vol%. Kamacite dominates over taenite, together = 6–8 vol%. Troilite and chromite are also common. The grain sizes of the opaques are 0.01–1.5 mm. Chondrules constitute 60 vol%, with a size range of 0.23–1.86 mm (mean 0.57 mm, standard deviation = 0.33).

Geochemistry: Olivine ($Fo_{79.7}$, $Fa_{19.7}$); pyroxene ($Wo_{1.3}En_{81.0}Fs_{17.7}$); feldspar ($Ab_{82.8}An_{11.8}Or_{5.4}$): kamacite (Ni 6.1–9.4 wt%); taenite (Ni = 27.4–51.8 wt%).

Classification: Ordinary chondrite (H5), S1, W0.

Type specimens: Main mass of 2 kg (20 cm in length) and

300 g are deposited in *GMAlBeda Geological Museum*, and 250 g in *PDAlBeda*; 2 g and four thin sections are deposited in *UWroc*.

Mali

Chergach **23° 41′47″N, 5° 00′53″W**
SW El Mokhtar, Erg Chech, Timbuktu district, Mali
Fall: 2 or 3 July 2007, daytime
Ordinary chondrite (H5)

History: In fall and winter, 2007 ~100 kg of meteorites were collected in the Erg Chech, north of Taoudenni. Nomads reported the stones fell after a smoke cloud was seen and several detonations were heard over a wide area during daytime in July 2007. The finder of the first meteorites was Mr Ouled Bleila, who died in a car accident on his way back from the trip to the Chergach strewn field in October 2007. According to the Tuareg people from Algeria who visited the fall site in September 2007, the elliptical strewn field stretches for more than 20 km in a northeasterly direction. No fireball was reported.

Physical characteristics: A large number of fusion-crusted stones have been recovered, the largest ones are 17.8 and 13.9 kg, the smallest ones about 1.5 g. Total known weight ~100 kg.

Petrography: (E. Gnos, *MHNGE*; B. Hofmann, *NMBE*, M. Eggimann, *UBE/NMBE*) Mean chondrule size is 0.38 mm (n = 61). Mean size of plagioclase grains is ~20 μm. Troilite is polycrystalline, rich in silicate inclusions, and shows diffuse boundaries to metal. Some metal is rich in silicate- and troilite inclusions. No Cu metal observed. Shock stage is S3, some shock veins are visible, no weathering (W0). In addition to this dominant lithology, a significant number of stones consist of chondritic clasts (H5 S3–4 W0, identical to the homogeneous lithology) set in a fine-grained, black, silicate impact melt matrix with abundant droplets of metal and metal-troilite. Shock stage of small clasts is up to S4.

Mineral compositions and geochemistry: Olivine $Fa_{18.2}$ (chondrite fragments in impact melt are $Fa_{18.4}$), pyroxene $Fs_{15.5}$ $Wo_{1.2}$ (fragments in impact melt are $Fs_{16.0}$, $Wo_{1.4}$).

Cosmogenic radionuclides: (Patrick Weber, Particle Physics Group, Institute of Physics, University of Neuchâtel) Gamma-spectroscopy performed in November, 2007 showed the presence of the following short-lived radionuclides: ^{46}Sc, ^{56}Co, ^{54}Mn, ^{58}Co, ^{7}Be, ^{57}Co, ^{22}Na, ^{60}Co, ^{26}Al. Recalculated to July, 2007, ^{22}Na was 44.0 ± 1.1 dpm/kg and ^{26}Al 20.8 ± 0.8 dpm/kg. The ^{22}Na/^{26}Al activity ratio of 2.1 is consistent with a fall in July, 2007 and demonstrates that this material is not identical with Bassikounou.

Classification: Ordinary chondrite (H5), some stones suggest an H impact melt breccia. S3, W0.

Type specimens and distribution: 115 g at *NMBE*; 17.8 kg P. Hermann, Canada; 13.9 kg D. Gheesling, USA; 4.9 kg S. Buhl, Germany.

Mauritania

Noktat Addagmar **25° 42′09″N, 10° 46′ 54″W**
Mauritania
Find: October or November 2006
Ordinary chondrite (LL5)

History: Two stones with a mass of 591 and 188 g, respectively (total known weight 779 g), were found by a Moroccan mineral collector (Sajid Ait Ben Chouk) near the caravansary of Noktat Addagmar after locals reported an abundance of "stones that recently fell from sky", close to the track from Assa (Morocco) to Nouakchott (Mauritania).

Physical characteristics: The main mass is partly covered with a black fusion crust. The interior is greenish grey with slight rust haloes around metal. Porosity 8.2% based on alcohol absorption.

Petrography: (E. Gnos, *MHNGE*; B. Hofmann, *NMBE*, M. Eggimann, *UBE/NMBE*) Olivine $Fa_{27.7 \pm 0.6}$ (n = 27), pyroxene $Fs_{23.1 \pm 1.0}$ $Wo_{1.6 \pm 0.3}$. (n = 20). Shock stage is S2, some shock veins are visible, no weathering (W0). The mean diameter of chondrules is ~1 mm.

Cosmogenic radionuclides: (Patrick Weber, Particle Physics Group, Institute of Physics, University of Neuchâtel) Gamma-spectroscopy performed in December-January 2006 demonstrated the absence of short-lived radionuclides (no ^{22}Na detected). The fall must have occurred at least several decades ago.

Classification: Ordinary chondrite (LL5), shock stage S2, no weathering (W0).

Type specimens: 22.4 g plus polished thin section at *NMBE*, main mass: Svend Buhl, Hamburg, Germany.

Morocco

Toufassour **29°39′.135 N, 07°44′.958 W**
Toufassour, Tata, Morocco
Find: 16 November 2007
Mesosiderite

History: A small impact structure about 3 m in diameter was found in the vicinity of the village of Toufassour (Tata, Morocco). A number of stones have been collected since 2003 by nomads and sold to dealers in Erfoud. In particular two stones totaling 3 kg and a number of fragments were sold by one nomad, but the most significant mass (an ~70 kg stone) was found by a woman hunting for meteorites. More recently many small stones were collected by Moroccan scientists (*IZU. Agadir*) around the impact structure: Three pieces of 61.0, 15.5 and 13.1 grams and fragments ranging 1 to 5 grams, totaling about 320 grams. Total mass exceeds ~73.3 kg.

Physical characteristics: The fusion crust is absent and the surface appears dark brown. Larger nodules of metal protrude here and there, and larger inclusions of silicates are seen, as greenish spots. Many of the smaller specimens were rich in metal, the phase, which best resisted weathering.

Petrography: (A. Ibhi and H. Nachit, *IZU*, and A. Jambon, O. Boudouma and D. Badia, *UPVI*) Mode (wt%): kamacite and (minor) sulfide, (partly oxidized) = 27, pyroxene = 56, plagioclase = 20, silica = 5, and chromite = 0.9. Rutile and schreibersite are also present.
Mineral compositions and geochemistry (EMPA): Pyroxene FeO/MnO = 27, En_{70} Fs_{26} Wo_4 to En_{59} Fs_{33} Wo_8. Chromite Cr/(Cr + Al) = 0.76. Plagioclase Ab_7, An_{93}. Kamacite, Ni = 6%. Merrillite contains significant amounts of MgO.
Classification: Mesosiderite. Moderately to significantly weathered, depending on the grain size.
Type specimens: 2 polished thin sections and 89.6 g at *IZU*, one polished thin section and 22 g at *UPVI*. An anonymous dealer holds 300 g.

Table 1 lists all newly approved (non-NWA) meteorites from Africa and their data.

Morocco and Other Northwest Africa (NWA) Regions

Northwest Africa 1709

Northwest Africa
Find: March 2002
Ordinary chondrite (H3.8)

History: A small stone was bought at an Erfoud market by an anonymous buyer.
Physical characteristics: A single dark brown piece of 9 g with fusion crust traces.
Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) The overall texture consists of chondrules 250–550 μm in size, of different types (PO, POP, BO, RP) and their fragments embedded in a fine-grained matrix; matrix silicates are mainly olivine and orthopyroxene, with minor clinopyroxene; some olivine grains in BO and PO chondrules are zoned and contain a glassy mesostasis. Opaque phases are kamacite and troilite.
Geochemistry: Olivine $Fa_{1.2–21.2}$, mean $Fa_{15.4}$ (P.M.D.Fa $_{47.5}$); low-Ca pyroxene ($Fs_{4.8–16.9}En_{95.0–82.4}Wo_{0.2–0.8}$, mean $Fs_{11.6}$ $En_{86.1}Wo_{1.5}$ P.M.D.Fs 38.70); diopside $Fa_{11.7}En_{51.0}Wo_{37.2}$. Oxygen isotopes (R. Greenwood, I. Franchi, *OU*) $\delta^{18}O$ = 2.840‰; $\delta^{17}O$ = 4.448‰; $\Delta^{17}O$ = 0.527‰.
Classification: Ordinary chondrite (H3.8); S2; W3.
Type specimens: A total of 1.7 g, one polished thin section and a block are on deposit at *MSP*. An anonymous collector holds the main mass.

Northwest Africa 3211

Northwest Africa
Find: 2005
Achondrite (eucrite)

History: A single stone of 89.2 g was purchased 2005 in Erfoud by M. Chinellato.
Physical characteristics: The sample has no fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) A polymict breccia consisting of basaltic and mineral clasts set into a fine-grained matrix of exsolved pyroxene, clinopyroxene and plagioclase. The large clasts are predominantly plagioclase and exsolved pyroxene, with minor clinopyroxene. Minor phases include silica, ilmenite and Al-Ti-chromite. Exsolution lamellae in pyroxene are generally very fine (1–2 μm width).
Geochemistry: Plagioclase $An_{86.6}$; Pyroxene ranges $Fs_{43.9–55.6}$, $En_{36.2–54.2}$, $Wo_{2.0–21.5}$. Oxygen isotopes (I. Franchi, R. Greenwood, *OU*) $\delta^{17}O$ = 1.71‰, $\delta^{18}O$ = 3.85‰, $\Delta^{17}O$ = –0.25‰.
Classification: Achondrite (eucrite) with moderate degree of shock and low degree of weathering. Possibly paired with NWA 3212.
Type specimens: A total of 17.9 g and one thin section are on deposit at *MSP*, Prato. *M. Chinellato* holds the main mass.

Northwest Africa 3212

Northwest Africa
Find: 2005
Achondrite (eucrite)

History: A single stone of 176.6 g was found purchased in 2005 in Erfoud by M. Chinellato.
Physical characteristics: The sample displays no fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) A polymict breccia consisting of basaltic and mineral clasts set into a fine-grained matrix of exsolved pyroxene, clinopyroxene and plagioclase. The large clasts are predominantly plagioclase and exsolved pyroxene, with minor clinopyroxene. Silica and spinel ilmenite, and Al-Ti-chromite are commonly minor phases. Exsolution lamellae in pyroxene are very fine (1–2 μm width).
Geochemistry: Plagioclase $An_{89.4}$; pyroxene ranges $Fs_{35.6–54.1}$, $En_{37.4–43.9}$, $Wo_{2.0–29.2}$. Oxygen isotopes (I. A. Franchi, R. Greenwood, *OU*) $\delta^{17}O$ = 1.74‰, $\delta^{18}O$ = 3.84‰, $\Delta^{17}O$ = –0.26‰.
Classification: Achondrite (eucrite) with moderate degree of shock and low degree of weathering. Possibly paired with NWA 3211.
Type specimens: A total of 20 g specimen and one thin section are on deposit at *MSP*, Prato. *Chin* holds the main mass.

Northwest Africa 3333

Morocco
Find: May 2005
Achondrite (lunar basaltic fragmental breccia)

History: Fabien Kuntz purchased a 33 g specimen from a Moroccan dealer. The original main mass was broken into at least 5 pieces and distributed to several dealers.
Physical characteristics: A partially weathered blackish-brown fusion crust was present on the specimen. Cut and

polished surfaces on two different specimens reveal a coarsely brecciated texture, while a third specimen exhibits three different lithologies.

Petrography: (R. Zeigler, *WUSL*) The specimen examined consists of one basalt clast (1.5 cm) and one clast of cumulus olivine gabbro (1.2 cm) set in a fragmental breccia matrix. The basalt consists of phenocrysts composed of large zoned olivine and smaller chromite set in a fine-grained matrix of spinifex olivine, skeletal pyroxene, and glass. The gabbro (vol%) is 50% olivine, 35% pyroxene, and 15% plagioclase. A vein of black shock melt separates the cumulate clast from the fragmental breccia. The breccia is composed predominantly of pyroxene and olivine clasts, with minor plagioclase, and trace silica, Fe-Ti-Cr oxides, troilite, chromite, ilmenite, FeNi, apatite, and RE-merrillite.

Mineral compositions and geochemistry: Matrix pyroxene and olivine is $Fs_{17–65}Wo_{12–29}En_{8-61}$ and $Fa_{40–95}$; plagioclase clasts are $An_{86–95}Or_{<2}$. Olivine in the basalt is zoned ($Fo_{47–72}$). Mineral compositions in the olivine cumulate are Fo_{68}, $Fs_{63}Wo_{15}$ and $Fs_{52}Wo_{32}$, and $An_{92}Or_1$. Fe/Mn = 85–110 (olivine) and 40–77 (pyroxene).

Bulk composition: (R. Zeigler and R. Korotev, *WUSL*) The basalt (TiO_2 = 0.8%, FeO = 21%, MgO = 14%, Th = 1.4 µg/g) is compositionally similar to that of NWA 3160; the cumulate olivine gabbro (TiO_2 = 0.4%, FeO = 20%, MgO = 27%, Th = 1.2 µg/g) is similar to NWA 773 and 2977. All lithologies are characterized by low concentrations of Na_2O (= 0.15 ± 0.06%) and Eu (= 0.4 ± 0.2 ppm) compared to other lunar basalts. The oxygen isotope composition (I. A. Franchi, R. C. Greenwood, *OU*) is consistent with lunar origin ($\delta^{17}O$ = 2.94, $\delta^{18}O$ = 5.59, $\Delta^{17}O$ = 0.032).

Classification: Achondrite (lunar basaltic fragmental breccia). The specimen is part of the NWA 773/2700/2727/2977/3160 pairing group.

Type specimens: A mass of 6.55 g is on deposit at *DuPont* and 0.4 g (neutron irradiated) and one thin section at *WUSL*.

Northwest Africa 4222

Northwest Africa
Find: 2006
Martian (shergottite)

History: A small fragment was purchased in Erfoud by a Moroccan dealer for M. Chinellato.

Physical characteristics: The sample weighs 16.5 g and is partially covered with a black fusion crust.

Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) Cumulitic fine-grained porphyritic texture consisting of few very large rounded and zoned phenocrysts of brown olivine up to 1350 µm in maximum size set in a fine-grained basaltic groundmass of twinned tabular pyroxene crystals from 80 to 240 µm wide and from 130 to 820 µm long surrounded by an interstitial glassy matrix. Pyroxene is primarily pigeonite with subordinate enstatite. Other minerals are chromite, titanian chromite and ilmenite, up to 100 µm in size, merrillite, and rare pyrrhotite grains up to 50 µm in size; shock features include strong mosaicism and planar deformation in olivine, undulose extinction and twinning in pyroxene.

Geochemistry and mineralogy: Olivine $Fo_{58.9–68.7}$; orthopyroxene (core $Fs_{17.2}En_{80.3}Wo_{2.4}$; rim $Fs_{31.4}En_{63.9}Wo_{4.7}$, FeO/MnO = 30.2–42.4); pigeonite (core $Fs_{24.1}En_{65.5}Wo_{10.3}$; rim $Fs_{32.6}En_{58.4}Wo_{8.9}$), FeO/MnO = 32.5–46.5). Plagioclase ($An_{61.1}Or_{0.2}$). Oxygen isotopes (I. A. Franchi, R. Greenwood, *OU*): $\delta^{17}O$ = 2.85‰, $\delta^{18}O$ = 4.91‰, $\Delta^{17}O$ = 0.30‰ (mean on 2 analyses).

Classification: Martian (shergottite). Low weathering and high shock.

Type specimens: A total of 3.55 g of sample and one thin section is on deposit at *MSP. Chin* holds the main mass.

Northwest Africa 4395

Northwest Africa
Find: 2004
Achondrite (diogenite)

History: The meteorite was bought by the main mass holder in Erfoud, Morocco, in 2006.

Physical characteristics: One brownish fragment without fusion crust weighing 240 g was found.

Petrography: (A. Greshake, *MNB*) The meteorite is composed of large blocky orthopyroxene. Minor phases include plagioclase, Ca-phosphates and FeNi metal.

Mineral compositions and geochemistry: Low-Ca pyroxene, $Fs_{30.5}Wo_{2.7}$; plagioclase, $An_{90.5–91.7}$. Oxygen isotopes (I. A. Franchi and R. C. Greenwood, *OU*) mean of two replicates $\delta^{17}O$ = 2.09‰, $\delta^{18}O$ = 4.39‰, $\delta^{17}O$ = –0.19‰.

Classification: Achondrite (diogenite), low degree of shock, moderate degree of weathering.

Type specimens: A total of 20.1 g plus one polished thin section are on deposit at *MNB*. Ralew holds the main mass.

Northwest Africa 4415

Northwest Africa
Find: 2006
Enstatite chondrite (EL6)

History: A small fragment was purchased at the Erfoud market by an anonymous collector.

Physical characteristics: A single dark brown piece of 10 g with no fusion crust and traces of marked staining.

Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) The overall texture is characterized by rare relic chondrules and chondrule fragments set in a fine-grained matrix mainly composed of pyroxene. Several multiple subparallel and anastomozing thin veinlets, about 200 µm large, filled with iron oxides/hydroxides can be easily observed in reflected light in the thin section. Enstatite accounts for about 90% of the total volume. Relic chondrules are mainly RP type, with minor PP, and range from 0.2 to 0.8 mm in diameter. Minor phases are altered kamacite, altered troilite, and plagioclase. Accessory phases are schreibersite and daubreelite as blades.

Geochemistry: Enstatite ($En_{98.5}Wo_{1.5}$), plagioclase ($An_{15.8}Or_{4.4}$). Oxygen isotopes (R. Greenwood, I. Franchi, *OU*), $\delta^{17}O = 3.340‰$; $\delta^{18}O = 6.388‰$; $\Delta^{17}O = -0.007‰$.
Classification: Enstatite chondrite (EL6); S1; W3. This specimen is probably paired with NWA 4416.
Specimens: A total of 2 g, one polished thin section and a block are on deposit at *MSP*. An anonymous collector holds the main mass.

Northwest Africa 4416
Northwest Africa
Find: 2006
Enstatite chondrite (EL6)
History: A single stone was purchased at the Erfoud market by an anonymous collector.
Physical characteristics: A single dark brown stone of 259.1 g with no fusion crust and traces of staining.
Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) The overall texture is characterized by rare relic chondrules and chondrule fragments set in a fine-grained matrix mainly composed of pyroxene. Thin veinlets about 200 μm wide in a subparallel and anastomozing array and filled with iron oxides/hydroxides can be easily observed in reflected light. Enstatite accounts for about 90% of the total volume. Relic chondrules are mainly RP type, with minor PP, and range from 0.3 to 0.8 mm in diameter. Minor phases are altered kamacite, altered troilite and plagioclase. Accessory phases are schreibersite and daubreelite, frequently associated with troilite.
Geochemistry: Enstatite ($En_{98.9}Wo_{1.1}$), plagioclase ($An_{15.3}Or_{4.7}$). Oxygen isotopes (R. Greenwood, I. Franchi, *OU*) $\delta^{17}O = 3.342‰$; $\delta^{18}O = 6.385‰$; $\Delta^{17}O = -0.009‰$.
Classification: Enstatite chondrite (EL6); S1; W3. This specimen is probably paired with NWA 4415.
Specimens: A total of 22 g, one polished thin section and a block are on deposit at *MSP*. An anonymous collector holds the main mass.

Northwest Africa 4418
Northwest Africa
Find: 2006
Mesosiderite
History: A complete stone was purchased in Erfoud by a Moroccan dealer for M. Chinellato.
Physical characteristics: The sample is a single stone of 103.8 g, partially covered with black fusion crust.
Petrography: (V. Moggi Cecchi and G. Pratesi, *MSP*) The meteorite exhibits a heterogeneous texture with large metal areas embedded in a silicate matrix. Metal accounts for 30 vol% of the total surface, with kamacite more abundant than taenite. Schreibersite is accessory. The silicate portion consists of a microbreccia with olivine grains no larger than ~40 μm and clasts of orthopyroxene with very small (1 μm) exsolution lamellae, olivine (up to 200 μm) and plagioclase (up to 100 μm), with minor clinopyroxene. The matrix is formed by orthopyroxene, olivine and minor plagioclase, with orthopyroxene more abundant than plagioclase, thus indicating class B. Textural features indicate type 3.
Geochemistry and mineralogy: Orthopyroxene is $Fs_{29.59}En_{67.32}\ Wo_{3.09}$, FeO/MnO = 26.3–37.0. Clinopyroxene ($Fs_{14.04}En_{43.93}\ Wo_{42.03}$) and exsolution lamellae ($Fs_{21.59}En_{49.84}Wo_{28.57}$); Plagioclase is $An_{90.6}Or_{0.6}$. Oxygen isotopes (I. Franchi, R. Greenwood, *OU*): $\delta^{17}O = 2.145‰$, $\delta^{18}O = 4.524‰$, $\Delta^{17}O = -0.207‰$.
Classification: Mesosiderite, B class; low shock, moderate weathering.
Type specimens: A total of 20.1 g and one thin section are on deposit at *MSP*. *Chin* holds the main mass.

Northwest Africa 4419
Northwest Africa
Find: 2006
Rumuruti chondrite (R4)
History: A complete stone was recovered in northwest Africa and sold in Erfoud to an anonymous buyer.
Physical characteristics: The sample is a single stone, weighing 103.15 g, partially covered with a black fusion crust.
Petrography: (V. Moggi Cecchi, G. Pratesi, *MSP*) The section consists of well-defined, chondrules (up to 1 mm), accounting for ~50% of the section by area, as well as chondrule and mineral fragments set in a slightly recrystallized matrix of silicates and sulfides (both troilite and pentlandite). Various textural types of chondrules are visible. Main phases are olivine, augite and plagioclase. The meteorite appears unbrecciated in the thin section studied.
Geochemistry: Mineralogy: Olivine $Fa_{39.8}$, low-Ca pyroxene mean $Fs_{22.8}$; range $Fs_{13.9–29.1}$. Oxygen isotopes (I. Franchi, R. Greenwood, *OU*): $\delta^{7}O = 5.469‰$, $\delta^{18}O = 6.031‰$, $\Delta^{17}O = +2.333‰$.
Classification: Rumuruti chondrite (R4): S2; moderate weathering.
Type specimens: A total of 20.8 g and one thin section are on deposit at *MSP*. An anonymous dealer holds the main mass.

Northwest Africa 4459
Algerian-Moroccan border
Find: June 2006
Ordinary chondrite (L3)
History: The sample was purchased in Erfoud by P. Thomas in June 2006.
Physical characteristics: A complete stone of 60.07 g, entirely covered with a very thin, slightly reddish, fusion crust.
Petrography: (M. Bourot-Denise, *MNHNP*) Sample displays a typical chondritic texture with small, round chondrules (100–200 μm in size) the major component. Matrix is abundant, little altered, and contains small metal grains. Large, rounded metal-sulfide nodules, which are slightly

deformed and quite weathered occur in the matrix between chondrules. In BSE images the chondrite appears unequilibrated. Type I porphyritic chondrules contain FeO-poor olivines and low-Ca pyroxene, and FeO-rich silicates are only found in type II chondrules.
Geochemistry: Olivine, $Fa_{12.0 \pm 11.4}$, range $Fa_{0.49–39.6}$, CaO up to 0.39, Cr_2O_3 in the range 0.11–0.76 (wt%); Low-Ca pyroxene, $Fs_{7.7 \pm 8.2}$, range $Fs_{1.15–26.1}$. Magnetic susceptibility (J. Gattacceca, *CEREGE*) χlog = 4.32 (10^{-9} m^3/kg) is consistent with an altered L chondrite.
Classification: Ordinary chondrite (L3, estimated subtype 3.3), weathering grade W3, shock stage S2.
Type specimens: A total of 14.4 g (1 sawn fragment) and one polished mount are on deposit at *MNHNP. Thomas* holds the main mass.

Northwest Africa 4483
Algeria
Find: July 2006
Achondrite (lunar, granulitic breccia)
History: Purchased by Stefan Ralew in July 2006 from a dealer in Erfoud, Morocco.
Physical characteristics: Twelve broken fragments of very fine-grained, pale grey rock with a combined weight of 208 g.
Petrography: (A. Irving and S. Kuehner, *UWS*) Fine grained recrystallized breccia composed of larger plagioclase grains (converted mainly to maskelynite) poikilitically enclosing very small grains (mostly 30–80 μm) of low-Ca pyroxene (some with very fine augite exsolution lamellae), olivine, Ti-chromite, ilmenite, troilite, and metal.
Geochemistry: Olivine ($Fa_{30.9–60.8}$, FeO/MnO = 88.1–106), plagioclase ($An_{96.2–98}Or_{<0.1}$), orthopyroxene ($Fs_{14.3}Wo_{2.0}$, FeO/MnO = 52.6), pigeonite ($Fs_{36.4–75.1}Wo_{6.3–13.5}$, FeO/MnO = 62.9–66.5).
Classification: Achondrite (lunar, granulitic breccia). Possibly paired with Northwest Africa 3163 (Irving et al. 2006).
Specimens: A total of 20 g and one polished mount are on deposit at *UWS*. *Ralew* holds the main mass.

Northwest Africa 4529
Algeria
Find: September 2006
Achondrite (lodranite)
History: Purchased by Greg Hupé in September 2006 from a Moroccan dealer in Tagounite.
Physical characteristics: A single, dense, dark colored stone (60.0 g) lacking fusion crust.
Petrography: (A. Irving and S. Kuehner, *UWS*) The overall texture is coarse-grained (grain size 0.6–1.6 mm) and relatively equigranular, but plagioclase grains (0.2–0.45 mm) are interstitial to other phases. The specimen is composed predominantly of orthopyroxene (with minor clinopyroxene exsolution lamellae) and olivine, with lesser amounts of sodic plagioclase (6.5 vol%), chromite, clinopyroxene (with minor orthopyroxene exsolution lamellae), Na-Mg-merrillite (grain size up to 0.5 mm), kamacite (some as relatively large grains up to 1.1 mm) and troilite.
Geochemistry: Orthopyroxene ($Fs_{12.6}Wo_{2.5}$, FeO/MnO = 14.7–15.9), olivine ($Fa_{14.3}$, FeO/MnO = 24.7–27.1), plagioclase ($An_{17.8–20.1}Or_{4.8–3.7}$), chromite (Cr/(Cr+Al) = 0.853, Mg/(Mg+Fe) = 0.337–0.342, mean TiO_2 = 0.77 wt%) Oxygen Isotopes (D. Rumble, *CIW*): $\delta^{18}O$ (‰) = 3.168, 3.189, 3.467, 2.894; $\delta^{17}O$ = 0.829, 0.757, 0.939, 0.613; $\Delta^{17}O$ = −0.837, −0.920, −0.884, −0.909.
Classification: Achondrite (lodranite).
Specimens: A total of 12.0 g and one polished thin section are on deposit at *UWS*. *GHupé* holds the main mass.

Northwest Africa 4536
Northwest Africa
Find: December 2006
Achondrite (eucrite)
History: Purchased in Erfoud (Morocco) in December 2006.
Physical characteristics: One piece with nearly complete (90%) shiny dark, cracked fusion crust and deep, well-formed regmaglypts. Interior is light greenish-yellow in color. Sawn section displays two lithologies: one fine-grained with millimeter length laths, dark needles (plagioclase and pyroxene) and white spots, the other is gray and brecciated with dominant pyroxene. Total weight, 283.1 g.
Petrography: (A. Jambon, O. Boudouma and D. Badia, *UPVI*) Fine-grained lithology dominated by equant grains of plagioclase and pigeonite. Accessories phases are ilmenite, augite, silica, and troilite. Plagioclase and pigeonite form equant sub-hexagonal crystals of about 5–20 μm. Mode (vol%): Plagioclase 44, pigeonite 27, augite 16, silica 10, ilmenite and troilite 1, fractures and voids 3. The coarse-grained lithology is dominated by shocked basaltic eucrite with grains of 0.2 to 1 mm. Laths of plagioclase interstitial to pyroxene.
Mineralogy: (EMPA and SEM). Plagioclase An_{89}; pigeonite $En_{35}Fs_{63}Wo_2$, FeO/MnO = 33, Mg# = 0.36; augite $En_{30}Fs_{30}Wo_{40}$, FeO/MnO = 34, Mg# = 0.50.
Classification: Basaltic, dimict eucrite; fresh sample, no weathering is observed.
Type specimens: A total of 20 g and one polished section are on deposit at *UPVI. P. Thomas* at Meteoritica (France) holds the main mass.

Northwest Africa 4537
Morocco
Find: 2005
Achondrite (aubrite)
History: Purchased in 2006, by Matteo Chinellato, from a Moroccan dealer in Erfoud.
Physical characteristics: A single green complete stone lacking fusion crust with a total weight of 261 g and displaying minute spots of yellow-orange staining and larger dark brown on the exterior.
Petrography: (V. Moggi Cecchi and G. Pratesi, *MSP*) The thin section displays a uniform very fine-grained

equigranular texture consisting of bladed grains of enstatite with sporadic clasts of enstatite (up to 0.7 mm across). The grain size is variable from 80 to 210 μm in width and up to 270 μm in length. Relatively few enstatite grains exhibit lamellar twinning. Other silicate phases include plagioclase, blades of daubreelite up to 50 μm in width, and rare troilite, Fe,Ni metal and schreibersite grains rounded. Minor barite and calcite are present, probably due to terrestrial weathering.

Geochemistry: Pyroxene ($En_{98.5}Wo_{1.5}$; Al_2O_3 = 0.19 wt%), plagioclase ($An_{14.3}Or_{4.1}$). Oxygen isotopes (R. Greenwood, I. Franchi, *OU*) $\delta^{17}O$ = 2.650‰; $\delta^{18}O$ = 5.021‰; $\Delta^{17}O$ = +0.039‰.

Classification: Achondrite (aubrite). Minor weathering effects on troilite, and minor yellow-orange staining on exterior surface.

Type specimen: A total of 136 g, one polished thin section and one block are on deposit at *MSP*; the *Museo di Storia Naturale dell'Università di Firenze* holds the remaining 125 g mass.

Northwest Africa 4642

Northwest Africa
Find: 2006
Enstatite achondrite

History: The meteorite was found by an anonymous finder in northwest Africa and bought by the main mass holder in Erfoud, Morocco.

Physical characteristics: One fragment of 483.2 g partly covered with fusion crust was found.

Petrography: (A. Greshake, *MNB*) The meteorite predominantly consists of subhedral enstatite grains. Minor phases include feldspar, Fe-Cr-sulfides, and rare Fe,Ni-metal; no chondrules were found.

Geochemistry: Pyroxene, $Fs_{0–1.2}$. Oxygen Isotopes (I. A. Franchi and R. C. Greenwood, *OU*): $\delta^{17}O$ = 2.975‰, $\delta^{18}O$ = 5.614‰, $\Delta^{17}O$ = 0.056‰.

Classification: Enstatite achondrite; low degree of shock, moderate degree of weathering.

Type specimens: A total of 22.6 g and one polished thin section are on deposit at *MNB*. *HSSH* holds the main mass.

Northwest Africa 4722

Morocco
Find: January 2006
Ordinary chondrite (LL3)

History: Stones were purchased in Erfoud by C. Giessler in January 2006.

Physical characteristics: 48 small, crusted stones with brownish interiors, totaling 294 g.

Petrography: (M. Bourot-Denise, *MNHNP*) The meteorite displays a homogeneous texture with mm-sized chondrules. BSE images point to an unequilibrated chondrite, with large type II FeO-rich chondrules, and small (<500 μm in size) type I, FeO-poor chondrules. In the type I chondrules, olivines are sometimes zoned. Rare metal and sulfide occur in large nodules (100–200 μm). Terrestrial alteration has significantly affected the matrix and the opaque minerals in the matrix.

Geochemistry: Olivine, $Fa_{13.5 \pm 11.1}$, range $Fa_{0.8–36.5}$, CaO up to 0.18, Cr_2O_3 = 0.15 (both wt%); low-Ca pyroxene, $Fs_{10.3 \pm 9.5}$, range $Fs_{1.1–27.7}$. Magnetic susceptibility: (J. Gattacceca, *CEREGE)* $\log\chi$ = 3.23 (10^{-9} m^3/kg) is consistent with a weathered LL chondrite.

Classification: Ordinary chondrite (LL3, estimated subtype 3.4); weathering grade W3; shock stage S1.

Type specimens: A total of 24.3 g of sample (4 sawn fragments) and one polished mount are on deposit at *MNHNP. C. Giessler* holds the main mass.

Northwest Africa 4735

Erfoud, Morocco
Find: 2003
Primitive achondrite (acapulcoite/lodranite)

History: Bought in Erfoud in 2003.

Physical characteristics: One single stone of 64 g, prismatic shaped, about 2 × 1.5 × 5 cm. The thin dark brown fusion crust is rather fresh. Discrete, millimeter-sized regmaglypts are visible. One surface is broken.

Petrography: (A. Jambon, O. Boudouma and D. Badia. *UPVI*) Study of a polished section of 1 cm^2 reveals the rock is composed mostly of mm-sized low Ca pyroxene. Interstitial metal patches from 0.1 up to 1 mm are observed (kamacite sometimes enriched in Ni due to secondary oxidation). Most are rimmed by iron oxide. Iron sulfide may or may not be associated with metal. Olivine crystals may be as large as low Ca pyroxene mostly altered and replaced by clay minerals. Plagioclase and diopsidic pyroxene are subsidiary smaller interstitial phases. Some μm-sized rounded clinopyroxene crystals are poikilitically enclosed in plagioclase. The texture is equilibrated granulitic. Thin irregular fractures are filled with iron oxides. Mode (vol%): Low-Ca pyroxene 50.4, olivine and its alteration products about 5–10, diopsidic pyroxene 6.0, plagioclase 6.6, kamacite 17 (4.2 metal plus 8.8 oxidized), chromite 4, troilite 8.1, voids 1.3. Minor serpentine and chlorite.

Geochemistry: Olivine Fa_{10}. Low Ca pyroxene $En_{91}Fs_8Wo_1$. Diopside: $En_{50}Fs_4Wo_{46}$ with 1.1 wt% Cr_2O_3. Chromite (Cr_2O_3 = 62.6%, Al_2O_3 = 5.7%, MgO = 9.3%, MnO = 2.6%, FeO = 15.8, TiO_2 = 0.9%) kamacite (Ni = 7.0%; Co/Ni = 0.063). Feldspar $Ab_{81}An_{12}Or_7$. Logχ (nm^3/kg): 5.6.

Classification: Primitive achondrite (acapulcoite-lodranite) According to grain size this rock could be classified as a lodranite; according to its opx/olivine ratio it could be considered as an acapulcoite.

Type specimens: A total of 12.2 g and one polished section are on deposit at *UPVI. Moroccan Import (Asnières, France)* holds the main mass.

Northwest Africa 4742

Morocco
Find: 2001

Achondrite (polymict ureilite)

History: This meteorite was purchased from nomads in Erfoud and acquired by *MNHN* in 2007.

Physical characteristics: The meteorite comprises a single stone, light tan in color, with altered fusion crust and prominent crystals. It also contains numerous bright crystallites (diamonds). A one-cm splinter on one edge is covered with some thin desert varnish. The total mass of the stone is 376 g.

Petrography: (M. Denise, *MNHNP Paris*; A. Jambon, O. Boudouma, D. Badia, *UPVI*; C. Le Guillou and J-N Rouzaud, *ENS Paris*) Classification by EMPA, SEM, and Raman spectroscopy is based on examination of one polished section. The sample contains abundant mm-sized clasts (~30 vol%) of olivine with Fo-rich rims. Within the clasts, reduction rims extend over about 50 μm. The clasts are surrounded by a matrix composed of olivine, low-Ca pyroxene, and subsidiary augite of typically 20–30 μm with a mosaic texture. Numerous mm-sized, interconnected clusters of carbon infill fractures in the matrix. Carbon (~3.5 vol%) is partly amorphous, mostly polycrystalline aggregates of diamond and lonsdaleite (TEM, Raman, XRD) up to several mm and is found in systematic association with oxidized iron sulfide and metal. The thin section also shows rare Ca-carbonate filled veins.

Mineral compositions and geochemistry: Olivine clasts (core) Fo_{79}; Cr_2O_3 0.6%, CaO 0.3%; FeO/MnO = 44; rims and interstitial olivine up to Fo_{96}. Abundant low-Ca pyroxene: $En_{84}Fs_{15}Wo_1$; FeO/MnO = 42. Minor high-Ca pyroxene variable up to: $En_{45}Fs_{10}Wo_{45}$; FeO/MnO = 29, Mg# 75 to 81. Remnants of kamacite with 2% Ni are usually altered. Oxygen isotopes (R. Greenwood and I. Franchi, *OU*) $\delta^{17}O = 4.71‰$, $\delta^{18}O = 9.61‰$ $\Delta^{17}O = -0.29‰$.

Classification: Polymict ureilite

Type specimens: A specimen of 32 g and one polished section are on deposit at *UPVI*. *MNHNP* Paris holds the main mass. 10 g *Moroccan Imports*, Asnières, France.

Northwest Africa 4748

Northwest Africa
Find: 2005
Achondrite (eucrite, polymict)

History: The meteorite was bought by the main mass holder from a Moroccan dealer during the Munich Mineral Fair, Germany, 2005. The exact find location is not known.

Physical characteristics: Single oval stone of 80 g with a partly weathered shiny black fusion crust. The half of the stone that was wedged in the ground is covered with carbonate.

Petrography: (J. Schlüter, *Hamb*) Breccia, rich in mineral fragments with few lithic fragments. Rich in troilite and metal with metal grains up to 2 mm in size. Troilite occurs finely dispersed throughout the meteorite, attached to metal grains and frequently as symplectitic intergrowths with clinopyroxene (up to 400 μm in size). The main silicate phases are calcic plagioclase and clinopyroxene (pigeonite), which shows fine exsolution lamellae. Microprobe analyses of such grains give intermediate values. Further subordinate to rare components are chromite, orthopyroxene, olivine and silica.

Geochemistry: Plagioclase (n = 18) $An_{94.09}Ab_{5.79}Or_{0.12}$, pigeonite (n = 13) $Fs_{44.49}En_{53.23}Wo_{2.28}$. Several further clinopyroxene grains with differing chemistry (higher Wo or lower Fs). Orthopyroxene (n = 2) $Fs_{26.62}En_{70.63}Wo_{2.75}$. Olivine in a lithic fragment (n = 2) $Fa_{33.60}$. Metal with 5.09 wt% Ni (n = 3) and 40.15 wt% Ni (n = 1).

Classification: Achondrite, brecciated (eucrite, polymict). Appears to have a low degree of shock and minor weathering.

Type specimens: A 17 g sample and one polished thin section are on deposit at *Hamb*. *Wuthenau*, holds the main mass.

Northwest Africa 4799

Algeria
Find: May 2007
Achondrite (aubrite)

History: Purchased by Greg Hupé in May and October 2007 from a Moroccan dealer in Tagounite.

Physical characteristics: Eighty-six light brown stones and fragments (total 365 g); most are complete, some are broken, and some have remnant fusion crust.

Petrography: (A. Irving and S. Kuehner, *UWS*) The overall texture is that of a brecciated igneous rock, with larger angular to rounded clasts (some showing cumulus texture) in a matrix of smaller grains. The dominant mineral is pure enstatite with lesser amounts of interstitial albite (some in graphic intergrowths with a silica polymorph) and accessory Si-bearing kamacite, Ti-Cr-bearing troilite, oldhamite, niningerite, Ti-bearing daubreelite and schreibersite. The enstatite grains exhibit polysynthetic twinning indicative of inversion from former clinoenstatite. Grain boundary coatings of goethite or limonite and orange staining along enstatite cleavage planes, as well as veinlets of calcite, are evidently products of terrestrial desert weathering.

Geochemistry: Enstatite ($En_{99.5}Fs_{0.1}Wo_{0.4}$), kamacite (Fe 92.1 wt%, Ni 4.5 wt%, Si 3.4 wt%).

Classification: Achondrite (aubrite).

Specimens: A total of 20.1 g and one polished thin section are on deposit at *UWS*. *GHupé* holds the main mass.

Northwest Africa 4801

Algeria
Find: May 2007
Achondrite (angrite)

History: Greg Hupé purchased the single stone in Erfoud, Morocco. The stone is broken into four pieces (total weight 252 g) and was found in Algeria in May 2007.

Physical characteristics: Friable specimen composed of relatively coarse dark reddish-brown, pale yellow-green, white and black grains, with some large white patches

(polycrystalline anorthite aggregates). No fusion crust is evident.

Petrography: (A. Irving and S. Kuehner, *UWS*) The overall texture is granular with the presence of some polygonal grain aggregates and triple grain junctions. Grain size ranges from 0.1–1.2 mm. It is composed mostly of Al-Ti clinopyroxene and pure anorthite (some as polycrystalline aggregates up to 0.5 cm across), with sporadic large Cr-pleonaste grains (up to 200 mm across), calcic olivine, pleonaste, poikilitic merrillite and minor troilite and altered kamacite. Subhedral olivine grains are enclosed by clinopyroxene, and both these and pleonaste are surrounded by interstitial anorthite and merrillite. Pleonaste occurs as small grains throughout the specimen, but also as mantles around the large Cr-pleonaste grains, and those mantles contain abundant chadacrysts of subhedral olivine and clinopyroxene. Small cavities (2–5 μm across) within clinopyroxene contain olivine and anorthite grains. Kirschsteinite is absent, and merrillite is more abundant than in most other known angrites.

Geochemistry: Clinopyroxene ($Fs_{11.8}Wo_{56.9}$; Al_2O_3 = 10.6 wt%, TiO_2 = 2.4 wt%, FeO/MnO = 133), olivine ($Fa_{45.5}Ln_{2.4}$, FeO/MnO = 88), spinel (Cr-pleonaste: Cr_2O_3 = 6.3 wt%, Cr/(Cr + Al) = 0.070, Mg/(Mg + Fe) = 0.451; pleonaste: Cr_2O_3 = 1.9–2.4 wt%, Cr/(Cr + Al) = 0.021–0.026, Mg/(Mg + Fe) = 0.462–0.467). Oxygen isotopes (D. Rumble, *CIW*): $\delta^{18}O$ = 3.595, 3.544; $\delta^{17}O$ = 1.809, 1.823; $\Delta^{17}O$ = –0.082, –0.041 ‰.

Classification: Achondrite (angrite).

Specimens: A total of 20.0 g, one polished thin section and one polished mount are on deposit at *UWS*. *GHupé* holds the main mass.

Northwest Africa 4812

Northwest Africa
Find: 2006
Carbonaceous chondrite (CK)

History and physical characteristics: A 68 g stone was purchased in Erfoud, Morocco, by Stefan Ralew in 2006. Patchy distribution of dark gray fusion crust and desert etching.

Petrography: (T. Bunch and J. Wittke, *NAU*) dark interior with very dark chondrules and shock-melt clasts, the matrix is nearly opaque. Highly shocked and shock-darkened by melting to partial melting of matrix and redistribution of fine-grained magnetite similar to shock darkening of ordinary chondrites and redistribution of fine-grained metal droplets. Contains olivine, orthopyroxene, pigeonite, plagioclase, felsic glasses, Cr-magnetite, FeS, and pentlandite. The shock level is S5 and weathering grade is low.

Mineral compositions: Olivine, $Fa_{30.3}$ (FeO/MnO = 110); orthopyroxene, $Fs_{26.4}Wo_{0.7}$ (FeO/MnO = 74); pigeonite, $Fs_{21.1}Wo_{12.1}$ (FeO/MnO = 64); plagioclase, $An_{59.3}$ and magnetite, Cr_2O_3 = 3.64 wt% and Al_2O_3 = 1.26 wt%.

Classification: Carbonaceous chondrite (CK). High shock effects preclude further subtype classification.

Type specimen: A total of 6.9 g and one thin section are on deposit at *NAU*. *S. Ralew* is the main mass holder.

Northwest Africa 4816

Northwest Africa
Find: 2006
Achondrite (acapulcoite)

History and physical characteristics: A 63 g stone was purchased in Erfoud, Morocco, in 2006 by Stefan Ralew. The partial stone has moderate surface weathering of broken areas. Small metal spherules and droplets protrude through a thin, residual fusion crust.

Petrography: (T. Bunch and J. Wittke, *NAU*) Highly enriched in kamacite metal, mineral modes (in vol%) are orthopyroxene, 33; olivine, 25; kamacite, 24; diopside, 15, plagioclase and felsic glass, 3 and FeS + chromite, 1.0. Silicates are fine-grained (mean = 0.60 mm) and show euhedral to subhedral grain outlines. Orthopyroxene contains micrometer-sized glass blebs. Rare, round to ovoid granular clusters may represent relict chondrules. Shock level is S2 and the weathering grade is W1.

Mineral compositions: Olivine, $Fa_{5.6}$; FeO/MnO = 12. Orthopyroxene is $Fs_{6.2}Wo_{2.1}$, FeO/MnO = 9 and diopside is $Fs_{2.8}Wo_{45.5}$, FeO/MnO = 7. Plagioclase is An_{66}, chromite *cr#* = 69 and kamacite contains 6.1 wt% Ni. Felsic glass is (in wt%): SiO_2, 51.2; Al_2O_3, 20.3; CaO, 10.8; Na_2O, 2.6; K_2O, 0.8; MgO, 12.0 and FeO. 3.1.

Classification: Achondrite (acapulcoite).

Type specimen: A 12.4 g sample is on deposit at *NAU*. *S. Ralew* holds the main mass.

Northwest Africa 4824

Northwest Africa
Find: 2007
Achondrite (eucrite, monomict breccia)

History and physical characteristics: A 97 g fully crusted, fresh stone was purchased in Tucson at the Tucson Gem and Mineral Show in January 2007.

Petrography: (J. Wittke and T. Bunch, *NAU*) Highly shocked monomict, basaltic eucrite breccia. Partially recrystallized with plagioclase glass, mosaic to recrystallized pyroxenes, and dark, shock-melt clasts.

Mineral compositions: Pigeonite host, $Fs_{56.6}Wo_{5.7}$; augite lamellae, $Fs_{33.2}$ $Wo_{32.6}$. Plagioclase is $An_{90.8}$.

Classification: Achondrite (eucrite, monomict breccia).

Type specimen: 19.7 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 4825

Northwest Africa
Find: 2006
Achondrite (eucrite, polymict)

History and physical characteristics: A 226 g complete stone with moderately fresh fusion crust was purchased in Tucson at the Tucson Gem and Mineral Show in January 2007.

Petrography: (J. Wittke and T. Bunch, *NAU*) A brecciated polymict eucrite with cataclastic flow veins and partially recrystallized matrix. Consists of cumulate, subophitic, and ophitic basalt clasts. A portion of the plagioclase was converted to maskelynite by shock and most pyroxenes are shock-decorated. Weathering grade is very low.
Mineral compositions: subophitic orthopyroxene host, $Fs_{56.8}Wo_{3.6}$ (FeO/MnO = 30–32); exsolution lamellae, $Fs_{29}Wo_{39.5}$. Pigeonite is $Fs_{56.7}Wo_{8.8}$ and plagioclase is $An_{90.2–94.5}$. Minor minerals include silica, chromite, ilmenite, and FeS.
Classification: Achondrite (eucrite, polymict).
Type specimen: A total of 23.1 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 4826
Northwest Africa
Find: 2006
Achondrite (howardite)
History and physical characteristics: A 344 g fully crusted stone with fine-grained, light grey interior was purchased in Tucson at the Tucson Gem and Mineral Show in January 2007.
Petrography: (T. Bunch and J. Wittke, *NAU*) Consists mostly of two major eucrite lithologies and diogenitic fragments that display complicated sector and reverse zoning. The medium-grained eucrite (lithology A) is enriched in ilmenite and chromite and contains polygonized pyroxene, plagioclase is partially converted to maskelynite. Eucrite lithology (B) is less shocked and contains pigeonite with well-developed exsolution lamellae and is present as matrix fragments. Diogenitic fragments consist of those that are unzoned, those that are sector zoned, and several large fragments that show dramatic reverse zoning and patches of augite. The weathering grade is low.
Mineral compositions: Lithology (A) orthopyroxene host, $Fs_{50.3}Wo_{1.3}$ (FeO/MnO = 31), lamellae, $Fs_{23.7}Wo_{45.2}$. chromite *cr#* = 63 and plagioclase is $An_{93.8–97.8}$. Lithology (B) Ca-poor pyroxene is $Fs_{40.2}Wo_{4.6}$ (FeO/MnO = 29) and the lamellae are $Fs_{28.3}Wo_{30.1}$. Sector zoned orthopyroxene cores are $Fs_{25.3}Wo_{2.6}$ (FeO/MnO = 28) and rims are $Fs_{36.9–44.6}Wo_{2.3–3.2}$. Most pigeonite cores with reverse zoning are $Fs_{45}Wo_{14}$, rims are $Fs_{32.5}Wo_{19}$, and included augite is $Fs_{29}Wo_{35.7}$. One FeO-rich orthopyroxene grain has a core of $Fa_{70.5}Wo_{2,8}$ (FeO/MnO = 35) and a rim of $Fs_{56.6}Wo_{2.8}$.
Classification: Achondrite (howardite).
Type specimen: A 21.3 g specimen is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 4830
Northwest Africa
Find: 2006
Achondrite (eucrite, monomict)
History and physical characteristics: A 38 g fully crusted stone with moderately fresh fusion crust was purchased at the Denver Gem and Mineral Show in September 2006.
Petrography: (T. Bunch and J. Wittke, *NAU*) This stone is a monomict, eucrite basalt with granoblastic texture. Most of the sample was recrystallized into an assemblage of very fine-grained polygons (<0.03 mm). Vestiges of the original texture show a fabric of divergent plagioclase laths and interstitial pyroxenes. Maximum length of the plagioclase laths is <0.4 mm. Weathering effects are minimal.
Mineral compositions: (relict and recrystallized minerals are essentially the same). Orthopyroxene, $Fs_{60.5}Wo_{2.1}$ (FeO/MnO = 32); augite, $Fs_{37.4}Wo_{35.5}$; plagioclase, An_{93}; chromite *cr#* = 84.
Classification: Achondrite (eucrite, monomict).
Type specimen: A total of 7.7 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 4831
Northwest Africa
Find: 2006
Achondrite (eucrite)
History and physical characteristics: A 154 g, partial stone with moderately fresh fusion crust, was purchased at the Denver Gem and Mineral Show in September 2006.
Petrography: (J. Wittke and T. Bunch, *NAU*) A monomict cumulate eucrite with breccia-within-breccia texture. Clasts tend to be subrounded and contain orthopyroxenes that are commonly devoid of exsolved Ca-pyroxenes. Plagioclase contains µm-sized oriented pyroxene inclusions. Weathering grade is low.
Mineral compositions: Orthopyroxene, $Fs_{46.7–52}Wo_{2.2–3.1}$ (FeO/MnO = 32); augite, $Fs_{36.4}Wo_{44.7}$; plagioclase $An_{88–91.1}$.
Classification: Achondrite (eucrite, monomict cumulate).
Type specimen: A total of 21.4 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 4832
Northwest Africa
Find: 2006
Achondrite (aubrite)
History and physical characteristics: Hundreds of platey fragments, the largest weighing 33.1 g, were found in northwest Africa and purchased by A. Aaronson in 2007. The total known weight is 268 g. Fragments tend to break along the preferred orientation plane of constituent enstatite grains. Most of the dark brown pieces are moderately to heavily weathered, a few show small, fresh metal nuggets.
Petrography: (T. Bunch and J. Wittke, *NAU*) composed mostly of fine-to medium-grained (0.3 to 1.2 mm), euhedral to subhedral cumulate enstatite together with interstitial metal, schreibersite, graphite, FeS, a silica phase present as round inclusions in FeS, daubreelite, brezinaite and very fine-grained intercumulus plagioclase. Much of the metal is oxidized. The stone is unbrecciated with a low shock level.
Mineral chemistry: Enstatite is essentially Fe-free ($En_{99.6}Fs_{0.1}Wo_{0.3}$). Kamacite contains 4.5 to 5.6 wt% Si and FeS contains 2.6 wt% Ti. The rare mineral brezinaite contains S, 45.2 wt%; Cr, 36.9 to 46.6 wt%; Fe, 18.7 to 9.0 wt% and 1.1 wt% Mn.
Classification: Achondrite (aubrite)

Type specimen: A total of 20.6 g is on deposit at *NAU*. *Aaronson* is the main mass holder.

Northwest Africa 4833
Northwest Africa
Find: 2007
Achondrite (lodranite)

History and physical characteristics: A 608 g dark stone with a dull desert varnish and no remaining fusion crust was found in northwest Africa in 2007 and purchased by *A. Aaronson* in July 2007.

Petrography: (T. Bunch and J. Wittke, *NAU*) The stone displays a coarse-grained (olivine grains up to 6 mm) hypidiomorphic texture. Orthopyroxene shows a common lobate grain boundary relationship with olivine. Orthopyroxene is highly decorated with exsolved linear to bleb-shaped diopside (0.002 to 0.04 mm in size) that is oriented parallel to at least three crystal planes of the orthopyroxene host. Olivine is decorated with 0.005–0.02 mm sized ovoid-shaped microlites of plumose chromite set in anhedral diopside. Mineral modes (vol%) are: olivine = 65, orthopyroxene = 30, metal and oxidized metal = 2, chromite and diopside = 3, no plagioclase was found. The shock level is S3 based on moderate mosaic extinction in olivine and orthopyroxene and minor shock twinning in both.

Mineral compositions: Olivine ($Fa_{10.1}$; FeO/MnO = 23), orthopyroxene ($Fs_{9.4}Wo_{2.3}$; FeO/MnO = 14), diopside ($Fs_{8.0}$ $Wo_{45.9}$; FeO/MnO = 11), metal (2.98 wt% Ni) and FeS Cr = 1.1 wt%. Chromite *cr#* = 85.

Classification: Achondrite (lodranite).

Type specimen: A 22.2 g sample is on deposit at *NAU*. *A. Aaronson* holds the main mass.

Northwest Africa 4858
Morocco or Algeria
Find: 2004
Achondrite (howardite)

History: Purchased in July 2004 in Erfoud, Morocco, by Edwin Thompson.

Physical characteristics: A single stone weighing 329 g with a partial brown/black fusion coating.

Petrography: (A. Ruzicka and T. J. Schepker, Cascadia) In hand specimen, sample is light gray with numerous bright green crystals. It is clearly a polymict breccia with angular to subrounded clasts. These include coarse-grained diogenitic orthopyroxene clasts, which make up greater than 10% of the total material. Additionally, there are coarse-grained plagioclase mineral clasts, eucritic rock clasts that contain inverted pigeonite and plagioclase ± a silica mineral, pigeonite mineral clasts, fine-grained clasts that are interpreted to be crystallized impact melts, and some fine-grained pseudotachylite veins. Relatively rare oxide minerals are also present.

Mineral compositions and geochemistry: Most pyroxene and plagioclase grains show modest chemical zoning, but compositions between clasts differ significantly. Pyroxene types include diogentitic orthopyroxene ($Wo_{0.7–5}$ $En_{58–77}$ $Fs_{21–39}$, n = 22), non-inverted pigeonite ($Wo_{5–15}$ $En_{37–56}$ $Fs_{36–55}$, n = 9), inverted pigeonite, which contains lamellae of orthopyroxene ($Wo_{3–5}$ $En_{34–49}$ $Fs_{46–62}$, n = 9), and augite ($Wo_{41–43}$ $En_{31–36}$ $Fs_{21–29}$, n = 2). Plagioclase is fairly calcic ($Ab_{3–15}$, $An_{84–97}$, $Or_{0–1}$, n = 33).

Classification: Achondrite (howardite). Degree of shock varies from clast to clast and evidence of shock melting in a few clasts. Weathering is minimal.

Type specimens: A total of 42 g and one thin section are on deposit at *Cascadia*. *Thompson* holds the main mass.

Northwest Africa 4864
Northwest Africa
Find: 2007
Achondrite (Martian, basaltic shergottite)

History: On July 16, 2007, a person brought 10 pieces totaling 94 g to the Institut für Planetologie (Münster) for classification.

Physical characteristics and petrography: (A. Bischoff, *Mun*) The rock is slightly weathered and relatively coarse-grained. The main constituents, pyroxene and maskelynite, have sizes up to 2 mm (Fig. 1). Near equal abundances of these phases are estimated. In some pyroxenes, glassy melt veins and pockets are visible. Minor phases include ilmenite, Fe-sulfide, and phosphate.

Mineral compositions and geochemistry: The mean composition of pyroxene is $Fs_{50 \pm 5}$; $Wo_{13 \pm 2}$. Maskelynite $An_{51 \pm 3}$. Oxygen isotopes (A. Pack and A. Suessenberger, *University of Göttingen*) revealed: 1st analysis: $\delta^{18}O = +5.3 \pm .25‰$, $\delta^{17}O = +3.5 \pm 0.15‰$, $\Delta^{17}O = +0.31 \pm 0.03‰$, 2nd analysis: $\delta^{18}O = +5.1 \pm 0.25‰$, $\delta^{17}O = +3.4 \pm 0.15‰$, $\Delta^{17}O = +0.33 \pm 0.03‰$.

Classification: Achondrite (Martian, basaltic shergottite)

Type specimens: 19 g and one polished thin section is on deposit at *Mun*. An anonymous collector holds the main mass.

Northwest Africa 4869
Algeria
Find: 2006
Achondrite (howardite)

History and physical characteristics: A 191 g dark brown stone with little fusion crust was purchased in Morocco in July 2007 by A. Aaronson.

Petrography: (J. Wittke and T. Bunch, *NAU*) A complex breccia rich in silica minerals and basaltic eucrites, microbasalts, FeO-rich ferrosilite/hedenbergite/fayalite lithologies, shock melt clasts, and diogenitic pyroxene fragments that comprise 14 vol% of the stone. A silica polymorph is enriched in many of the eucrite lithologies and may account for up to 15 vol% of the

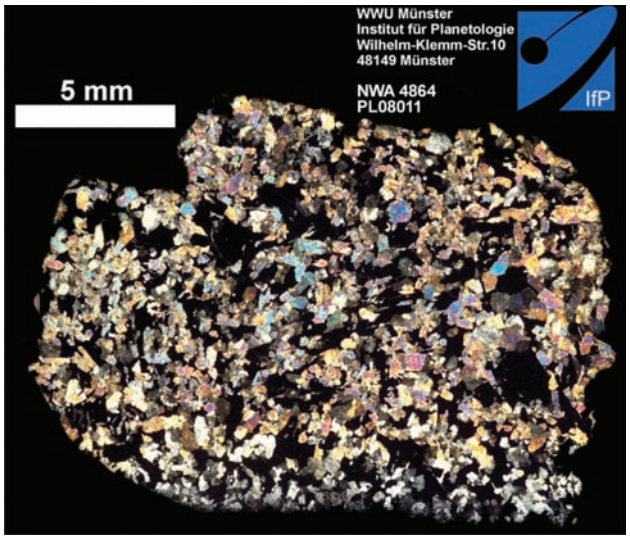

Fig. 1. Cross-polarized light photomicrograph of NWA 4864.

gabbroic basalts and as much as 21 vol% of medium to fine-grained basalts. The shock level is high with most plagioclase present as maskelynite. Weathering grade is moderate.

Mineral compositions: Subophitic orthopyroxene host, $Fs_{53}Wo_{4.5}$ (FeO/MnO = 26); exsolved augite, $Fs_{26.3}Wo_{44}$; plagioclase (maskelynite), An_{92}. Cumulate unexsolved pigeonite, $Fs_{45.5}Wo_{12.6}$ and maskelynite, An_{84}. Silica-rich basalt host pyroxene, $Fs_{61.1}Wo_{3.1}$; lamellae, $Fs_{32.7}Wo_{42}$; olivine, $Fa_{60.6}$ (FeO/MnO = 44); maskelynite, An_{69} Diogenitic pyroxenes, $Fs_{28–34.4}Wo_{1.1–1.4}$ (FeO/MnO = 29). Minor minerals include chromite, *cr#* = 78–88, merrillite, Ni-poor metal, ilmenite and FeS.

Classification: Achondrite (howardite).

Type specimen: A total of 20.1 g is on deposit at *NAU*. *Aaronson* holds the main mass.

Northwest Africa 4871

Morocco
Find: 2006
Achondrite (aubrite)

History and physical characteristics: Sixty-one pieces with a total weight of 906 g were purchased in Tagounite, Morocco in May 2007. Most of the stones are medium to dark brown with some remnant fusion crust.

Petrography: (T. Bunch and J. Wittke, *NAU*) A brecciated cumulate rock with clasts as large as 2 cm. The intact lithology is dominated by subhedral to anhedral polysynthetically twinned enstatite with fine-grained intercumulus intergrowths of feldspathic glasses and a silica phase. Other minerals include graphite, FeS, daubreelite, schreibersite, niningerite, perryite as exsolution lamellae in Si-bearing kamacite and Zn-bearing brezinaite. Large clasts show a multitude of sub-parallel, closely spaced compression fractures. Shock level is S3 and the weathering grade is W5 for small pieces (<3 cm) and W3 for the interiors of larger specimens.

Mineral compositions: Enstatite is essentially Fe-free ($Fs_{0.1}Wo_{0.3}$), kamacite Si content is 3.1 to 3.6 wt% and perryite is (in wt%): Si, 12.4; Fe, 4.5; Ni, 77.5 and P, 3.8. ferroan brezinaite is (in wt%): Cr, 43.2; S, 44.1; Fe, 6.3; Mn, 1.2; Zn, 5.1.

Classification: Achondrite (aubrite), possibly paired with NWA 4799.

Type specimen: A total of 22.3 g is on deposit at *NAU*. *Aaronson* holds the main mass.

Northwest Africa 4875

Northwest Africa
Find: 2007
Achondrite (lodranite)

History and physical characteristics: A 904 g dark brown stone was purchased by A. Aaronson in Morocco in July 2007. The irregular-shaped stone has no remnant fusion crust and has been desert-polished.

Petrography: (T. Bunch and J. Wittke, *NAU*) This coarse-grained harzburgite-like specimen is brecciated and contains olivine and orthopyroxene grains of ~equal size (up to 5 mm in diameter). In addition, intact lithologic clasts contain minor interstitial clinopyroxene, kamacite, troilite, and pentlandite, no plagioclase was found. Olivine shows small (<0.02 mm), randomly oriented irregular- to ovoid-shaped inclusions of chromite and diopside. Some of these inclusions exhibit a symplectitic relationship with host olivine. Orthopyroxene has twin lamellae and tiny metal and sulfide inclusions oriented parallel to the (100) crystallographic plane. Oxidation of kamacite is extensive and imparts a dark stain throughout the sample. Shock level is S3.

Mineral compositions: Olivine is $Fa_{10.3}$ and FeO/MnO = 24; orthopyroxene is $Fs_{9.6}Wo_{1.4}$ and FeO/MnO = 14; clinopyroxene is $Fs_{3.6}Wo_{45.7}$ and contains 1.35 wt% Cr_2O_3. Chromite *cr#* is 84 and troilite contains 2.5 to 5.4 wt% Ni.

Classification: Achondrite (lodranite), possibly paired with NWA 4478, but not with NWA 4833.

Type specimen: A total of 21.2 g is on deposit at *NAU*. *A. Aaronson* holds the main mass.

Northwest Africa 4925

Erfoud, Morocco
Find: 2007
Achondrite (Martian, olivine-phyric shergottite)

History: The meteorite was found by an anonymous person in northwest Africa and bought by the main mass holder in Erfoud, Morocco.

Physical characteristics: One fragment partly covered by fusion crust weighing 282.3 g was found.

Petrography: (A. Greshake, *MNB*) The meteorite displays a porphyritic texture with large chemically zoned olivine megacrysts set into a fine-grained groundmass composed of pyroxene and maskelynite. Minor phases include chromite, sulfides, phosphates, and small Fe-rich olivines. The olivine

megacrysts often contain melt inclusions and small chromites.
Geochemistry: Mineral composition (EMPA): Olivine, $Fa_{27.6–46.8}$; pyroxene, $Fs_{20.0–37.7}Wo_{3–14.8}$; maskelynite, $An_{67–69}$.
Classification: Achondrite (Martian, olivine-phyric shergottite); severely shocked with some melt pockets; moderately weathered.
Specimens: A total of 20.1 g plus one polished thin section are on deposit at *MNB*. Ralew holds the main mass.

Northwest Africa 4932
Algeria
Find: October 2007
Achondrite (lunar, feldspathic breccia)
History: Purchased by Greg Hupé from a Moroccan dealer in Tagounite, Morocco, in October 2007.
Physical characteristics: A single, light colored 93.3 g stone. The interior is light gray, mostly very fine grained with a few white clasts (Fig. 2), and prominent but sparsely distributed metal grains (surrounded by hydroxide staining).
Petrography: (A. Irving and S. Kuehner, *UWS*) Breccia composed of small gabbroic to troctolitic clasts (granular aggregates of rounded olivine grains and calcic plagioclase enclosed within low-Ca pyroxene with accessory Ti-chromite and troilite), sparse large grains of kamacite (up to 1 mm, partly altered to iron hydroxide) and rare large grains of silica polymorph in a dominant, very fine grained matrix of the same phases. There are secondary (terrestrial) veinlets and small patches of calcite.
Geochemistry: Low-Ca pyroxene ($Fs_{22.3–22.8}Wo_{5.9–5.3}$, FeO/MnO = 51.9–53.0; $Fs_{20.8–36.1}Wo_{7.4–12.0}$, FeO/MnO = 56.5–58.3), olivine ($Fa_{27.2–36.9}$, FeO/MnO = 87.7–96.3), plagioclase ($An_{94.9–96.4}Or_{0.3–0.1}$). Bulk composition (R. Korotev, *WUSL*): FeO 8.5 wt%, Sc 19.2 ppm, Sm 1.1 ppm, Th 0.6 ppm, Ni 450 ppm.

Fig. 2. Hand sample of NWA 4932 showing a cut surface with white clasts.

Classification: Achondrite (lunar, feldspathic breccia).
Specimens: A total of 18.7 g and one polished thin section are on deposit at *UWS*. The main mass is held by *Mr. G. Hupé*.

Northwest Africa 4937
Morocco
Find: May 2007
Achondrite (winonaite)
History: Purchased by an anonymous Moroccan dealer in Bir Elmalh Mahbas, Morocco, in May 2007.
Physical characteristics: A brown, somewhat weathered stone (212 g, broken into several fragments) with visible metal and patches of brown fusion crust. Interior silicates are fresh, but metal is partly altered to reddish-brown iron hydroxides.
Petrography: (A. Irving and S. Kuehner, *UWS*) Coarse grained (0.6–1.5 mm) protogranular aggregate of silicate phases (mostly sodic plagioclase, orthopyroxene and clinopyroxene) with abundant rounded to cuspate grains of metal (kamacite) and accessory olivine, schreibersite and troilite. No chromite was found. The estimated mineral mode is metal (+ altered metal) 40, plagioclase 28, orthopyroxene 20, clinopyroxene 10, others 2 (see image). Olivine is very rare, and occurs only as small round inclusions (up to 100 μm) within clinopyroxene.
Geochemistry: Orthopyroxene ($Fs_{7.4–7.9}Wo_{2.4–2.7}$, FeO/MnO = 8.2–9.8, 0.52 wt% Cr_2O_3), clinopyroxene ($Fs_{3.7–4.1}$ $Wo_{40.6–42.5}$, FeO/MnO = 6.3–8.1, 1.2 wt% Cr_2O_3), plagioclase ($An_{14.9–18.6}Or_{2.3–2.1}$), olivine ($Fa_{7.0}$, FeO/MnO = 12.8). Oxygen isotopes (D. Rumble, CIW): $\delta^{18}O$ = 4.370, 4.206; $\delta^{17}O$ = 1.763, 1.738; $\Delta^{17}O$ = –0.535, –0.474 (all‰).
Classification: Achondrite (winonaite). This specimen is a metal-rich gabbro-norite that contains less than 0.1 vol% olivine, and is much coarser grained than typical winonaites, yet it has oxygen isotope affinities to the latter group.
Specimens: A total of 20.1 g of sample and one polished mount are on deposit at *UWS*. The main mass is held by an anonymous collector.

Northwest Africa 5151
Algeria
Find: 2007
Achondrite (lunar, feldspathic breccia)
History and physical characteristics: A 289 g stone was purchased in Rissani, Morocco, in 2007. The exterior is reddish-brown to dark gray with minor, translucent residual fusion crust.
Petrography: (J. Wittke and T. Bunch, *NAU*) The fragmental to melt matrix contains abundant breccia-within-breccia clasts together with typical highlands lithic components that mostly include anorthosites, noritic and troctolitic anorthosites, troctolites (olivine >40 vol%), gabbros, granulites, cataclastic breccias, shock melt clasts, in addition to mare basalt clasts and mineral fragments. Several small to mm-size metal globules are scattered throughout the matrix. Numerous dark brown, shock-melt veins are present along large clast margins. Interior weathering grade is very low with no apparent alteration veins.

Mineral compositions: Noritic anorthosite orthopyroxene is $Fs_{24.4}Wo_{3.8}$ (FeO/MnO = 60), plagioclase = $An_{94.2}$. Gabbro olivine is $Fa_{34.1}$ (FeO/MnO = 97), plagioclase is $An_{88.1}$, pigeonite is $Fs_{27.9}Wo_{9.2}$ (FeO/MnO = 55), chromite Cr/(Cr + Al) = 0.65 and Ni in metal is 5.8 to 6.6 wt%.
Bulk chemistry (R. Korotev, *WUSL*): Na_2O = 0.478 wt%; Sc = 16.7 ppm, Cr = 1440 ppm; FeO = 8.52 wt%; Ni = 171 ppm; Ba = 183 ppm; Th = 1.76 ppm.
Classification: Achondrite (lunar feldspathic breccia).
Type specimen: A total of 20.3 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 5152
Morocco
Find: 2006
Achondrite (lunar, feldspathic breccia)
History and physical characteristics: A 38 g complete stone was purchased in Rissani, Morocco, in 2007. The dark gray fusion crust is mostly eroded away by wind ablation.
Petrography: (J. Wittke and T. Bunch, *NAU*) The vesiculated melt matrix regolith breccia contains an abundance of typical anorthositic lithologies that include anorthosites, anorthositic norites, troctolitic anorthosites, granulites, devitrified shock melts, breccia-in-breccias, in addition to mare basalts and mineral fragments. Interior weathering effects are minimal.
Mineral compositions: Troctolite olivine, $Fa_{27.6}$ (FeO/MnO = 95); maskelynitized plagioclase fragments, $An_{91.2–97.6}$, norite orthopyroxene, $Fs_{25.5}Wo_{3.8}$ (FeO/MnO = 62); subophitic basalt pigeonite, $Fs_{29.7}Wo_{7.8}$.
Bulk chemistry (R. Korotev, *WUSL*): Sc = 16.8 ppm; Cr = 1460 ppm; FeO = 9.03 wt%; Ni = 210 ppm; Ir = 210 ppm.
Classification: Achondrite (lunar feldspathic breccia).
Type specimen: A total of 7.7 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 5153
Morocco
Find: 2007
Achondrite (lunar, feldspathic breccia)
History and physical characteristics: A 50.4 g nearly complete stone was purchased in Erfoud, Morocco, in January 2008. The aeolian-modified fusion crust is dark gray to reddish-brown.
Petrography: (T. Bunch and J. Wittke, *NAU*; Dolores Hill, *UA*) Fragmental to melt-matrix breccia that contains an assortment of lunar highland lithologies and Mare basalts and glasses. Highland components include cataclastic gabbro, troctolite, fragments of granophyric intergrowths of K-feldspar, felsic glasses and silica. Mare components include ophitic pigeonite and olivine basalts. Interior is very fresh and lacks alteration veins.
Mineral/phase compositions: Gabbro olivine is $Fa_{31.7}$ (FeO/MnO = 99) and pigeonite is $Fs_{25.7}Wo_{9.3}$ (FeO/MnO = 53). Troctolite olivine is $Fa_{22.3}$ (FeO/MnO = 80), Ca-pyroxene is $Fs_{22.1}Wo_{17}$, chromite Cr/(Cr + Al) = 0.63, and granophyric K-feldspar is $An_{14.5}Or_{54.3}$ with BaO = 2.6 wt%. Mare ophitic pigeonite basalt olivine is $Fa_{36.7}$ (FeO/MnO = 106), pigeonite is $Fs_{7.1}Wo_{13.3}$(FeO/MnO = 65) and ilmenite MgO = 5.2 wt%. Olivine basalt olivine is $Fa_{36.2}$ (FeO/MnO = 94) and Ca-poor pyroxene is $Fs_{32.1}Wo_{13.3}$ (FeO/MnO = 62).
Bulk chemistry: (R. Korotev, *WUSL*): Na_2O = 0.476 wt%; Sc = 25.6 ppm; Cr = 1963 ppm; FeO = 12.72 wt%; Ni = 150 ppm; Co = 42.4 ppm and Sr = 132 ppm.
Classification: Achondrite (lunar feldspathic breccia).
Type specimen: 5 g and one thin section are on deposit at *NAU* and one thin section and 0.3 g are on deposit at *UA*. *D. Pitt* holds the main mass.

Northwest Africa 5191
Northwest Africa
Find: June 2006
Achondrite (brachinite)
History: A single stone was found in 2006 by anonymous finder in northwest African desert.
Physical characteristics: Partially crusted stone of 26.5 g.
Petrography: (A. Ibhi, Laboratory of Petrology, Mineralogy and Materials, Faculty of Sciences, Agadir (*LPMM*), and M. Van Ginneken and L. Folco, *MNA-SI*) It is a fine-grained (average grain size in the 100–200 μm range) granoblastic rock, consisting mainly of polygonal olivine, minor polygonal chromite and interstitial augite, and lesser, Fe-sulfide, enstatite and metal. Mafic silicates are devoid of shock features. Although the silicate minerals are fresh, terrestrial weathering has altered some of the primary sulfides and metal to hydroxides, which may also form thin veinlets along grain boundaries.
Geochemistry: Olivine ($Fa_{32.5}$), augite (Fs_{10} Wo_{45}).
Classification: Brachinite, S1, moderate weathering. Texture, mineral mode and mineral composition of mafic silicates suggest pairing with NWA 3151.
Type specimen: A total of 26.5 g and one thin section are on deposit at *LPMM*, one polished thin section at *MNA-SI*.

Northwest Africa 5207
Morocco
Find: 2007
Achondrite (lunar feldspathic breccia)
History and physical characteristics: A 101 g stone was purchased in Rissani, Morocco, in 2007 by A. Aaronson. The exterior is dark in color.
Petrography: (T. Bunch and J. Wittke, *NAU*) The fragmental matrix contains a wide variety of lithic, glassy, and shocked components that mainly include plagioclase-olivine orthocumulates, recrystallized noritic and troctolitic anorthosites, gabbros and course to fine-grained basalts, microbreccias, shock-melted lithologies, symplectites (from pyroxferroite decomposition), very sparse Apollo-like “green glasses” (A), and irregular-shaped light to dark green glasses

(B), some of which are vesicular and contain tiny metal-sulfide spherules. The interior weathering grade is very low.
Mineral/phase chemistry: Orthocumulate olivine, $Fa_{26.5}$ (FeO/MnO = 96) and plagioclase, $An_{99.3}$. Coarse-grained basalt olivine is Fa_{30}; Ca-pyroxene core, $Fs_{45.1}Wo_{30.4}$ and rim, $Fs_{62.7}Wo_{16.8}$; plagioclase, $An_{87.7}$. Fine-grained basalt olivine is $Fa_{56.9}$ (FeO/MnO = 93); Ca-pyroxene, $Fs_{28.5}Wo_{34.7}$; plagioclase, $An_{91.2}$. Green glasses (B) in wt%: SiO_2 = 43.8; Al_2O_3 = 18.7; Cr_2O_3 = 0.50; TiO_2 = 0.78; FeO = 12.5; MgO = 7.0; CaO = 15.2; K_2O = 0.33 and Na_2O = 0.58 (N = 17).
Bulk chemistry ((R. Korotev, *WUSL*): Na_2O = 0.484 wt%; Sc = 15.52 ppm; Cr = 1065 ppm; FeO = 7.56 wt%; Co = 26.7 ppm; Ni = 233 ppm; Th = 1.26 ppm and Ba = 123 ppm.
Classification: Achondrite (lunar, feldspathic breccia).
Type specimen: A total of 20 g is on deposit at *NAU*. The main mass holder is anonymous.

Northwest Africa 5217
Morocco
Find: 2007
Achondrite (aubrite)
History and physical characteristics: A 39.1 g complete and fully crusted stone was found in Morocco in 2007 and given to the present owner at the Tucson Gem and Mineral Show in January 2008.
Petrography: (T. Bunch and J. Wittke, *NAU*) The fine to medium-grained (<1.2 mm) unbrecciated, cumulate-textured stone is composed essentially of enstatite with interstitial Si-bearing kamacite; sulfides (troilite, daubreelite, brezinaite, oldhamite, alabandite, niningerite, caswellsilverite), graphite, plagioclase, a silica phase, and schöllhornite, a weathering product of caswellsilverite. Weathering grade is low.
Mineral compositions: (EMPA analyses, all in wt%) Enstatite is $En_{99.4}Fs_{0.2}Wo_{0.4}$; metal is Si-rich kamacite (Ni = 5.8–6.6; Si = 3.9–4.5); Oldhamite: S = 38.7, Ca = 59.2, Cr = 1.4, Mn = 1.2; brezinaite: S = 46.0, Cr =54.1; caswellsilverite: S = 45.3, Cr = 38.4, Na = 14.7, Fe = 0.7; troilite: Cr = 2.68, Ti = 3.38; plagioclase: $An_{17}Or_{3.7}$; and schöllhornite: S = 46.0, Cr = 37.3, Fe = 1.1 (remainder is oxygen and hydrogen).
Classification: Achondrite (aubrite).
Type specimen: A total of 8.5 g and one thin section are on deposit at *NAU*. The holder of the main mass is anonymous.

Northwest Africa 5247
Morocco
Find: 2005
Carbonaceous chondrite (CO3)
History: One black stone was purchased by an anonymous buyer in Munich, October 2005.
Physical characteristics: The single piece weighing 15.2 g is black and covered with black fusion crust.
Petrography: (M. A. Ivanova, *Vernad*) meteorite consists of chondrules, CAIs, matrix, mineral and chondrules fragments. Average chondrule size is 0.2 mm. The main minerals are olivine, pyroxene, plagioclase. Chondrules contain feldspathic glass. The minor phases are melilite, spinel, chromite, ilmenite, sulfides, kamacite, and tetrataenite. Hydroxides present around metal grains.
Mineral chemistry and geochemistry: Olivine (EMPA) is $Fa_{0.3–49}$, Cr_2O_3 0.17, CaO 0.20; MnO 0.21 (wt%); orthopyroxene $Fs_{0.9}$ $Wo_{1.1}$ En_{98}, augite $Fs_{2.3}$ $Wo_{39.8}$ $En_{57.9}$, diopside $Fs_{0.6}$ $Wo_{47.9}$ $En_{51.5}$, plagioclase $An_{71.5}$ $Ab_{28.2}$ $Or_{0.3}$; spinel contains 21.8 wt% FeO and 12.0 wt% MgO: Oxygen isotopic compositions (I. A Franchi and R. C Greenwood, *OU*, by laser fluorination,): $\delta^{18}O$ = 1.54‰; $\delta^{17}O$ = –2.89‰; $\Delta^{17}O$ = –3.69‰.
Classification: Carbonaceous chondrite (CO3). The meteorite shows moderate weathering features.
Type specimens: A total of 3.72 g sample and one thin section are on deposit at Vernad. The anonymous buyer holds the main mass.

Northwest Africa 5289
Northwest Africa
Find: 2007
Iron (IVA)
History: A single iron mass was purchased from a Moroccan dealer in August 2007 by M. Graul (Bernau, Germany).
Physical characteristics: The 296 g mass, measuring approximately 81 × 54 × 30 mm, has a flattened shape. The portion of the surface originally sitting into the soil is partially covered with caliche deposit, whereas the remaining portion appears to be polished by wind-driven sand. No fusion crust is preserved.

Fig. 3. Hand sample of NWA 5298 showing its weathered exterior.

Petrography: (M. D'Orazio, *DST-PI*) Widmanstätten pattern with kamacite lamellae (bandwidth = 0.32 ± 0.04 mm)

and plessite fields in approximately 1:1 volumetric ratio. The kamacite lamellae show abundant Neumann bands and occasionally are displaced along shear planes. Accessory phases: schreibersite, troilite, chromite (tiny euhedral crystals included in troilite) and anhydrous Fe-phosphate (up to 1.3 mm in maximum length and surrounded by swathing kamacite).

Geochemistry: (M. D'Orazio, *DST-PI*) Composition of the metal (ICP-MS) is Co = 0.404, Ni = 9.02 (both in wt%), Cu = 111, Ga = 2.0, Ge < 1, As = 12.0, W = 0.36, Re = 0.08, Ir = 0.80, Pt = 3.76, Au = 2.33 (all in ppm).

Classification: Iron meteorite (IVA), fine octahedrite.

Type specimen: A 20.3 g etched endcut sample and 11.3 g of shavings are on deposit at DST-PI. M. Graul holds the main mass.

Northwest Africa 5298

Northwest Africa
Find: March 2008
Achondrite (Martian, basaltic shergottite)

History: Found near Bir Gandouz, northwest Africa, in March 2008 and purchased by an anonymous dealer.

Physical characteristics: A single 445 g stone lacking fusion crust with a brown exterior weathered surface (Fig. 3). The fresh interior is composed of yellow green grains with interstitial dark gray patches containing small vesicles.

Petrography: (A. Irving and S. Kuehner, *UWS*) The rock is composed mainly of intergrown prismatic grains of zoned pyroxene (up to 1.5 mm long) and lath-shaped regions of similar size composed of vesicular material with plagioclase composition. Some of this material is clear isotropic glass, but the majority consists of intersecting domains of subradiating, fibrous, birefringent plagioclase crystallites. Accessory minerals are titanomagnetite, ilmenite, silica polymorph, Na-Fe-merrillite, Cl-apatite, pyrrhotite, fayalite and baddeleyite. Silica is relatively abundant and forms subhedral grains (up to 0.4 mm across) within plagioclase composition material. Pyroxene grains have complex compositional zoning, with highly irregular and curvilinear zone boundaries between augite and pigeonite. Titanomagnetite and ilmenite commonly coexist in adjacent portions of composite grains.

Geochemistry: Pyroxene is zoned from subcalcic augite cores ($Fs_{23.8}Wo_{28.4}$, FeO/MnO = 26.3) to pigeonite mantles ($Fs_{30.2}Wo_{11.7}$; FeO/MnO = 30.7) to ferropigeonite rims ($Fs_{68.0}Wo_{15.3}$, FeO/MnO = 39.4). The average composition of the plagioclase is $An_{51.8}Or_{1.9}$. Titanomagnetite (TiO_2 23.7–24.5 wt%, FeO 68.7–67.6 wt%, Al_2O_3 2.1–2.1 wt%); ilmenite (TiO_2 48.2–49.0 wt%, FeO 48.4–47.7 wt%).

Classification: Achondrite (Martian, basaltic shergottite).

Type specimens: A total of 20 g and one polished thin section are on deposit at *UWS*. The main mass holder is anonymous.

Table 2 lists all newly approved meteorites (and their data) from Northwest Africa.

THE AMERICAS

North America

Canada

Whitecourt 53°59.95′N, 115°35.85′W

Alberta, Canada
Find: 1 July 1 2007
Iron, medium octahedrite (IIIAB)

History: Four small fragments were found buried adjacent to a circular depression by two local residents using a metal detector. The circular depression was subsequently confirmed as a 36 m diameter Late Holocene impact crater based on morphology, identification of impact ejecta and crater fill, and presence of impact melt (C. Herd and D. Froese, University of Alberta), and further fragments were recovered.

Physical characteristics: The meteorite consists of 74 samples with a total mass of 5372 g. The samples were found buried up to 25 cm and have a red-brown exterior.

Petrography: (C. Herd, *University of Alberta, UAb*) Widmanstätten pattern with an average bandwidth of 0.8 ± 0.2 mm and areas of plessite are evident on polished and etched surfaces. Locally, kamacite lamellae are coarser and taenite lamellae are offset as a result of shock deformation and recrystallization. Rare Fe-Ni phosphide inclusions are present.

Mineral compositions and geochemistry: Bulk composition: INAA data (J. Duke, *UAb*): Ni = 8.11 ± 0.13 wt%, Co = 4950 ± 100 μg/g, Ir 10.3 ± 0.5 μg/g, (uncertainties 1σ, 68% confidence level), Ge ≤ 40 μg/g, indicate the IIIAB group.

Classification: Iron, IIIAB medium octahedrite, extensive shock, moderate weathering.

Type specimens: A total of 2.4 kg is on deposit at UAb. The remainder of the known material is held by the anonymous finders.

United States

Arivaca 31° 35′ 38.09″N, 111° 22′ 12.84″ W

Arizona
Find: January 1999
Achondrite (eucrite)

History: Found by Carl Esparza on the historic Wilbur Cruce Ranch near Arivaca, Arizona, in January 1999.

Physical characteristics: A single 30.1 g naturally broken stone, about half coated by dark brown fusion crust. The weathered former interior surfaces are gray and white in color. Sparse small grains of metal are visible on a freshly cut surface.

Petrography: (A. Irving and S. Kuehner, *UWS*) The

specimen is a breccia composed of fragments of ophitic-textured basaltic eucrites and related mineral fragments (possibly from more than one precursor lithology) plus small grains of Ni-poor metal. The major minerals are low-Ca pyroxene (mostly orthopyroxene with sparse exsolved blades of clinopyroxene, but also some homogeneous pigeonite) and calcic plagioclase, with accessory clinopyroxene, silica polymorph, ilmenite, chromite, and troilite (some finely intergrown with clinopyroxene and silica). Orthopyroxene host ($Fs_{55.3–55.7}Wo_{2.6–2.9}$, FeO/MnO = 30.5–34.6), plagioclase ($An_{82.5–83.7}Or_{2.1–1.9}$)

Classification: Achondrite (basaltic eucrite). This brecciated specimen contains more metal than most eucrites. Specimens: A total of 6.4 g and one polished thin section are on deposit at *UWS*. The main mass is held by *C. Esparza.* [Carl Esparza, 4941 E. Placita Alisa, Tucson, AZ 85718].

Berthoud 40°18′21.0″N, 105°1′23.7″W

Weld County, Colorado, USA.
Fall: 5 October 2004, ~13:30 local daylight time (UT-6)
Achondrite (eucrite)

History: A meteorite fell ~4 km east of Berthoud, Colorado. According to information from those who visited the site, Megan and Andy Clifford "had just walked out of their house when they were distracted by whistling noise and a thump. Megan observed some dust kicked up in a horse pen about 100 feet away. After a short search, they recovered the object." (http://www.cloudbait.com/science/bermet.html). The meteorite embedded itself a few inches below the surface.

Physical characteristics: A single stone, 120 mm across, ~960 g was recovered soon after the fall. Fresh, glossy, black fusion crust covered the stone except for a small broken corner. The interior is medium gray in color.

Petrography: (D. H. Hill, *UAz*) Overall, texture is ophitic to subophitic with evidence of brecciation and recrystallization. The meteorite is shocked with occurrences of dislocated grains; fine melt veins run through the sample. Exsolution is observed in pyroxenes; several exhibit finely spaced fractures. Plagioclase contains many blebby inclusions. Accessory minerals include chromite, phosphates, iron sulfides, ilmenite, and silica.

Mineral compositions and geochemistry: (M. Killgore, *UAz*) Opx ($Fs_{54.03}En_{42.82}Wo_{3.15}$); Cpx ($Fs_{31.21}En_{35.80}Wo_{33.00}$); Plag ($An_{82.72}Ab_{16.04}Or_{1.24}$); pyroxene molar Fe/Mn = 31. Oxygen isotopes (R. Greenwood, I. Franchi, *OU*) $\delta^{17}O$ = 1.58‰; $\delta^{18}O$ = 3.46‰; $\Delta^{17}O$ = –0.227‰.

Classification: Achondrite (eucrite)

Type specimens: A total sample mass of 24.3 g and one thin section are on deposit at UA; owners hold the main mass; several thin sections with anonymous persons.

Dumont 33°49′N, 100°31′W

Dumont, King County, Texas USA
Find: 1994
Iron (IVB)

History: Found by a rancher who kept it in his garage. Identified by McCartney Taylor in 2005.

Physical characteristics: Weathered and pitted iron with a weight of 27.42 kg. Single mass found, broken end.

Petrography: (J. Wasson, *UCLA*) Ataxite, schlieren lines, no kamacite.

Mineral compositions and geochemistry (J. Wasson, *UCLA*): Ni =16.2% Ir = 29 mg/g.

Classification: Ataxite iron (IVB).

Type specimens: A total of 70.6 g is on deposit at *UCLA*. McCartney Taylor holds the main mass.

San Joaquin 32°9.994′N, 111°7.031′W

Pima County, Arizona, USA
Find: May 1, 2005
Ordinary chondrite (L5/6)

History: Mr. Bill Braggs found the sample May 1, 2005, while looking at cacti blooms ~¼ mile NW of Snyder Hill during a visit to a friend. The stone was found on the surface with no other rocks nearby.

Physical characteristics: The meteorite is one complete stone weighing 31.8 g. It exhibits an irregular, angular shape with dimensions of 4 × 3 × 2 cm; >90% weathered, black fusion crust with rusty-orange patches.

Petrography: (D. H. Hill, *UAz*) Chondrules range in size from 0.2 to 1.5 mm. They are mostly porphyritic and granular chondrules. Fragments of BO chondrules and a few RP chondrules are also observed. Chondrule outlines are visible but not well delineated. At least 30% of the matrix is recrystallized with chondrule boundaries not discernible. Metal and sulfide grains are ~1:1 in abundance and range from ~20–500 μm, except for one 1.3 mm metal grain. Many irregular melt pockets <40 μm across contain metal globules usually adjacent to metal grains. There is orange staining of silicates especially near metal grains. A clast, whitish in hand specimen, is composed of recrystallized material with no easily discernible chondrules and smaller metal grains than the main meteorite.

Mineral compositions and geochemistry: Olivine (Fa 24.79% ± 0.57), pyroxene (Fs 21.15% ± 1.01), and kamacite (Co 0.79% ± 0.17) (EMPA).

Classification: Ordinary chondrite (L5/6); W2, S4.

Type specimens: Mass of 5.5 g and two thin sections are on deposit at UAz. B. Braggs holds 26 g (5731 N. 3rd Street, Phoenix AZ 85012). Main mass is on loan to the UAz Mineral Museum at *UAz* Flandrau Science Center.

Willow Wash 35°22′24.88″N, 115°20″37.95″W

San Bernardino County, CA, USA
Find: 14 September 2006
Ordinary chondrite (H3.5, breccia)

History: The stone was found by Steve Humeston in an area covered with sand, scattered rocks and sparse native vegetation.

Physical characteristics: A single stone of 552 g was recovered. It was completely covered with fusion crust.

Petrography: (A. Rubin, *UCLA*) Chondrule outlines are well defined; there has been little integration between chondrules and matrix. Some chondrules contain glassy mesostases. The rock has been shocked; olivine grains exhibit undulose extinction under crossed polarizers in the petrographic microscope; the olivine grains contain planar fractures in their crystal structure caused by shock. The rock is moderately weathered; between 20% and 60% of the metal grains have been at least somewhat oxidized. The rock is also a breccia. It contains a clast that has experienced more significant shock than the host; much of the metal and sulfide in the clast was melted and mobilized by shock. The boundary between the clast and the host is sharp.
Mineral compositions and geochemistry: The rock is unequilibrated with a large range in olivine composition (Fa 12.8–30.9 mol%, n=13). The mean Fa content is 20.9±4.7 mol% and it has a percent mean deviation (PMD for Fa) of 17.2.
Classification: Ordinary chondrite (H3.5 breccia), S3, W2.
Type specimens: A total sample mass of 30 g is on deposit at *UCLA*. The remaining mass of 472 g is in the possession of the finder.

Table 3 lists all newly approved meteorites (and their data) from Americas.

ANTARCTICA

ANSMET

Table 4 lists 806 meteorites recovered from Antarctica by ANSMET. These meteorites appear in Antarctic Meteorite Newsletters 30 no. 2 (2007) and 31 no. 1 (2008). For further information on these meteorites visit the Antarctic Meteorite Newsletter, NASA, webpage at http://curator.jsc.nasa.gov/antmet/amn/amn.cfm.

ASIA

India

Jodiya **22°40′48″N 70°18′48″E**
Jodiya, Jamnagar District, Gujarat, India
Fall: 31 July 2006, 21:28 h. Indian Standard Time (IST) (UT+5 h)
Ordinary chondrite (L5)
History: A meteorite shower was witnessed on July 31, 2006, at 21:28 h. IST, in the regions of Jodiya, Jamnagar district, and Vandya, Kuchchh district, Gujarat. Many pieces fell in marshland and rain filled agricultural lands and could not be recovered. A search team from Geological Survey of India (GSI) has collected several fragments.
Physical characteristics: The samples collected have fallen on rooftops of houses and/or courtyards. The largest sample collected is ~4 × 2 cm and is partly fusion crusted. An ~4 g sample, partly covered with fusion crust has been given to PRL, Ahmedabad, for analysis.
Petrography: (Z. G. Ghevaria, GSI, Gandhinagar, Gujarat, India and S. V. S. Murty, *PRL*) The general texture of the Jodiya meteorite is brecciated with porphyritic chondrules of olivine and low Ca pyroxene and low amount of metal. Chondrule sizes range from 0.92 to 1.46 with an average of 1.23 mm. The average olivine composition is $Fa_{25.1}$, low Ca pyroxene is $Fs_{21.2}$ and compositions are uniform within 1–2% suggesting that the metamorphic grade is 5–6, but trapped noble gas amounts fall in the range of 4–5. Thus, Jodiya is classified as L5. $\Delta^{17}O$ is 1.16‰.
Classification: Ordinary chondrite (L5)
Type specimens: All collected fragments (~100 g) are in the possession of *GSI*, Calcutta. A thick section and a small, fusion crusted chip (~2 g) with FC are at *PRL*, Ahmedabad.

Kaprada **20°20′20.96″N, 73°13′23.86″E**
Kaprada, Valsad, Gujarat, India
Fall: 28 October 2004 and 16:30 (Indian Standard Time [UT+5 h])
Ordinary chondrite (L5/6)
History: A stone fell in the farm of Kashiram Bhikabhai Diva in Nandgam village of Kaprada Taluka of Valsad district in South Gujarat, India at about 16:30 h. IST on 28th October, 2004. The meteorite was promptly brought to Physical Research Laboratory, Ahmedabad by Manoj Pai, an amateur astronomer of Ahmedabad.
Physical characteristics: The single recovered stone weighed about 1.6 kg. The stone is mostly crusted and has an approximately conical shape, the convex face containing the apex having been smoothened due to ablation whereas the concave base appears rough.
Petrography: (N. Bhandari, S. V. S. Murty, R. R. Mahajan, P. N. Shukla, A. D. Shukla, *PRL*; M. S. Sisodia, *J. N. V. University*, *Jodhpur*; G. Parthasarathy, *PNGRI*; an V. K. Rai; Department of Chemistry, University of California, San Diego, CA, USA [*UCSD*]) The major minerals in the meteorite are olivine, clino- and orthopyroxene, and metal and sulfide. Some glass is also present. The meteorite shows a melt crystallization texture and veins. A variety of chondrule types is present, the commonest being granular olivine and olivine-pyroxene and radiating fine-grained pyroxene. The chondrule margins are diffuse, tending to merge with the granular groundmass, which consists of olivine and pyroxene with minor sub equal amounts of nickel-iron and troilite.
Mineral compositions and geochemistry: The olivine is $Fa_{23.7}$ and pyroxene is $Wo_{39.92}En_{43.3}Fs_{16.79}$. The chemical composition is Fe = 21.5%, Mg = 15.3%, Al = 1.2%, Ni = 1.27%, Ca = 1.33% by weight as determined by X-ray fluorescence.
Classification: The meteorite is an ordinary chondrite, (L 5/6).
Type specimens: The main mass is with Geological Survey of India at Calcutta. Thin sections are available at J. N. V.

University, Jodhpur, National Geophysical Research Institute, Hyderabad and Physical Research laboratory, Ahmedabad.

Kavarpura **25°8′36″N 75°48′48″E**

Kavarpura, near Rawatbhata village, Rajasthan, India
Fall: 29 August 2006; 13:37 h Indian Standard Time (IST)
Iron meteorite (IIE-Anom.)

History: Two shepherds witnessed the fall of a single piece (6.8 kg) in bright day light, and reported to the local police. It is an iron mass with regmaglyphs on the surface. A cut piece of ~20 g has been given to PRL, Ahmedabad for analysis.

Physical and chemical characteristics (Z. G. Ghevaria, GSI, Gandhinagar, Gujarat, India, and S. V. S. Murty, PRL, Ahmedabad, India): Polished and etched surface shows Widmanstätten pattern with fine kamacite bandwidths. Optical microscopic observation revealed inclusions ranging in size from few tens of microns to few hundred micrometers across on the polished surface. Qualitative EPMA studies show that some of the inclusions are C rich and some are rich in Si, Cr and P, in addition to Fe, Ni. Preliminary data on siderophiles (Ni 9.5%, Co 0.39%, Ir 1.6 ppm, Ga 6.8 ppm and Ge 5.8 ppm) by ICP-MS and the presence of non-metallic inclusions suggest that Kavarpura can be classified as IIE-Anom. A very interesting feature of this meteorite is the presence of solar noble gases.

Classification: Iron meteorite (IIE-Anom.)

Type specimen: ~10 g piece in PRL, Ahmedabad; the main mass is with GSI, Calcutta.

Mahadevpur **27°40′N, 95°47′E**

Mahadevpur, Near Namsai Town, Arunachal Pradesh, India
Fall: 21 February 2007, 9:10 Indian Standard Time (IST)
Ordinary chondrite (H4/5)

History: The fall was witnessed by many people. The meteoroid broke up mid air and fell as several pieces. At least 4 large fragments were collected; the largest is ~60 kg and is in private hands. A 3.4 kg piece fell through the roof of a house and into the living room, in Mahadevpur, Arunachal Pradesh, and was collected by Guwahati University, Assam.

Physical and chemical characteristics: (A. C. Mazumdar, Guwahati University, Assam, India and S. V. S. Murty, *PRL*, Ahmedabad) The meteorite is a heterogeneous aggregate of chondrules of varying types (dominantly porphyritic) and the matrix made up of mostly chondrules fragments. Chondrule sizes range from 250 to 1300 μm. The various mineral phases are olivine (Fa_{19}), orthopyroxene (En_{82} Fs_{17} Wo_1), clinopyroxene (En_{57} Fs_8 Wo_{35}), albitic plagioclase (Ab_{87} Or_3 An_{10}), kamacite, taenite, apatite and rare chromite. Olivine grains both in chondrules and matrix are homogeneous. Chemical composition and $\Delta^{17}O$ (0.857‰) match with H chondrites. Low amounts of trapped noble gases suggest that Mahadevpur belongs to metamorphic grade 4/5. Shock stage is S1.

Classification: Ordinary chondrite (H4/5)

Type specimen: The main mass (~3.2 kg) and thin sections are with Guwahati University (*GauU*); A small mass is with PRL, on loan from *GauU*. Total known weight is 70.5 kg

TURKEY

Didim **37°21′6.2″N 27°19′47.9″E**

Didim, Aydin province, Turkey
Fall: 1 February 2007 at 5.30 p.m. local time
Ordinary Chondrite (H 3–5 regolith breccia)

History: Many persons from Bodrum, Milas and Didim cities heard an enormous explosion followed by dozens of sounds like gunshots, several in a short interval. Other people as far as 200 km from Didim saw a fireball indicating that the meteorite fell in a southerly direction in the vicinity of the southwestern coastline on the Aegean Sea. Many rocks probably fell into the sea. One (D1) weighing about 500 g fell about ten meters from Mr Abdullah Aritürk at Yesilkent, a small district of Didim. He kept about half of it and gave 210 g to Prof. Mehmet Emin Özel of Çanakkale Onsekiz Mart University, Physics Department. Two other samples (D2 = 846 g and D3 = 2340 g) were found one after the other by Mr Hayati Ertugrul and collected by Ms Özlem Kocahan, PhD student, and Prof. Özel. Two small pieces of D1 and D2 were brought to the MNHN in Paris by Mr Mesut Kasikci, the only Turkish collector, living in France, who first informed academic research institutions of the recent fall.

Physical characteristics: All three samples (total mass: 3396 g) were totally covered by a thin black fusion crust.

Petrography: (Catherine Caillet Komorowski, *MNHNP*) Breccia showing a mixture of sub-millimeter to centimeter size H5 white clasts in a dark H3 host. D1 sample exhibits exclusively the H5 texture with little matrix and poorly defined chondrules. Opaque phases represent about 9.5 vol% and rare copper occurs in Ni-rich metal at the interface with sulfide in the H5 part. D2 sample exhibits both H5 (observed in D1 sample) and H3 lithologies. In the unequilibrated H3 part, opaque phases represent 12 vol%. Metal is much more abundant than sulfide and is located in and around the chondrules. Chondrules are small, in some cases less than 0.2 mm. Many olivine porphyritic chondrules and some large olivine crystals (0.5 mm) are present in a fine-grained matrix. Numerous chondrules contain luminescent forsterite. Silica-bearing, spinel-rich, chromite and glassy chondrules were found in addition to banded clasts and broken chondrules which both can contain pure enstatite associated with fine-grained metal. No CAIs were found.

Mineral compositions: EMPA of olivine and pyroxene crystals indicate a rather homogeneous composition in the white lithology ($Fa_{19–20}$, $Fs_{17–19}$) and a quite variable composition in the darker lithology of the meteorite where about one third of the chondrules and clasts contain almost pure forsterite and enstatite compositions. In this type 3 lithology Fo ranges from 67 to 100% and En ranges from 70 to 99%.

Classification: Ordinary chondrite (H3-5); S2, W0.
Type specimens: Two samples (total mass of 31,6 grams), one polished thin section of D1 and one polished section of D2 are on deposit at *MNHNP*. Another sample of D3 will soon be deposited at *MNHNP*. Main masses are kept at Çanakkale University, Turkey (*CanaU*). A sample of D3 belongs to a private collector, Mesut Kasikçi.

Table 5 lists all newly approved meteorites (and their data) from Asia.

AUSTRALIA

Georgetown
Queensland, Australia
Found 1988
Iron (IAB complex)
This meteorite was analyzed by Choi et al. (1995) and subsequently listed in the *Catalogue of meteorites* (Grady 2000) as an anomalous IIICD iron with silicate inclusions. It was later analyzed by Wasson and Kallemeyn (2002), who classified it as a "solo iron related to IAB." The name "Georgetown (iron)" is now recognized as official by the Meteorite Nomenclature Committee. J. T. Wasson (personal communication 2007) reports that Georgetown (iron) was found an unknown distance from Georgetown, Queensland, Australia, by a gold prospector with a metal detector. A 1.3 kg specimen was received by Robert Haag in 1991. *UCLA* now holds pieces weighing 645 g (possibly part of the Haag piece), 420 g, and 461 g.

Prospector Pool 29° 21′S, 121° 46′E
Eastern Goldfields, Western Australia, Australia
Find: November 2003
Iron (ungrouped, fine octahedrite; possibly an ungrouped member of the IAB complex)
History: A single mass was found by J. Harrop while he was prospecting.
Physical characteristics: The irregular, weathered mass weighing 2.768 kg when found, lacks fusion crust and has a deeply pitted surface. A rust line around the mass indicates partial burial in the soil to a depth of 8 cm.
Petrography: (A. W. R. Bevan WAM) The meteorite is troilite-rich comprising metal to troilite in the approximate volume ratio 4:1. Accessory minerals include schreibersite and a trace of copper. Metal displays a fine octahedrite (bandwidth 0.4 mm) structure.
Geochemistry: (J. T. Wasson *UCLA*) The composition (by INAA, average of two replicate analyses) of the metal is Ni = 89.4, Co = 4.35 (both mg/g), Cr = 331, Cu = 397, Ga = 22.7, Ge = 130 ± 32, As = 12.2, W = 0.97, Ir = 4.45, Pt = 9.2, Au 1.227 (all µg/g), Sb = 180, Re = 517 (both ng/g).
Classification: Iron (ungrouped, fine octahedrite; possibly an ungrouped member of the IAB complex).
Type specimens: Main mass, now 2.437 kg, and slices, 135.1 and 42 g, at *WAM*. Analyzed sample 35.9 g at *UCLA*.
Table 6 lists all newly approved meteorites (and their data) from Australia.

EUROPE

Święcany 49°47′29″ N, 21°15′28″E
Jasło, Poland
Find: September 2004
Ordinary chondrite (L/LL5)
History: A girl of age 12, Katarzyna Dępczyńska, found the stone in gravel on a road about 100 m from the house no. 73 in the village of Święcany, Jasło district, Podkarpackie province, Poland. The gravel was probably brought from a quarry near Skołyszyn in 2003. The stone was then given to Mr. Marcin Mazur from the town of Jasło, who gave it for examination to Mr. Łukasz Bandur, student of geology, who found it was a chondrite. Then the stone was given for classification to Dr. Łukasz Karwowski *USil*.
Physical characteristics: It is an 8 g rusty stone with tiny grains of quartz and argillaceous slate stuck to its surface and rare fragments of fusion crust.
Petrography: (Ł. Karwowski *USil*) Metallic Fe-Ni is replaced by iron oxide except a few tiny taenite grains. Troilite is largely weathered. Iron hydroxides and the remaining metal and troilite comprise 5–6 vol%. No alteration of silicates. There are few well-delineated chondrules and many chondrule fragments. Matrix is composed of olivine and pyroxene grains, some of which are quite large, comparable with chondrules in size (up to 1.5 mm). The stone is brecciated.
Mineral compositions: Olivine ($Fa_{25.3–26.4}$), low-Ca pyroxene ($Fs_{22.0–22.8}$), high-Ca pyroxene ($Fs_{7.0–7.0}$ $Wo_{46.5–46.5}$), feldspar ($An_{10.4–13.9}$ $Or_{4.4–6.3}$).
Classification: Ordinary chondrite (L/LL5); S2, W3.
Type specimens: One thin section and the main mass, 6.62 g, are on deposit at *USil*.

Table 7 lists all newly approved meteorites (and their data) from Europe.

ERRATA

Errata to previous editions of the Meteoritical Bulletin.

The Meteoritical Bulletin 85
In Table 1, for SaU 094, the correct coordinates are 20°59.469′N, 57°20.326′E. The find date is 08 Feb. 2001.
The Meteoritical Bulletin 87
The classification of Saint Aubin is in error. It is a high-Ni, high-Au, low-Ir member of the IIIAB group.

The Meteoritical Bulletin 88

For Shalim 005, the correct shock stage is S2.

Twannberg (The Meteoritical Bulletin 64/91)
Twannberg total mass is 15910 + 2246 + 2533 = 20689 g/ 20.889 kg
(This is published information from MB 64 and 91.)
Three small masses have turned up in 2007, bringing the total known mass to 20.771 kg.

Dhofar 658 was listed as an L4/5 chondrite. More recently A. Bischoff (*Mun*) and J. Grossman (*USGS*) studied this sample and found that the classification was incorrect. Dhofar 658 is an H chondrite with $Fa_{19.1}$ and $Fs_{17.0}$ $Wo_{1.2}$.

Meteoritical Bulletin 91
For Shişr 100, the correct mass is 579.1 g.

The Meteoritical Bulletin 93
On page 587, For the CHINARE meteorites listed, all type specimens and main masses are on deposit at the Polar Research Institute of China *(PRIC*).

GRV 052049 should be deleted from MB 93.

The correct classification for MET 00557 is LL6.

MET 00546, H5, 75.87 g, weathering A/B, Fa_{18} and Fs_{16}.

MET 00456, LL5, 575.5 g, weathering B.

For NWA 4724, the correct find year is 2001.

The following are corrected oxygen isotopic compositions for three meteorites:
NWA 4663, $\delta^{17}O$ = 1.144, 1.202; $\delta^{18}O$ = 4.125, 4.015; $\Delta^{17}O$ = –1.025, –0.910
NWA 4872, $\delta^{17}O$ = 2.061, 2.012; $\delta^{18}O$ = .354, 4.308; $\Delta^{17}O$ = –0.229, –0.254
NWA 4882, $\delta^{17}O$=2.095, 2.064; $\delta^{18}O$ = 4.455, 4.368; $\Delta^{17}O$ = –0.248, –0.234

In Table 3, the meteorite name Desaguadero is incorrect. The correct name is Carancas.

On page 594, under Errata, the name Adam Thalha should be Adam Talha.

On page 592, the correct latitude for Ramlat as Sahmah 221 is 20°31.912′N.

In Table 2, the entry for NWA 4796 is repeated.

In Table 6, entries for GRV 052082, 052085, 052104, and 052116 are repeated.

For JaH 122, the correct find date is 12-Dec-2002.

The following 4 meteorites have wrong coordinates:
The correct ones are listed below:

JaH 335	19°37.423′N	55°43.695′E
JaH 336	19°54.159′N	55°39.323′E
JaH 337	20°00.293′N	55°42.916′E
JaH 339	19°55.731′N	55°40.133′E

In Table 8, for Mughsayl, the correct find year is 2005 with no exact date. The correct shock level is S4 and the weathering degree: W2. The correct fayalite content of olivine: $Fa_{24.2}$. The correct weight deposited at *NMBE*: 6.4 g. The mass at *SQU* is to be considered type specimen as mentioned in the write-up submitted.

Reclassification and correction: Y-86332 was incorrectly listed by Ninagawa et al. (1998) as an L3.6 chondrite. The meteorite that they actually analyzed was Y-86632, which is hereby reclassified as L3.6. The real Y-86332 has now been classified as H4 by Kojima and Yamaguchi (2008).

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ABBREVIATIONS

Classifiers, Type Specimen Locations, Finders, and Holders of Main Masses

A key to abbreviations for addresses used in the Meteoritical

Bulletin is found at our web site, http://tin.er.usgs.gov/meteor/MetBullAddresses.php.

Listed throughout most of the tables within the "Info" column are relevant data on who classified the samples, where the type specimen is located, etc. Below is a key to the abbreviations used within this edition.

CanaU = Çanakkale University, Turkey
DuPont = James M. DuPont Meteorite Collection, Planetary Studies Foundation, 10 Winterwood Lane, Unit B., Galena, Illinois 61036-9283 USA
GMAlBeda = Geological Museum, Omar El-Mokhtar University, Al Beda (Libya)
PDAlBeda = Physics Department, Omar El-Mokhtar University, Al Beda (Libya)
PNGRI = National Geophysical Research Institute, Uppal Road, Hyderabad, India
TantaU = Tanta University, Faculty of Science, 31527 Tanta, Egypt, mmanbar@yahoo.com
UTWroc = Wrocław University of Technology, Faculty of Geoengineering Mining and Geology, Institute of Minings, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland, tadeusz.przylibski@pwr.wroc.pl
WrocU = Wrocław University, Institute of Geological Sciences, ul. Cybulskiego 30, 50-205 Wrocław, Poland, ryszard.kryza@ing.uni.wroc.pl

ABBREVIATIONS USED WITHIN THE TEXT

For chondrule textural types: BO = barred olivine, GO = granular olivine, PO = porphyritic olivine, POP = porphyritic olivine pyroxene, PP = porphyritic pyroxene.

cr# = Cr/ (Cr + Al).
EMPA = electron microprobe analysis.
SEM = scanning electron microscope.

Abbreviations for the locations of Antarctic meteorites recovered by ANSMET: ALH = Allan Hills, CRS = Mount Cranfield, CMS = Cumulus Hills; DOM = Dominion Range; GRO = Grosvenor Mountains; LAP = LaPaz Ice Field; LAR = Larkman Nunatak; MAC = MacAlpine Hills; MCY = MacKay Glacier; MIL = Miller Range; PRA = Mount Pratt, RBT = Roberts Massif, SAN = Sandford Cliff, and TYR = Taylor Glacier.

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Table 1. Meteorites from Africa.

Name	Location of recovery	Date of recovery (dd-m-yyyy)1	Find/ Fall	Latitude	Longitude	Mass (g)	Number pieces	Class	Type specimen mass (g)	Shock stage	Weath. grade	Fa mol%	Fs mol%	Wo mol%	Magn. sus logχ (10^{-9} m^3/kg)	Location of type specimen and classifier(s)	Location of main mass	Comments, additional data
Acfer 370	Algeria	Nov.-2002	Find	27°40.35′ N	4°21.40′ E	129	1	Ungrouped Chondrite	67	S3	W2	5.6	6.9–22.6			MSP1	*MSP*	$\delta^{17}O$ = 2.673‰; $\delta^{18}O$ = 4.172‰ $\Delta^{17}O$ = 0.504‰
Bouri	Middle Awash, Ethiopia	Fall-1996	Find	10°16′ N	40°34′ E	9.1	>30	H4	9000	S4	W4	20.1	14.8		4.68	CEREGE/ NME1	*NME*	
Chergach	Timbouctou district, Mali	2-Jul-07	Fall	23° 41′47″ N	5°00′53′ W	100000	Many	H5	115	S3	W0	18.2	15.5	1.4		NMBE1	*DGheesling*	
Dar al Gani 1049	Libya	21-Oct-07	Find	27°15.98′ N	16°21.47′ E	88	4	H5	88	S2	W3	17.2	15.6	1.5		OAM1	*OAM*	found by Monica Basolo
Dar al Gani 1050	Libya	23-Oct-07	Find	28°12.85′ N	15°33.05′ E	265	2	H6	265	S3	W4	18	15.4	0.9		OAM1	*OAM*	found by Monica Basolo
Noktat Addagmar	Mauritania	0ct-2006	Find	25° 42′ 09″ N	10°46′54″ W	779	2	LL5	22.4	S2	W0	27.7	23.1	1.6		NMBE1	*SBuhl, Hamburg, Germany*	
Toufassour	Toufassour, Tata, Morocco	16-Nov-07	Find	29°39′.135 N	7°44′.958 W	73300	>5	Mesosiderite	89.6				26 to 33	3 to 8		IZU/UPVI1	*anonymous*	
Werdama	Libya	21-May-06	Fall	32°47.839′ N	21°47.228′ E	2552	3	H5	2300	S1	W0	19.8	17.7	1.3		UTWroc/ GMAlBeda1	*GMAlBeda*	

MSP1-Type specimen at *MSP* classified by V. Moggi Cecchi, G Pratesi, *Museo di Scienze Planetarie*. CEREGE/NME1-Type specimens at *CEREGE* and *NME*, classified by J. Gattacceca (*CEREGE*) and M. Bourot-Denise (*MNHN*). NMBE1-Type specimen at *NMBE*, E. Gnos, *MHNGE*; B. Hofmann, *NMBE*, M. Eggimann, *UBE/NMBE*). OAM1-Type specimen at *OAMI*, classified by L. Folco (*MNA-SI*). IZU1/UPZI1-A. Ibhi and H. Nachit (IZU), and A. Jambon, O. Boudouma and D. Badia (UPVI). UTWroc/GMAlBeda1-R. Kryza, T. Przylibski (*UTWroc*).
Magn sus = magnetic susceptibility; given values given as logχ (mg/g).
Weath. grade = weathering grade.

Table 2. Meteorites from Morocco and other Northwest Africa regions.

Meteorite name	Location of recovery or purchase	Date of recovery or purchase	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Shock stage	Weathering grade	Fa mol%	Fs mol%	Wo mol%	Magnetic sus logχ (10^{-9} m^3/kg)	Location of type specimens and classifiers	Location of main mass	Comments, additional data
NWA 1709	Northwest Africa	Mar-02	9	1	H3.8	1.7	S2	W3	1.2–21.2	4.8–16.9	0.2–0.8		MSP1	*Anonymous*	$\delta^{18}O$ = 2.840‰; $\delta^{17}O$ = 4.448‰; $\Delta^{17}O$ = 0.527‰.
NWA 2218	Tucson	Jan-2006	6,050	1	Ureilite	26			19.1	16.9	6.5		UWS	*Gregory*	
NWA 2219	Tucson	Jan-2006	260	1	Diogenite	20.6			27.9–28.6	24.6–26.3	3.3–3.9		UWS	*Gregory*	Plagioclase $An_{83.7–84.4}Or_{0.5}$
NWA 3211	Northwest Africa	2005	89.2	1	Eucrite	17.9				43.9–55.6	2–21.5		MSP1	*Chin*	$\delta^{17}O$ = 1.71‰, $\delta^{18}O$ = 3.85‰, $\Delta^{17}O$ = –0.25‰
NWA 3212	Northwest Africa	2005	176.6	1	Eucrite	20				35.6–54.1	2–29.2		MSP1	*Chin*	$\delta^{17}O$ = 1.74‰, $\delta^{18}O$ = 3.84‰, $\Delta^{17}O$ = –0.26‰.
NWA3333	Morocco	May-05	33	1	Lunar basalt fragmental breccia	6.55			40–96	17–65	12.–29.		WUSL1	*DuPont*	
NWA 4222	Northwest Africa	2006	16.5	1	Shergottite	3.5			31.3–41.1	24.1–32.6	8.9–10.3		MSP1	*Chin*	$\delta^{17}O$ = 2.85‰, $\delta^{18}O$ = 4.91‰, $\Delta^{17}O$ = 0.30‰ (mean on 2 analyses).
NWA 4224	Tagounite	Dec-2005	10.8	1	Eucrite	2.2				50.2–50.3	12.8–13.7		UWS	*GHupé*	Plagioclase $An_{85.1-89.6}Or_{0.6}$
NWA 4225	Erfoud	Dec-2005	1,609	1	Ureilite	20.8			12.7–14.1				UWS	*GHupé*	Cr_2O_3 in olivine = 0.64 wt%
NWA 4227	Tagounite	Dec-2005	17.6	1	Eucrite	3.6				46.9–47.9	4.8–11.2		UWS	*GHupé*	Plagioclase $An_{84-95}Or_{0.8-0.3}$
NWA 4228	Tagounite	Dec-2005	181	1	Ureilite	20.8			17.0	13.5–13.7	4.8–5.0		UWS	*GHupé*	Cr_2O_3 in olivine = 0.57 wt%
NWA 4231	Erfoud	Dec-2005	269	1	Ureilite	21.7			22.7	18.7	9.4		UWS	*GHupé*	Cr_2O_3 in olivine = 0.60 wt%
NWA 4291	Denver	Sep-2005	23	1	Eucrite	4.6				21.4, 53.6	44.2, 2.3		UWS	*AHupé*	FeO/MnO in px = 32.0
NWA 4297	Denver	Sep-2005		1	H4		S1	W1/2	19.8	17.1	1.4		UWS	*Ahupé*	
NWA 4299	Erfoud	Mar-2006	127	2	H4	25.7	S2	W2/3	19.6–19.9	17.2	1.5		UWS	*Ahupé*	
NWA 4395	Morocco	2004	240	1	Diogenite	20.1				30.5	2.7		MNB1	*Ralew*	Mean of two replicates $\delta^{17}O$ = 2.09‰, $\delta^{18}O$ = 4.39‰, $\Delta^{17}O$ = –0.19‰.
NWA 4415	Northwest Africa	2006	10	1	EL6	2				1.5	1.5		MSP1	*Anonymous*	$\delta^{18}O$ = 3.340‰; $\delta^{17}O$ = 6.388‰; $\Delta^{17}O$ = –0.007‰.

Table 2. *Continued.* Meteorites from Morocco and other Northwest Africa regions.

Meteorite name	Location of recovery or purchase	Date of recovery or purchase	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Shock stage	Weathering grade	Fa mol%	Fs mol%	Wo mol%	Magnetic sus logχ (10^{-9} m^3/kg)	Location of type specimens and classifiers	Location of main mass	Comments, additional data
NWA 4416	Northwest Africa	2006	259.1	1	EL6	22				1.1	1.1		MSP1	*Anonymous*	Probably paired with NWA 4415
NWA 4418	Northwest Africa	2006	103.8	1	Mesosiderite	20.1				29.6, 14.4	3.1, 42.0		MSP1	*Chin*	$\delta^{17}O = 2.145‰$, $\delta^{18}O = 4.524‰$, $\Delta^{17}O = -0.207‰$.
NWA 4419	Northwest Africa	2006	103.1	1	R4	20.8			39.8	13.9–29.1			MSP1	*Anonymous*	$\delta^{17}O = 5.469‰$, $\delta^{18}O = 6.031‰$, $\Delta^{17}O = +2.333‰$.
NWA 4435	Algeria, Purchased in Morocco	2006; 2-2006	42.6	1	CV3	9.4	S1	W1	1.3–56	2.4–31.5			NAU, T. Bunch	*MCimala*	
NWA 4439	Algeria, Purchased in Erfoud, Morocco	2005; 3-2006	484	1	CO3.3	20.4	S2	W4	33.8–42.2				NAU, T. Bunch	*GHupé*	Olivine Cr_2O_3 = 0.02–0.18 wt%
NWA 4441	Algeria, Purchased in Erfoud, Morocco	2005; 3-2006	124	3	CO3.2	20	S2	W2	28.3–36.3				NAU, T. Bunch	*GHupé*	Olivine Cr_2O_3 = 0.06–0.24; FeO/MnO = 56 to 100
NWA 4442	Algeria, Purchased in Erfound, Morocco	2005; 3-2006	1528	4	CV3	20.7	S1	W1	3.8–62				NAU, T. Bunch	*GHupé*	Many cm-sized dark inclusions
NWA 4444	Algeria, Purchased in Erfound, Morocco	2005; 3-2006	145	1	L3.2	20.8	S2	W2	9.8–32.1				NAU, T. Bunch	*GHupé*	Olivine Cr_2O_3 = 0.05–0.46 wt%
NWA 4446	Algeria, Purchased in Erfound, Morocco	2005; 3-2006	4386	3	CV3	20	S2	W2	3.1–44.7	0.9–27			NAU, T. Bunch	*GHupé*	
NWA 4459	Algerian-Moroccan border	2006	60.07	1	L3	14.4	S2	W3	0.5–39.6	1.1–26.1		logχ = 4.32 (10^{-9} m^3/kg)	MNHNP1	*PThomas*	
NWA 4469	Tagounite	Jun-2006	1,823	1	Ureilite	20.4			19.2	17.0	9.4		UWS	*GHupé*	Cr_2O_3 in olivine = 0.56 wt%
NWA 4471	Tagounite	Jun-2006	881	1	Ureilite	20.4			22.4	17.4	12.0		UWS	*GHupé*	
NWA 4474	Rissani	Jun-2006	2,374	1	Ureilite	25.3			19.2	15.2	4.0		UWS	*GHupé*	Cr_2O_3 in olivine = 0.65 wt%
NWA 4481	Tagounite	Sep-2006	112	1	Ureilite	20.8			20.4	17.9	5.1		UWS	*GHupé*	
NWA 4483	Algeria	2006	208	12 fragments	Lunar granulitic breccia	20			30.9–60.8	14.3, 36.4–75.1	2, 6.3–13.5		UWS	Ralew	Possibly paired with Northwest Africa 3163
NWA 4529	Algeria	Sep-06	60	1	Iodranite	20				63	2		UWS1	*Ghupé*	
NWA 4536	Morocco	2006	283.1	1	Eucrite	20				63, 30	2, 40		UPVI1	*PThomas*	
NWA 4537	Morocco	2005	261	1	Aubrite	136				1.5	1.5		MSP	*MSP*	$\delta^{18}O = 5.021‰$; $\delta^{17}O = 2.650‰$; $\Delta^{17}O = +0.039‰$.
NWA 4538	Erfoud	2006	206	1	H3	20.8	S3-5	W2	15.8–18.6	15.0–16.5	2.1		NAU	*Strope*	Shock melt
NWA 4539	Erfound, Morocco	2006	483	1	CV3	21	Mod	Mod	0/8–58.1	1.1–32	2.5		NAU	*Strope*	olivine with 0.0 to 0.33 wt% NiO
NWA 4540	Erfound, Morocco	2006	1310	1	CO3.5	22	Mod	Mod	38.3				NAU	*Turecki*	FeO/MnO = 121
NWA 4542	Erfound, Morocco	2006		1	CO3.6		Mod	Min	36.7				NAU	*Turecki*	FeO/MnO = 110
NWA 4543	Morocco	2006	339	1	CV3	23	Min	Min	50.1 (±1.7)				NAU, Bunch/ Connolly	*Strope*	Matrix olv listed; numerous AOAs.
NWA 4544	Erfound, Morocco	2006	>200 kg	Many	EL3	24	Mod	Ext		1–2.1			NAU	*Farmer*	Paired with NWA 2965: Si = 0.6–0.95 wt%
NWA 4551	Erfound, Morocco	2006	104	1	CO3.5	21	Mod	Mod	37.7–38.7				NAU	*Aaronson*	
NWA 4556	Erfound, Morocco	2006	313	1	EL3	28.6	Mod	Ext		<2			NAU	*MCimala*	$An_{17.5}Or_{4.4}$: paired with NWA 2965: Si = 0.6–0.95 wt%
NWA 4561	Erfound, Morocco	2006	> 200 kg	Many	EL3	27	Mod	Ext		<2			NAU	*MCimala*	An16.8Or 4.2: paired with NWA 2828:Si = 0.6–0.95 wt%
NWA 4566	Erfound, Morocco	2005	74	1	L3.7	15.1	S2	W2	18.7–29.	14.7–24.5	1.4		NAU	*Hall*	
NWA 4568	″	2005	123	1	Ureilite	23	Mod	Min	17.6 (cores)	15	7.6		NAU	*Hall*	
NWA 4569	Erfoud	2005	484	Many	Angrite	24.3	Mod	Mod	40.3	10.8	53		NAU	*GHupé*	An_{100}; paired with NWA 2999
NWA 4589	Tagounite	Sep-2006	6,504.0	1	Ureilite	20.2			19.5	5.7	11.9		UWS; A. Hupé	*GHupé*	Dunite with <5 vol% pyroxene

Table 2. *Continued.* Meteorites from Morocco and other Northwest Africa regions.

Meteorite name	Location of recovery or purchase	Date of recovery or purchase	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Shock stage	Weathering grade	Fa mol%	Fs mol%	Wo mol%	Magnetic sus logχ (10^{-9} m^3/kg)	Location of type specimens and classifiers	Location of main mass	Comments, additional data
NWA 4642	Morocco	2006	483.2	1	Enstatite achondrite	22.6				0–1.2			MNB1	*HSSH*	$\delta^{17}O = 2.975‰$, $\delta^{18}O = 5.614‰$, $\Delta^{17}O = 0.056‰$.
NWA 4651	Erfound, Morocco	2005	1052	1	LL3.2	22	S2	W2	17.2–30.1	13.4–25.2	1.8		NAU, T. Bunch	*Aaronson*	Ol Cr_2O_3 = 0.12–0.35 wt%
NWA 4655	Rissani	2006	37	1	Eucrite	8	Mod	Low		51.3–58.7	3.4–45.7		NAU, T. Bunch	*Boswell*	Recrystallized shock melt breccia
NWA 4660	Erfound, Morocco	2006	226	1	LL3.8	21	S2	W2	26–35.2	26	2		NAU, T. Bunch	*Webb*	
NWA 4662	Erfoud	2006	60	1	Angrite	13.1	Mod	Mod	40.1	10.1	53		NAU, T. Bunch	*Aaronson*	An_{100}; paired with NWA 2999
NWA 4722	Morocco	2006	294	48	LL3	24.3	S1	W3	0.8–36.5	1.1–27.7		3.23	MNHNP1	*Giessler*	
NWA 4735	Morocco	2003	64	1	Acapulcoite/ lodranite	12.2			10	8	1		UPVI1	*MIA*	
NWA 4742	Morocco	2007	376.0	1	Ureilite	32			21	16	1		UPVI1	*MIA*	
NWA 4748	Northwest Africa	2005	80	1	Polymict eucrite	17			33.6	44.5, 26.6	2.3, 2.3		Hamb1	*Wuthenau*	
NWA 4799	Algeria	May-07	365	86	Aubrite	20.1				0.1	0.4		UWS1	*Ghupé*	Kamacite (Fe 92.1 wt%, Ni 4.5 wt%, Si 3.4 wt%)
NWA 4801	Erfoud	May-2007	252	1	Angrite	20			45.5 (Ln2.4)	11.8	56.9		UWS1	*GHupé*	Oxygen isotopes (D. Rumble, CIW): $\delta^{18}O = 3.595, 3.544$; $\delta^{17}O = 1.809, 1.823$; $\Delta^{17}O = -0.082, -0.041$ per mil.
NWA 4808	Erfoud	2006	69	3	Diogenite	14.1	Mod	Low	24	22	2.6		NAU1	*Ralew*	Paired with NWA 4473
NWA 4812	″	″	68	1	CK	13.2	Mod-Ext	See separate entry					NAU1	*Ralew*	
NWA 4814	″	″	1120	1	R4	20.6	Mod	Mod	38.7				NAU1	*Ralew*	Chromite cr# = 88
NWA 4816	″	″	63	1	Acapulcoite	12.1	Mod	See separate entry					NAU1	*Ralew*	
NWA 4820	Erfoud	2006	168	1	CK5	20.5	Min-Mod	Min-Mod	39.1				NAU1	*Burkhard*	2.34 wt% Cr_2O_3 in magnetite
NWA 4821	″	2006	117	1	CK4	22	Min-Mod	Min-Mod	38.4				NAU1	Burkhard	3.3 wt% Cr_2O_3 in magnetite
NWA 4824	″	2007	97	1	Eucrite	19.7	mod						NAU1	*Farrell*	
NWA 4825	″	2007	226	1	Howardite	23.8	mod						NAU1	*Farrell*	
NWA 4826	″	2007	344	1	Howardite	21.3	mod						NAU1	*Farrell*	
NWA 4827	″	2007	327	1	Ureilite	23.4	low	Moderate	Core = 22.7	core = 16.8	2.4		NAU1	*Hermann*	
NWA 4830	″	2006	78	1	Eucrite	16	Ext						NAU1	*Boswell*	
NWA 4831	″	2006	154	1	Eucrite	22	Mod						NAU1	*Boswell*	
NWA 4832	″	2007	8.3	1	Aubrite	2.2	Min-Mod						NAU1	*Anonymous*	
NWA 4833	″	2007	60	1	Lodranite	12.7	Min-Mod						NAU1	*Anonymous*	
NWA 4858	Erfoud	2004	329.0	1	Howardite	42				21–39, 36–35	0.7–5, 5–15		Cascadia1	*Thompson*	
NWA 4864	Northwest Africa	2007	94.0	10	shergottite	19				50	13		Mun1	*Anonymous*	
NWA 4868	Erfoud	July 2007	953	1	CO3.3	21	Min-Mod	W2	3–40; FeO/MnO = 128	2–30.4			NAU1	*Aaronson*	Cr_2O_3 in ol = 0.06–0.28
NWA 4869	″	″	96	1	Howardite	20.1	Mod	Low	separate entry				NAU11	*Aaronson*	
NWA 4870	″	″	330	1	LL3.7	21	S2	W2	16–33; FeO/MnO = 58	23–26			NAU1	*Aaronson*	Many large chondrules
NWA 4871	″	″	115	1	Aubrite	20.3	Min-Mod	Mod	separate entry				NAU1	*Aaronson*	
NWA 4873	″	″	609	1	LL3.6	21.2	S1	W2	15.3–30.8	13.4–25	1.6–2.3		NAU1	*Aaronson*	
NWA 4875	″	″	900	1	Lodranite	22	Mion-Mod	Mod	separate entry				NAU1	*Aaronson*	
NWA 4877	″	″	1000	1	Angrite	21.7	Mod	Mod	40.8; FeO/MnO = 88	10.3	53.5		NAU1	*Aaronson*	Paired with NWA 2999
NWA 4878	″	″	130	1	Martian	20.2	Min-Mod	Min		pig 36.1–55.4	12–16.3		NAU1	*Aaronson*	Paired with NWA 2975
NWA 4880	Erfoud	Jul-2007	81.6	34	Shergottite	16.4				38.5	29.3		UWS1	*AHupé*	Paired with NWA 2975
NWA 4925	Erfoud	2007	282.3	1	Shergottite	20.1			27.6–46.8	20.0–37.7	3–14.8		MNB1	*Ralew*	

Table 2. *Continued.* Meteorites from Morocco and other Northwest Africa regions.

Meteorite name	Location of recovery or purchase	Date of recovery or purchase	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Shock stage	Weathering grade	Fa mol%	Fs mol%	Wo mol%	Magnetic sus logχ (10^{-9} m^3/kg)	Location of type specimens and classifiers	Location of main mass	Comments, additional data
NWA 4930	Ensisheim	Jun-2007	117.5	76	Shergottite	20.1				23.4; 59.6	33.6; 16.7		UWS1	GHupé	Paired with NWA 2975
NWA 4931	Tagounite	Oct-2007	2,140	2	Angrite	28.2			39.3–39.5	10.1–10.4	53.9–52.3		UWS1	*GHupé*	Paired with NWA 2999
NWA 4932	Algeria	Oct.-2007	93	1	Lunar feldspathic breccia	18.7			27.2–36.9	22.3–22.8	5.9–5.3		UWS1	*GHupé*	
NWA 4933	Tagounite	Oct-2007	2,529	2	Lodranite	20.2			10.6–10.7	3.6; 9.2	44.3; 1.3		UWS1	*GHupé*	Paired with NWA 4478
NWA 4935	Erfoud	Mar-2007	73	1	Eucrite	14.6				35.8; 55.8	38.9; 12.8		UWS1	*MIA*	FeO/MnO in pigeonite = 24.6
NWA 4937	Morocco	May-2007	212	1	Winonaite	20.3			7.0	7.4–7.9	2.4–2.7		UWS1	*Anonymous*	Oxygen isotopes: $\delta^{18}O = 4.370$, 4.206; $\delta^{17}O = 1.763$, 1.738; $\Delta^{17}O = -0.535$, −0.474 (all‰)
NWA 5151	Algeria	2007	289	1	Lunar, feldspathic breccia	20.3	Low		34.1	24.4, 27.9	3.8, 9.2		NAU1	*Anonymous*	
NWA 5152	Morocco	2006	38	1	Lunar, feldspathic breccia	7.7			27.6	25.5	3.8		NAU1	*Anonymous*	
NWA 5153	Morocco	2006	50	1	Lunar, feldspathic breccia	5			31.7, 22.3, 36.7	25.7, 22.1, 7.1	9.3, 17, 13.3		NAU1	*DPitt*	
NWA 5191	Northwest Africa	2006	27	1	Brachinite	26.5	S1	Mod	32.5	10	45		LPMM1	*LPMM*	
NWA 5207	Morocco	2007	101	1	Lunar, feldspathic breccia	20		Low	30, 56.9	28.5–62.7	16.8–34.7		NAU1	*Anonymous*	
NWA 5217	Morocco	2007	39.1	1	Aubrite	8.5				0.2	0.4		NAU1	*Anonymous*	
NWA 5247	Morocco	2005	15.2	1	CO3	3.7			0.3–49	0.9	1.1		Vernad	*Anonymous*	$\delta^{18}O = 1.54$‰; $\delta^{17}O = -2.89$‰; $\Delta^{17}O = -3.69$‰.
NWA 5289	Northwest Africa	2007	296	1	Iron IVA	31.6							DST-PI	*Graul*	Co = 0.404, Ni = 9.02 (both in wt%), Cu = 111, Ga = 2.0, Ge < 1, As = 12.0, W = 0.36, Re = 0.08, Ir = 0.80, Pt = 3.76, Au = 2.33 (all in ppm).
NWA 5298	Morocco	Mar-2008	445.0	1	Shergottite	20				23.8–30.2	28.4–11.7		UWS1	*Anonymous*	

MSP1-Type specimen at MSP, classified by V. Moggi Cecchi, G. Pratesi, *Museo di Scienze* Planetarie. WUSL1-Type specimen at *Dupont* and *WUSL*, classified by R. Zeigler and R. Korotev, *WUSL*. MNB1-Type specimen at *MNB*, classified by A. Greshake, *MNB*. MNHNP1-Type specimen at *MNHNP*, classified by M. Bourot-Denise, *MNHNP*. UPVI1-Types specimen at *UPVI*, classified by A. Jambon, O. Boudouma and D. Badia, *UPVI*. UWS1-Type specimen at *UWS*, classified by A. Irving and S. Kuehner, *UWS*. MIAMoroccan Imports, Asnières, France. HAMB1-Type specimen at *HAMB*, classified by J. Schlüter, *Hamb*. NAU1-Type specimen at *NAU*, T. Bunch and J. Wittke, *NAU*. Cascadia1-Type specimen at *Thompson*, classified by A. Ruzicka and T. J. Schepker, *Cascadia*. Mun1—Type specimen at Mun, classified by A. Bischoff, *Mun*. LPMM1—Type specimen at Laboratory of Petrology, Mineralogy and Materials, Faculty of Sciences, Agadir (LPMM), classified by A. Ibhi, *LPMM*. Verdad1—Type specimen at *Vernad*, classified by M.A. Ivanova, *Vernad*. DST-PI1—Type specimen at *DST-PI*, classified by M. D'Orazio, *DST-PI*.

Table 3. Meteorites from the Americas.

Name	Location of recovery (description of county, state, province, country, etc.)	Date of recovery or purchase (d-m-yyyy)1	Find/ fall	Latitude	Longitude	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Shock stage	Weathering grade	Fa mol%	Fs mol%	Wo mol%	Location of type specimen and classifier(s)	Location of main mass	Comments, additional data
Arivaca	Arivaca, Arizona	Jan-1999	Find	31°35′38.09″N	111°22′12.84″W	30.1	1	Monomict eucrite	6.4				55.3–55.7	2.6–2.9	UWS1	*CEsparza*	plag ($An_{82.5–83.7}Or_{2.1–1.9}$)
Berthoud	Weld County, Colorado	05-Oct-2004	Fall	40°18′21.0″N	105°1′23.7″W	960	1	Eucrite (monomict breccia)	24.3				54.03	3.15	UAz1	*Anonymous*	
Dumont	Dumont, King County, Texas	1994	Find	33°49′N	100°31′W	27420	1	Iron (IVB)	70.6						UCLA1	*MTaylor*	Ni =16.2% Ir = 29 mg/g
San Joaquin	Pima County, Arizona	01-Ma-2005	Find	32°9.994′N	111°7.031′W	31.8	1	Ordinary chondrite (L5/6)	26	S4	W2	24	21.1		UAz1	*Uaz*	
Whitecourt	Alberta, Canada	1-July-2007	Find	53°59.95′N	115°35.85′W	5372	74	IIIAB	2400						UAb1	*Anonymous*	Ni = 8.11 ± 0.13 wt%, Co = 4950 ± 100 mg/g, Ir 10.3 ± 0.5 mg/g, Ge £ 40 mg/g
Willow Wash	San Bernardino County, CA	14-Sept-2006	Find	35° 22′24.88″N	115° 20′ 37.95″ W	552	1	H3.5	30	S3	W2	12.8–30.9			UCLA	*SHumeston*	

UAb1-Type specimen at University of Alberta (*Uab*), classified by C. Herd, *Uab*. UAz1-Type specimen at Uaz, classified by D. H. Hill, *Uaz*. UCLA1-Type specimen at *UCLA*, classified by J. Wasson, *UCLA*. UCLA2-Type specimen at UCLA, classified by A. Rubin, *UCLA*.

Table 4. Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
DNG 06004	CM2	47.437	B					30(2)
GRA 06100	CR2	421.76	B	1	15	1	3	30(2)
GRA 06101	CV3	3555	B	1	23	0	1	30(2)
GRA 06128	Achon ungr	447.6	CE					30(2)
GRA 06129	Achon ungr	196.45	C	59	59	19	44	30(2)
GRA 06130	CV3	13.639	BE	1	32	0	2	30(2)
GRA 06131	CM2	7.273	B/C	1	23			30(2)
GRA 06157	Lun-A	0.788	A/B	7	54	19	66	30(2)
GRA 06172	CM2	21.069	B	1	44	3	3	30(2)
GRA 06173	CK4	5.505	A/B	31	31			30(2)
GRA 06189	Eu “ub”	2.941	B			60	60	30(2)
GRO 06082	LL6	52.532	B/C	31	31	25	25	30(2)
LAP 04444	L6	168.57	A/B					30(2)
LAP 04446	LL5	202.519	B					30(2)
LAP 04448	L5	122.64	A/B					30(2)
LAP 04449	LL5	105.485	B					30(2)
LAP 04450	L5	102.248	B/C					30(2)
LAP 04451	L5	150.962	C					30(2)
LAP 04452	L5	109.801	B					30(2)
LAP 04453	L5	85.38	B					30(2)
LAP 04454	L6	96.72	B					30(2)
LAP 04455	L6	52.768	C					30(2)
LAP 04456	L5	38.867	B					30(2)
LAP 04457	L6	32.383	B/C					30(2)
LAP 04458	L6	59.905	C					30(2)
LAP 04459	L5	63.712	B/C					30(2)
LAP 04460	L5	118.385	A/B					30(2)
LAP 04461	L5	27.879	B					30(2)
LAP 04462	H (Imp melt)	45.949	C	18	18	16	16	30(2)
LAP 04463	L5	53.213	A/B					30(2)
LAP 04464	LL6	31.879	B					30(2)
LAP 04465	H5	46.813	B					30(2)
LAP 04466	L6	29.414	B/C					30(2)
LAP 04467	L6	34.41	B/C					30(2)
LAP 04468	L6	16.807	B/C					30(2)
LAP 04469	L6	30.543	C					30(2)
LAP 04470	L5	19.415	C					30(2)
LAP 04471	L5	6.09	B/C					30(2)
LAP 04472	L5	22.333	C					30(2)
LAP 04473	L5	9.592	C					30(2)
LAP 04474	L5	25.133	C					30(2)
LAP 04475	L3	13.784	B	5	37	12	22	30(2)
LAP 04476	L5	9.967	B/C					30(2)
LAP 04477	LL5	25.536	B					30(2)
LAP 04478	L5	7.314	C					30(2)
LAP 04479	LL5	5.533	C					30(2)
LAP 04480	LL5	9.48	A/B					30(2)
LAP 04481	L6	12.646	B/C					30(2)
LAP 04482	L5	15.633	A					30(2)
LAP 04483	LL5	18.286	A/B					30(2)
LAP 04484	L5	11.78	C					30(2)
LAP 04485	L5	15.142	B/C					30(2)
LAP 04486	L5	9.749	B					30(2)
LAP 04487	L5	12.754	C					30(2)
LAP 04488	L4	9.84	C					30(2)
LAP 04489	L6	2.742	C					30(2)
LAP 04490	L5	3.659	B/C					30(2)
LAP 04491	L5	4.039	B/C					30(2)
LAP 04492	L6	6.823	B					30(2)
LAP 04493	L5	2.891	B					30(2)
LAP 04494	L5	5.031	B					30(2)
LAP 04495	H5	3.384	C					30(2)
LAP 04496	H6	5.743	C					30(2)
LAP 04497	LL5	7.598	B					30(2)
LAP 04498	H6	12.549	C					30(2)
LAP 04499	H6	2.777	C					30(2)
LAP 04500	H6	2.094	C					30(2)
LAP 04501	H6	1.704	C					30(2)
LAP 04502	L6	1.608	B/C					30(2)
LAP 04503	L5	4.005	B					30(2)
LAP 04504	H5	3.74	C					30(2)
LAP 04505	H6	2.517	B	18	18	16	16	30(2)
LAP 04506	LL6	2	A/B					30(2)
LAP 04507	H6	2.782	C					30(2)
LAP 04508	H6	2.383	C					30(2)
LAP 04509	H6	1.972	C					30(2)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
LAP 04510	H6	31.139	C					30(2)
LAP 04511	H5	17.104	C					30(2)
LAP 04512	L6	19.524	B/C					30(2)
LAP 04513	L5	17.473	C					30(2)
LAP 04514	CM2	14.796	B	0	64	1	1	30(2)
LAP 04515	L5	7.216	C					30(2)
LAP 04516	CR2	26.258	B	1	6	1	3	30(2)
LAP 04517	H5	7.847	B					30(2)
LAP 04518	L5	19.675	B/C					30(2)
LAP 04519	L5	26.314	B/C					30(2)
LAP 04520	H6	1.725	C					30(2)
LAP 04521	H5	7.136	B/C	19	19	17	17	30(2)
LAP 04522	LL6	7.17	A/B					30(2)
LAP 04523	H6	14.159	C					30(2)
LAP 04524	L6	2.287	B/C					30(2)
LAP 04525	L5	6.817	B/C					30(2)
LAP 04526	LL5	2.393	C					30(2)
LAP 04527	CM2	1.964	B	1	60	1	1	30(2)
LAP 04528	H5	15.606	C					30(2)
LAP 04529	L5	3.091	C					30(2)
LAP 04550	L5	22.994	B/C					30(2)
LAP 04551	L6	15.62	C					30(2)
LAP 04552	CM2	11.417	C	1	39	1	5	30(2)
LAP 04553	L6	7.615	B					30(2)
LAP 04554	L5	14.213	B					30(2)
LAP 04555	LL5	23.745	A/B					30(2)
LAP 04556	H4	43.7	B/C	19	19	17	17	30(2)
LAP 04557	LL5	25.339	A/B					30(2)
LAP 04558	H6	7.415	C					30(2)
LAP 04559	L6	16.977	B/C					30(2)
LAP 04560	L5	38.726	B					30(2)
LAP 04561	L5	6.737	C					30(2)
LAP 04562	H6	5.505	C					30(2)
LAP 04563	L4	6.824	B					30(2)
LAP 04564	L6	4.131	C					30(2)
LAP 04565	CM2	7.066	B	1	56	1	1	30(2)
LAP 04566	LL6	9.941	C					30(2)
LAP 04567	L5	3.13	C					30(2)
LAP 04568	LL6	3.117	A/B					30(2)
LAP 04569	LL5	1.879	A					30(2)
LAP 04570	L5	3.953	B/C					30(2)
LAP 04571	LL5	5.972	B					30(2)
LAP 04572	CK5	6.62	B	36	36	30	30	30(2)
LAP 04573	LL6	3.987	B					30(2)
LAP 04574	L6	10.062	C					30(2)
LAP 04575	L5	8.17	C					30(2)
LAP 04576	L6	1.845	C					30(2)
LAP 04577	LL5	4.869	B					30(2)
LAP 04578	L5	4.427	C	24	24	21	21	30(2)
LAP 04579	LL6	5.706	B					30(2)
LAP 04580	H6	21.932	C					30(2)
LAP 04581	LL5	16.021	A/B	31	31	25	25	30(2)
LAP 04582	LL6	86.866	B/C					30(2)
LAP 04583	LL6	81.835	A					30(2)
LAP 04584	LL5	33.273	B/C					30(2)
LAP 04585	L5	26.663	C					30(2)
LAP 04586	LL5	30.181	B					30(2)
LAP 04587	L5	26.126	B/C					30(2)
LAP 04588	CM2	10.984	C	1	40	1	8	30(2)
LAP 04589	LL6	10.258	B/C					30(2)
LAP 04590	L5	19.921	C					30(2)
LAP 04591	L5	5.362	B/C					30(2)
LAP 04592	CR2	13.056	B/C	1	3	1	6	30(2)
LAP 04593	L5	16.556	B/C					30(2)
LAP 04594	H6	7.514	B/C					30(2)
LAP 04595	H6	3.25	C					30(2)
LAP 04596	LL5	1.954	B					30(2)
LAP 04597	H6	13.62	B/C					30(2)
LAP 04598	LL5	23.989	B/C					30(2)
LAP 04599	L5	41.327	B/C					30(2)
LAP 04600	LL6	20.981	B					30(2)
LAP 04601	L6	48.775	B/C					30(2)
LAP 04602	L5	20.098	A/B					30(2)
LAP 04603	L5	20.426	C					30(2)
LAP 04604	LL5	30.07	B/C					30(2)
LAP 04605	L5	63.047	B/C					30(2)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
LAP 04606	L6	21.002	C					30(2)
LAP 04607	L6	32.989	C					30(2)
LAP 04608	L5	15.54	C					30(2)
LAP 04609	LL6	27.359	A/B					30(2)
LAP 04610	LL5	18.804	B					30(2)
LAP 04611	LL5	37.219	A/B					30(2)
LAP 04612	L3	22.433	B	8	25	4	19	30(2)
LAP 04613	L6	17.794	B/C					30(2)
LAP 04614	H (Imp melt)	5.653	C	19	19	17	17	30(2)
LAP 04615	L5	9.392	C					30(2)
LAP 04616	L5	19.289	B					30(2)
LAP 04617	LL6	22.822	B					30(2)
LAP 04618	L5	10.004	C					30(2)
LAP 04619	LL5	16.332	A/B					30(2)
LAP 04620	L5	6.14	B					30(2)
LAP 04621	L5	8.016	B					30(2)
LAP 04622	L6	7.355	B					30(2)
LAP 04623	LL5	4.996	A/B					30(2)
LAP 04624	L5	5.879	B					30(2)
LAP 04625	L5	6.061	A/B					30(2)
LAP 04626	L6	6.255	B					30(2)
LAP 04627	LL5	4.663	A/B					30(2)
LAP 04628	L6	3.09	C					30(2)
LAP 04629	L5	2.817	C					30(2)
LAP 04630	L6	4.042	C					30(2)
LAP 04631	L6	5.495	B/C					30(2)
LAP 04632	L6	8.524	B/C					30(2)
LAP 04633	L6	1.92	C					30(2)
LAP 04634	L5	3.155	C					30(2)
LAP 04635	L5	6.778	C					30(2)
LAP 04636	L6	4.09	C					30(2)
LAP 04637	L6	5.174	C					30(2)
LAP 04638	L6	3.48	C					30(2)
LAP 04639	L6	3.791	C					30(2)
LAP 04650	L5	49.552	B					30(2)
LAP 04651	L5	43.884	B					30(2)
LAP 04652	L5	27.712	B					30(2)
LAP 04653	L5	47.23	B/C					30(2)
LAP 04654	L5	56.758	B					30(2)
LAP 04655	LL5	28.984	A/B					30(2)
LAP 04656	L5	35.326	B					30(2)
LAP 04657	LL6	34.691	A/B					30(2)
LAP 04658	L5	25.597	B/C					30(2)
LAP 04659	L5	29.815	B/C					30(2)
LAP 04660	H6	22.654	B					30(2)
LAP 04661	L6	43.852	B/C					30(2)
LAP 04662	L6	13.422	C					30(2)
LAP 04663	LL5	11.598	B					30(2)
LAP 04664	L6	15.774	C					30(2)
LAP 04665	L6	8.903	C					30(2)
LAP 04666	L6	12.66	A/B					30(2)
LAP 04667	L6	9.76	C					30(2)
LAP 04668	L6	10.306	C					30(2)
LAP 04669	L6	3.945	A/B					30(2)
LAP 04670	L6	8.075	B/C					30(2)
LAP 04671	LL5	5.368	B/C					30(2)
LAP 04672	H5	3.655	C	19	19	17	17	30(2)
LAP 04673	L5	8.639	C					30(2)
LAP 04674	L6	6.245	B/C					30(2)
LAP 04675	CM2	6.573	B	1	50	1	5	30(2)
LAP 04676	L5	9.341	B/C					30(2)
LAP 04677	L5	13.538	C					30(2)
LAP 04678	L6	21.336	C					30(2)
LAP 04679	LL6	8.832	B					30(2)
LAP 04680	CM2	14.047	B/C	1	50	1	2	30(2)
LAP 04681	LL4	34.18	A/B					30(2)
LAP 04682	L5	41.418	C					30(2)
LAP 04683	H5	32.402	C					30(2)
LAP 04684	LL6	22.305	A/B					30(2)
LAP 04685	L4	17.541	B					30(2)
LAP 04686	L6	26.336	C					30(2)
LAP 04687	H6	11.303	C					30(2)
LAP 04688	H6	19.616	C					30(2)
LAP 04689	H5	11.242	C	19	19	17	17	30(2)
LAP 04690	L6	10.216	C					30(2)
LAP 04691	L5	11.712	B					30(2)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
LAP 04692	L6	12.592	C					30(2)
LAP 04693	L5	11.299	B/C					30(2)
LAP 04694	L5	7.492	C					30(2)
LAP 04695	L5	7.382	C					30(2)
LAP 04696	LL5	7.395	A/B					30(2)
LAP 04697	L5	2.774	C					30(2)
LAP 04698	L5	5.44	C					30(2)
LAP 04699	L5	6.854	C					30(2)
LAP 04700	L5	7.069	C					30(2)
LAP 04701	L5	7.554	B/C					30(2)
LAP 04702	LL5	4.623	A/B					30(2)
LAP 04703	H5	6.132	B/C					30(2)
LAP 04704	H6	4.148	B/C					30(2)
LAP 04705	H6	1.893	C					30(2)
LAP 04706	L5	2.747	B					30(2)
LAP 04707	L6	1.934	B/C					30(2)
LAP 04708	L5	1.1	B					30(2)
LAP 04709	L6	0.7	B					30(2)
LAP 04730	LL5	26.517	A/B					30(2)
LAP 04731	L6	14.51	A					30(2)
LAP 04732	L5	25.776	C					30(2)
LAP 04733	LL5	20.058	A/B					30(2)
LAP 04734	L6	26.695	C					30(2)
LAP 04735	L5	22.117	B/C					30(2)
LAP 04736	H6	15.052	C					30(2)
LAP 04737	L5	14.323	B					30(2)
LAP 04738	LL5	20.379	B					30(2)
LAP 04739	H5	6.564	B/C					30(2)
LAP 04740	LL5	9.795	A/B					30(2)
LAP 04741	H5	3.215	B	19	19	17	17	30(2)
LAP 04742	L5	11.554	B/C					30(2)
LAP 04743	L6	3	B					30(2)
LAP 04744	LL6	10.837	B					30(2)
LAP 04745	H (Imp melt)	3.225	C	19	19	17	17	30(2)
LAP 04746	L5	7.733	C					30(2)
LAP 04747	LL6	11.909	B					30(2)
LAP 04748	L6	7.539	C					30(2)
LAP 04749	L4	5.93	C					30(2)
LAP 04760	CM2	1.119	B	1	38	42	42	30(2)
LAP 04761	L5	2.673	B					30(2)
LAP 04762	L6	3.381	C					30(2)
LAP 04763	H6	2.501	C					30(2)
LAP 04764	L6	2.72	C					30(2)
LAP 04765	L6	2.703	C					30(2)
LAP 04766	L6	1.1	C					30(2)
LAP 04767	L6	6.475	B/C					30(2)
LAP 04768	L5	2.021	B/C					30(2)
LAP 04769	LL5	3.389	A					30(2)
LAP 04790	LL5	65.954	A/B					30(2)
LAP 04791	LL5	50.76	B					30(2)
LAP 04792	L5	39.744	B/C					30(2)
LAP 04793	LL5	34.572	B/C					30(2)
LAP 04794	L5	37.74	C					30(2)
LAP 04795	LL5	55.992	B					30(2)
LAP 04796	CM2	15.695	A/B					30(2)
LAP 04797	LL6	49.792	A/B					30(2)
LAP 04798	LL5	69.589	A/B					30(2)
LAP 04799	L6	13.968	C					30(2)
LAP 04800	L5	32.354	B					30(2)
LAP 04801	L5	18.477	C					30(2)
LAP 04802	L5	23.087	B					30(2)
LAP 04803	L5	27.907	A/B					30(2)
LAP 04804	L5	19.484	B/C					30(2)
LAP 04805	L5	14.646	B/C					30(2)
LAP 04806	L5	14.544	C					30(2)
LAP 04807	CM2	11.59	B/C	1	61	5	5	30(2)
LAP 04808	H5	20.139	B/C					30(2)
LAP 04809	CM2	15.835	B	1	46			30(2)
LAP 04810	L6	15.178	B/C					30(2)
LAP 04811	L6	8.673	B/C					30(2)
LAP 04812	LL6	20.595	B					30(2)
LAP 04813	LL6	9.937	B					30(2)
LAP 04814	LL6	8.38	A					30(2)
LAP 04815	L6	12.101	B/C					30(2)
LAP 04816	L6	15.129	C					30(2)
LAP 04817	H5	14.728	C					30(2)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
LAP 04818	L6	13.884	C					30(2)
LAP 04819	LL5	16.319	A/B					30(2)
LAP 04820	H5	14.747	B/C					30(2)
LAP 04821	L6	22.008	B/C					30(2)
LAP 04822	L6	4.94	C					30(2)
LAP 04823	L6	9.667	B/C					30(2)
LAP 04824	CM1	1.706	B					30(2)
LAP 04825	L5	6.104	C					30(2)
LAP 04826	LL6	5.84	A/B					30(2)
LAP 04827	LL6	3.028	A/B					30(2)
LAP 04828	L5	7.02	C					30(2)
LAP 04829	LL5	14.896	A/B					30(2)
LAR 04364	CV3	5.823	CE	1	36			30(2)
LAR 04369	H METAL	0.6	C	19	19	17	17	30(2)
LAR 04380	L3	13.986	B	17	31	6	27	30(2)
LAR 04382	H3	43.664	B	6	30	1	13	30(2)
LAR 06319	Sherg	78.572	A/B	25	48	25	51	30(2)
LAR 06621	How	20.235	A/B			19	60	30(2)
LAR 06638	Lun-A	5.293	A/B	28	33	27	39	30(2)
LAR 06870	Eu “br”	15.43	A/B			60	60	30(2)
LAR 06875	Eu “br”	165.797	B/C			61	61	30(2)
LAR 06876	IAB	475.3	A	5	5	6	6	30(2)
LAR 06877	IIIAB	588.2	A					30(2)
MAC 04860	H6	6.17	C					30(2)
MAC 04861	L5	2.442	B/C					30(2)
MAC 04869	L5	3.332	B					30(2)
MAC 04993	L5	18.569	B					30(2)
MAC 04996	H5	2.072	B/C					30(2)
MAC 04997	L5	6.766	B/C					30(2)
MAC 04998	L5	18.25	B					30(2)
MAC 04999	L5	13.544	B/C					30(2)
MAC 041000	H6	32.306	C					30(2)
MAC 041001	H5	12.35	B					30(2)
MAC 041002	H5	19.216	B					30(2)
MAC 041003	H5	5.481	B/C					30(2)
MAC 041004	L5	6.57	B/C					30(2)
MAC 041005	H6	5.227	C					30(2)
MAC 041006	L5	8.286	B					30(2)
MAC 041007	H5	5.607	B					30(2)
MAC 041008	L6	16.768	A/B					30(2)
MAC 041009	H5	4.886	B					30(2)
MAC 041020	L5	1.439	C					30(2)
MAC 041022	H5	2.249	B/C					30(2)
MAC 041023	H5	3.754	B/C					30(2)
MAC 041024	L5	4.524	B/C					30(2)
MAC 041240	L5	3.967	C					30(2)
MAC 041241	L5	1.426	C					30(2)
MAC 041242	L5	2.392	B					30(2)
MAC 041243	L5	3.054	B					30(2)
MAC 041244	L5	3.107	C					30(2)
MAC 041245	L6	2.903	C					30(2)
MAC 041246	L6	2.068	C					30(2)
MAC 041247	L5	2.039	B/C					30(2)
MAC 041248	L6	5.412	C					30(2)
MAC 041249	L5	2.77	C					30(2)
MAC 041250	L5	1.2	B					30(2)
MAC 041251	LL5	1.512	A/B					30(2)
MAC 041252	L4	3.045	B/C					30(2)
MAC 041253	L5	1.2	B					30(2)
MAC 041254	L5	1.637	C					30(2)
MAC 041255	L5	5.526	B					30(2)
MAC 041256	L5	3.643	B/C					30(2)
MAC 041257	L4	3.325	B/C					30(2)
MAC 041258	L5	2.863	C					30(2)
MAC 041259	L5	1.873	C					30(2)
MIL 05069	EH3	76.452	C	0	1	0	2	30(2)
MIL 05147	IIIAB	4.9	A					30(2)
PRA 04414	H4	104.4	B	18	18	16	23	30(2)
RBT 04127	LL5	3805.2	A					30(2)
RBT 04143	CV3	89.562	B	1	69	1	3	30(2)
RBT 04251	H3	19.542	B	1	20	1	6	30(2)
RBT 04255	Achon ungr	10.17	C	24	24	21	21	30(2)
RBT 04263	LL5	711.4	B					30(2)
RBT 04264	L5	576.5	C					30(2)
RBT 04265	LL5	401.3	B					30(2)
RBT 04266	L6	739.7	B/C					30(2)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
RBT 04267	L5	564.3	B					30(2)
RBT 04268	L5	714.8	C					30(2)
RBT 04269	LL5	616.3	B					30(2)
SCO 06040	How	60.162	A/B			19	65	30(2)
SCO 06041	Eu “br”	45.154	A			49	49	30(2)
TYR 05181	IIE	544.1	A			19	19	30(2)
CMS 04004	LL6	493.1	B/C					31(1)
CMS 04005	H5	491.4	B/C					31(1)
CMS 04020	LL6	97.8	A/BE					31(1)
CMS 04022	L5	197.3	C					31(1)
CMS 04023	L5	22.7	C					31(1)
CMS 04024	LL5	152.6	AE					31(1)
CMS 04025	L5	12.8	B					31(1)
CMS 04026	LL6	114	A/B					31(1)
CMS 04027	LL6	82.3	B/C					31(1)
CMS 04028	L5	116.6	CE					31(1)
CMS 04029	H6	96	C					31(1)
CMS 04030	L5	117.6	B					31(1)
CMS 04031	L5	32.4	B					31(1)
CMS 04032	Mesosiderite	84.9	B/C			30	33	31(1)
CMS 04033	L5	35.1	B/C					31(1)
CMS 04034	L5	14.6	B					31(1)
CMS 04035	L5	6.7	B					31(1)
CMS 04036	L5	19.4	C					31(1)
CMS 04037	H5	56	C					31(1)
CMS 04038	H6	28	C					31(1)
CMS 04039	L5	43.2	C					31(1)
CMS 04050	H6	3908	CE					31(1)
CMS 04051	H5	1789.9	B/C					31(1)
CMS 04052	LL5	1511.2	BE					31(1)
CMS 04053	L5	1310.6	B/E					31(1)
CMS 04054	LL6	1113.6	A/BE					31(1)
CMS 04055	LL6	1715	A/BE					31(1)
CMS 04056	L6	2291.6	B/C					31(1)
CMS 04057	L6	2403.2	B/CE					31(1)
CMS 04059	L5	1858	B/CE					31(1)
CMS 04060	LL5	320.7	A/B					31(1)
LAP 04430	L5	2408	AB					31(1)
LAP 04431	L5	531.5	B/C					31(1)
LAP 04432	L5	162.7	A/B					31(1)
LAP 04433	L5	226.6	B					31(1)
LAP 04434	H6	227.2	C					31(1)
LAP 04435	L5	148.7	B/C					31(1)
LAP 04436	L5	408.9	B					31(1)
LAP 04437	LL5	190	A					31(1)
LAP 04438	L5	166.9	B					31(1)
LAP 04439	L5	576.5	B					31(1)
LAP 04440	L5	3085.9	A/B					31(1)
LAP 04441	L6	702.8	B					31(1)
LAP 04442	L6	291	B					31(1)
LAP 04443	L5	144.7	B					31(1)
LAP 04445	L5	258.7	B					31(1)
LAP 04447	H6	104.5	C					31(1)
LAP 04540	L5	180.2	A					31(1)
LAP 04541	L5	63	B/C					31(1)
LAP 04542	L5	94	B/C					31(1)
LAP 04543	L5	35.3	B/C					31(1)
LAP 04544	H5	50.5	C					31(1)
LAP 04545	L5	71.5	A/B					31(1)
LAP 04546	LL6	48.6	B					31(1)
LAP 04547	L6	93.9	C					31(1)
LAP 04548	LL6	99.5	A					31(1)
LAP 04549	H5	96.9	C					31(1)
LAP 04710	L5	154.6	A/B					31(1)
LAP 04711	L5	54.4	B					31(1)
LAP 04712	L5	128.3	B					31(1)
LAP 04713	L5	92.8	A/B					31(1)
LAP 04714	LL6	61.7	B					31(1)
LAP 04715	L6	93.4	A/B					31(1)
LAP 04716	LL6	66.6	B/C					31(1)
LAP 04717	L5	100.8	A/B					31(1)
LAP 04718	L5	50.3	B/C					31(1)
LAP 04719	LL6	61.9	A/B					31(1)
LAP 04720	CR2	58.8	B/C	1	2	2	3	31(1)
LAP 04721	CR2	35	B/C	1	68	1	2	31(1)
LAP 04722	L5	36.5	B/C					31(1)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
LAP 04723	L5	36.9	B/C					31(1)
LAP 04724	H5	33.7	B/C					31(1)
LAP 04725	L5	33	A/B					31(1)
LAP 04726	L5	47.2	A/B					31(1)
LAP 04727	L5	29.3	A/B					31(1)
LAP 04728	L5	45.1	B/C					31(1)
LAP 04729	L5	43.3	A/B					31(1)
LAP 04754	CM2	7.2	C	1	5			31(1)
LAP 04780	LL6	74.9	A/B					31(1)
LAP 04781	LL6	43.2	A					31(1)
LAP 04782	L5	69.2	B					31(1)
LAP 04783	LL6	55	A/B					31(1)
LAP 04784	L5	56.5	B/C					31(1)
LAP 04785	LL6	132.5	A/B					31(1)
LAP 04786	LL6	68.9	A/B					31(1)
LAP 04787	L5	69.3	A/B					31(1)
LAP 04788	L5	119.8	A/B					31(1)
LAP 04789	L5	83.1	B/C					31(1)
LAR 04320	L6	463	B/C					31(1)
LAR 04321	L6	266	A/B					31(1)
LAR 04322	H6	261.2	B/C					31(1)
LAR 04323	L6	380.4	A/B					31(1)
LAR 04324	LL5	1194.8	A/B					31(1)
LAR 04325	LL5	806.5	B	28	28	23	23	31(1)
LAR 04326	LL6	582.9	A/B					31(1)
LAR 04327	L5	719	B/C					31(1)
LAR 04329	LL6	2005.1	A/B					31(1)
LAR 04330	LL5	2237.2	A/B					31(1)
LAR 04331	L5	172	B					31(1)
LAR 04332	L5	95	B/C					31(1)
LAR 04333	L5	211.4	C					31(1)
LAR 04334	LL6	211.9	B					31(1)
LAR 04335	LL5	192	B					31(1)
LAR 04336	H5	228.2	B/C					31(1)
LAR 04337	L5	192.7	B/C					31(1)
LAR 04338	L5	199.3	B					31(1)
LAR 04339	L5	166.5	A/B					31(1)
LAR 04340	L5	322.8	A/B					31(1)
LAR 04341	L5	153.9	B/C					31(1)
LAR 04342	H6	132	B/C					31(1)
LAR 04343	LL5	171.2	A/B					31(1)
LAR 04344	H6	121.3	B/C					31(1)
LAR 04345	L6	255.2	A/B					31(1)
LAR 04346	H5	72.3	B/C					31(1)
LAR 04347	L5	96.4	B/C					31(1)
LAR 04348	L6	50	A/B					31(1)
LAR 04349	L6	69.9	A/B					31(1)
LAR 04350	L5	31.6	B					31(1)
LAR 04351	L5	62.9	C					31(1)
LAR 04352	L5	31.5	B					31(1)
LAR 04353	L5	55.8	B/C					31(1)
LAR 04354	H6	39.3	B					31(1)
LAR 04355	H6	44	C					31(1)
LAR 04356	L5	31.7	B					31(1)
LAR 04357	H5	79.5	C					31(1)
LAR 04358	L5	46.6	B					31(1)
LAR 04359	L5	40.5	B					31(1)
LAR 04362	H5	22.1	C					31(1)
LAR 04390	H6	15.8	C					31(1)
LAR 04391	H6	12	C					31(1)
LAR 04392	H6	6.2	C					31(1)
LAR 04393	H6	19.2	C					31(1)
MAC 04850	L5	1999.1	B/CE					31(1)
MAC 04851	H5	2007.3	B/C					31(1)
MAC 04852	H5	906.1	B/C					31(1)
MAC 04853	LL5	375.8	A/B					31(1)
MAC 04854	H5	373	B/C					31(1)
MAC 04855	LL5	83.7	B					31(1)
MAC 04856	H5	75.5	C					31(1)
MAC 04857	LL6	88	A/B					31(1)
MAC 04858	H5	38.2	B/C					31(1)
MAC 04859	H5	43.9	C					31(1)
MAC 04873	H5	2.3	C					31(1)
MAC 04875	H5	1.4	C					31(1)
MAC 04878	H5	0.9	C					31(1)
MAC 04879	H5	1.4	C					31(1)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
MAC 04890	H5	8.3	B/C					31(1)
MAC 04891	LL6	6.2	A/B					31(1)
MAC 04892	L5	17.5	B					31(1)
MAC 04893	L6	12.2	A/B					31(1)
MAC 04894	L5	57.6	B/C					31(1)
MAC 04895	H5	33.7	B/C					31(1)
MAC 04896	LL5	105.9	A/B					31(1)
MAC 04897	L5	17.4	B/C					31(1)
MAC 04898	L5	11.6	B					31(1)
MAC 04899	L5	26.5	B					31(1)
MAC 04901	H6	5.1	C					31(1)
MAC 04902	L5	2.9	B					31(1)
MAC 04910	L5	2.5	B/C					31(1)
MAC 04913	H5	1.6	B/C					31(1)
MAC 04914	H5	2.8	C					31(1)
MAC 04916	L5	4.9	B/C					31(1)
MAC 04917	H5	1.1	B					31(1)
MAC 04920	L5	1.9	B/C					31(1)
MAC 04921	L5	1.9	B/C					31(1)
MAC 04922	L5	3	B					31(1)
MAC 04923	L5	2.1	B					31(1)
MAC 04924	L5	1.8	B					31(1)
MAC 04925	H5	0.3	B					31(1)
MAC 04926	H5	1.9	B					31(1)
MAC 04927	L5	1.2	B					31(1)
MAC 04928	L5	0.3	B					31(1)
MAC 04929	H5	0.2	B					31(1)
MAC 04942	L4	13.1	B/C					31(1)
MAC 04943	L5	1.6	B/C					31(1)
MAC 04944	H5	0.9	B					31(1)
MAC 04945	L5	2	B/C					31(1)
MAC 04949	LL5	4.5	B					31(1)
MAC 04950	L5	6.5	C					31(1)
MAC 04951	L5	7.4	C					31(1)
MAC 04952	L5	9	C					31(1)
MAC 04953	L5	3.6	B/C					31(1)
MAC 04954	H6	11.7	C					31(1)
MAC 04967	L5	1.5	B/C					31(1)
MAC 04969	H5	1.1	B/C					31(1)
MAC 04971	H5	2	B/C					31(1)
MAC 04975	H5	1.2	B/C					31(1)
MAC 04976	L5	2.9	B/C					31(1)
MAC 041021	H4	2.8	C	19	19	14	27	31(1)
MAC 041025	L5	3.1	B					31(1)
MAC 041026	L5	8.5	B					31(1)
MAC 041028	L5	2.5	B/C					31(1)
MAC 041029	L5	2.5	B/C					31(1)
MAC 041040	H5	1.7	C					31(1)
MAC 041041	L5	1.6	C					31(1)
MAC 041042	L5	2.8	C					31(1)
MAC 041043	L5	7.7	C					31(1)
MAC 041044	L5	16	C					31(1)
MAC 041045	L5	15.5	C					31(1)
MAC 041046	H6	14.2	C					31(1)
MAC 041047	H5	5.6	C					31(1)
MAC 041048	H5	8.1	C					31(1)
MAC 041049	H5	33.4	C					31(1)
MAC 041050	H6	25.6	C					31(1)
MAC 041051	H6	40	C					31(1)
MAC 041052	L5	7.3	B/C					31(1)
MAC 041053	L5	4.3	B/C					31(1)
MAC 041054	L5	4.2	C					31(1)
MAC 041055	L5	9.5	B					31(1)
MAC 041056	H5	2.8	B/C					31(1)
MAC 041057	L5	7.8	B/C					31(1)
MAC 041058	L5	5.2	B/C					31(1)
MAC 041059	L5	5.7	C					31(1)
MAC 041060	L5	8.2	C					31(1)
MAC 041061	L5	2.3	B/C					31(1)
MAC 041062	L5	2.4	B					31(1)
MAC 041063	L5	4.6	B/C					31(1)
MAC 041064	H5	5	C					31(1)
MAC 041065	H5	2.5	B/C					31(1)
MAC 041066	L5	3	B					31(1)
MAC 041067	H5	2.7	B/C					31(1)
MAC 041068	H5	1.6	B/C					31(1)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
MAC 041069	L5	3.3	B/C					31(1)
MAC 041085	L5	1.6	B/C					31(1)
MAC 041086	H5	1.8	C					31(1)
MAC 041087	L5	1.5	B					31(1)
MAC 041088	H5	2.6	B/C					31(1)
MAC 041089	H5	1.5	B/C					31(1)
MAC 041090	L5	2.9	B/C					31(1)
MAC 041091	H5	7.7	B/C					31(1)
MAC 041092	H5	2.1	C					31(1)
MAC 041093	L5	7.2	B/C					31(1)
MAC 041094	L6	4.8	B/C					31(1)
MAC 041095	L5	2.5	B/C					31(1)
MAC 041096	L5	2.8	C					31(1)
MAC 041098	H6	2.4	C					31(1)
MAC 041099	H5	1.7	C					31(1)
MAC 041160	H5	1.4	B/C					31(1)
MAC 041161	H5	1.7	B/C					31(1)
MAC 041162	H5	2.1	B/C					31(1)
MAC 041163	L5	1.8	B/C					31(1)
MAC 041165	L6	1.9	B/C					31(1)
MAC 041166	L5	2.4	B/C					31(1)
MAC 041167	H5	6.2	B/C					31(1)
MAC 041168	L5	2.4	B					31(1)
MAC 041170	H5	26.4	C					31(1)
MAC 041171	H5	30.6	C					31(1)
MAC 041172	LL5	32.5	B					31(1)
MAC 041173	LL5	34	B					31(1)
MAC 041174	L5	6.9	B/C					31(1)
MAC 041175	H5	11.4	C					31(1)
MAC 041176	H5	24.1	C					31(1)
MAC 041177	H5	52.2	C					31(1)
MAC 041178	H5	97.8	C					31(1)
MAC 041179	H5	185.6	C					31(1)
MAC 041260	H5	2.6	B/C					31(1)
MAC 041261	H5	4	B/C					31(1)
MAC 041262	H5	3.4	B/C					31(1)
MAC 041263	H5	2.6	B/C					31(1)
MAC 041264	H5	1.2	B/C					31(1)
MAC 041265	H5	3.3	B/C					31(1)
MAC 041266	H5	3.9	B/C					31(1)
MAC 041267	H5	2.7	B/C					31(1)
MAC 041268	H5	1.5	B/C					31(1)
MAC 041270	H5	4.6	B/C					31(1)
MAC 041271	H5	3.3	B/C					31(1)
RBT 04130	L5	897.1	B/C					31(1)
RBT 04131	L5	392.4	B/C					31(1)
RBT 04132	L5	950.7	B/C					31(1)
RBT 04133	CR2	459.4	B/C	1	12	1	2	31(1)
RBT 04240	LL5	58.1	A					31(1)
RBT 04278	H5	271	C					31(1)
GRA 06102	L5	12497.5	B					31(1)
GRA 06150	L6	179.5	B					31(1)
GRA 06151	L5	63.4	B					31(1)
GRA 06152	L5	126.4	C					31(1)
GRA 06153	L5	106.2	B/C					31(1)
GRA 06154	H5	38.8	C					31(1)
GRA 06155	H6	24.9	C					31(1)
GRA 06156	L5	7	B/C					31(1)
GRA 06158	CM2	1.3	B/C	1	23	3	4	31(1)
GRA 06159	L5	5.2	B/C					31(1)
GRA 06160	L5	1.2	B/C					31(1)
GRA 06161	L5	0.5	B					31(1)
GRA 06162	L6	42.1	B/C					31(1)
GRA 06163	LL5	20.2	B					31(1)
GRA 06164	L5	11.4	C					31(1)
GRA 06165	H5	3	C					31(1)
GRA 06166	L5	15.5	C					31(1)
GRA 06167	LL6	4.9	A/B					31(1)
GRA 06168	L5	1.8	B					31(1)
GRA 06169	L5	4.1	B					31(1)
GRA 06180	L5	23.7	B/C					31(1)
GRA 06181	LL5	50.4	B					31(1)
GRA 06182	LL6	30.7	B					31(1)
GRA 06183	L5	7.1	B/C					31(1)
GRA 06184	L6	37.4	B/C					31(1)
GRA 06185	LL6	54.4	B					31(1)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
GRA 06186	LL6	9.5	B					31(1)
GRA 06187	L5	2.7	C					31(1)
GRA 06188	L5	7.5	C					31(1)
GRA 06190	L6	12.7	B					31(1)
GRA 06191	L5	10.1	A/B					31(1)
GRA 06192	H6	32.4	C					31(1)
GRA 06193	L5	4.2	C					31(1)
GRA 06194	L5	3.3	B					31(1)
GRA 06195	L5	6.2	B/C					31(1)
GRA 06196	L5	12	B/C					31(1)
GRA 06197	L6	11.7	B/C					31(1)
GRA 06198	LL5	8.4	B					31(1)
GRA 06199	H6	6	C					31(1)
GRA 06200	L5	158.6	C					31(1)
GRA 06201	L5	91.6	B					31(1)
GRA 06202	L5	65.6	B/C					31(1)
GRA 06203	LL5	63.6	A					31(1)
GRA 06204	L5	84.5	C					31(1)
GRA 06210	H5	38.8	C					31(1)
GRA 06211	H5	22.1	C					31(1)
GRA 06212	LL5	32.1	A					31(1)
GRA 06213	LL6	31.3	B					31(1)
GRA 06214	LL6	21.4	B					31(1)
GRA 06215	L5	8	B					31(1)
GRA 06216	L5	1.1	B					31(1)
GRA 06217	L5	5.3	C					31(1)
GRA 06218	L5	1.6	C					31(1)
GRA 06219	L5	4	C					31(1)
GRA 06220	H5	4.5	C					31(1)
GRA 06221	L5	0.4	B					31(1)
GRA 06222	L5	1.1	B					31(1)
GRA 06223	L6	9.2	B					31(1)
GRA 06224	L5	3.8	C					31(1)
GRA 06225	L5	1	B					31(1)
GRA 06226	L5	2.2	B					31(1)
GRA 06227	L5	13.8	B					31(1)
GRA 06228	L5	10.9	B/C					31(1)
GRA 06229	L5	7.2	B/C					31(1)
GRA 06230	LL6	3.3	B					31(1)
GRA 06231	L5	3.2	C					31(1)
GRA 06232	L6	7.5	B/C					31(1)
GRA 06233	LL6	7.3	A/B					31(1)
GRA 06234	L5	4.1	B/C					31(1)
GRO 06050	Iron-IAB	9130	BE	2	2	8	8	31(1)
GRO 06051	L5	1501.6	B/C					31(1)
GRO 06052	LL6	907.6	A/B					31(1)
GRO 06053	L5	1033.1	B					31(1)
GRO 06054	L3	1319.4	A	4	28	4	23	31(1)
GRO 06055	L6	917.9	B					31(1)
GRO 06056	L5	500.6	C					31(1)
GRO 06057	L5	730.9	B/CE					31(1)
GRO 06058	LL6	482.3	B					31(1)
GRO 06059	Eu "br"	433.5	A			29	58	31(1)
GRO 06060	H6	325.7	C					31(1)
GRO 06061	L5	199.3	C					31(1)
GRO 06062	LL5	243	B					31(1)
GRO 06063	L5	218	C					31(1)
GRO 06064	L5	174	B/C					31(1)
GRO 06065	H5	139.6	B/C					31(1)
GRO 06066	L6	292.7	B/C					31(1)
GRO 06067	H5	176	C					31(1)
GRO 06068	H3	174.3	B/C	9	30	3	23	31(1)
GRO 06069	H6	94	C					31(1)
GRO 06070	H5	80.8	C					31(1)
GRO 06071	L6	108.1	C					31(1)
GRO 06072	L5	83.8	C					31(1)
GRO 06073	H5	67.6	C					31(1)
GRO 06074	H5	98.5	C					31(1)
GRO 06075	H6	41.5	C					31(1)
GRO 06076	L6	156.7	B					31(1)
GRO 06077	H6	138.8	C					31(1)
GRO 06078	L6	75.6	C					31(1)
GRO 06079	H6	88.7	C					31(1)
GRO 06080	L5	99.6	A/B					31(1)
GRO 06081	L6	66.2	B/C					31(1)
GRO 06083	H5	42.4	C					31(1)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
GRO 06084	L6	50.7	C					31(1)
GRO 06085	L5	49	C					31(1)
GRO 06086	LL6	29.4	A/B					31(1)
GRO 06087	H6	33.2	C					31(1)
GRO 06088	H5	23.5	C					31(1)
GRO 06089	H5	23.4	C					31(1)
GRO 06090	L6	16.3	B/C					31(1)
GRO 06091	LL5	27.7	A					31(1)
GRO 06092	H6	15	C					31(1)
GRO 06093	LL5	3.4	A					31(1)
GRO 06094	L5	3.7	B					31(1)
GRO 06096	LL5	10.3	A					31(1)
GRO 06097	L6	2.3	B					31(1)
GRO 06098	L5	3.3	B/C					31(1)
LAR 06253	H6	7595	B/C					31(1)
LAR 06317	CV3	167.2	B	0	34	1	3	31(1)
LAR 06318	CM2	25	A/B	0	54	1	4	31(1)
LAR 06867	CV3	6.5	B	1	4	1	1	31(1)
LAR 06868	CK5	15.4	C	31	31	26	26	31(1)
LAR 06869	CK6	18.4	C	34	34			31(1)
LAR 06871	CK5	25.7	B	29	29	26	26	31(1)
LAR 06872	CK6	31	C	34	34			31(1)

Table 4. *Continued.* Antarctic Meteorites collected and classified by the ANSMET program.

Name	Type	Mass (g)	Weath [a]	%Fa -min	%Fa -max	%Fs -min	%Fs -max	AMN ref
LAR 06873	CK6	15.5	C	34	34			31(1)
LAR 06874	CK5	42.2	A/B	29	29	25	25	31(1)
SCO 06012	CM2	14.3	B/C	0	39			31(1)
SCO 06013	CM2	20.7	B/C	1	30			31(1)
SCO 06014	CM2	48.2	B/C	1	35			31(1)
SCO 06015	L5	205.1	A					31(1)
SCO 06016	L5	204.2	A					31(1)
SCO 06017	L5	64.1	A					31(1)
SCO 06018	L5	32.7	A					31(1)
SCO 06019	L5	65.4	A					31(1)
SCO 06020	L5	13.4	A/B					31(1)
SCO 06021	L5	17	A/B					31(1)
SCO 06022	L5	3.5	A/B					31(1)
SCO 06023	L5	6.1	A/B					31(1)
SCO 06024	H6	9.5	C					31(1)
SCO 06025	L5	5.7	A/B					31(1)
SCO 06026	L5	14.4	C					31(1)
SCO 06027	L5	22.4	A/B					31(1)
SCO 06028	L5	39.1	A/B					31(1)
SCO 06029	L5	16.8	A/B					31(1)
SCO 06042	CM2	6.4	C	0	36			31(1)
SCO 06043	CM1	27.6	B/CE					31(1)

[a]Weath = weathering grade.

Table 5. Meteorites from Asia.

Name	Location of recovery (Description of county, state, province, country, etc.)	Date of recovery (dd-m-yyyy)	Find/fall	Latitude	Longitude	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Fa mol%	Fs mol%	Wo mol%	Location of type specimen and classifier(s)	Location of main mass	Comments, additional data
Didim	Didim, Aydin province, Turkey	1-Feb-07	Fall	37°21′6.2″N	27°19′47.9″E	500	Many	H3–5	31.6	19–20	17–19		*MNHNP1*	*CanaU*	
Jodiya	Jamnagar District, Gujarat, India	31-Jul-06	Fall	22°40′48″N	70°18′48″E	~100	Many	L5	~100	25.1	21.2		*PRL1*	*GSI* and *PRL*	
Kaprada	Valsad, Gujarat and India	28-Oct-04	Fall	20°20′20.96″N	73°13′23.86″ E	1600	1	L5/6	Main mass	23.7	16.8	39.9	*GSI1*	*GSI*	
Kavarpura	Kavarpura (Near Rawatbhata village, Rajasthan, India	29-Aug-06	Fall	25°8′36″N	75°48′48″E	6800	1	IIE-Anom	10				*PRL2*	*GSI*	Ni 9.5%, Co 0.39%, Ir 1.6 ppm, Ga 6.8 ppm and Ge 5.8 ppm
Mahadevpur	Near Namsai Town, Arunachal Pradesh, India	21-Feb-07	Fall	27°40′N	95°47′E	~70500	4	H4/5	3200+	19	17	1	*GauU*	*GauU*	

PRL1-Type specimen at *GSI* and *PRL*, classified by N. Bhandari, S. V. S. Murty, R. R. Mahajan, P. N.Shukla, A. D.Shukla, *PRL*.
GSI1-Type specimen at *GSI*, classified by N. Bhandari, S. V. S. Murty, R. R. Mahajan, P. N. Shukla, A. D. Shukla, *PRL*; M. S. Sisodia, J. N. V. University, Jodhpur; G. Parthasarathy, National Geophysical Research Institute, Uppal Road, Hyderabad, India, *PNGRI*.
PRL2-Type specimen at *PRL*, classified by Z. G. Ghevaria, *GSI*, Gandhinagar, Gujarat, India, and S. V. S. Murty, *PRL*.
MNHNP1-Type specimen at *MNHNP*, classified by Catherine Caillet Komorowski, *MNHNP*.
CanaU-Çanakkale University, Turkey.

Table 6. Meteorites from Australia.

Name	Location of recovery	Date of recovery	Find/Fall	Latitude	Longitude	Mass (g)	Number of pieces	Class	Type specimen mass (g)	Location of type specimen and classifier(s)	Location of main mass	Comments, additional data
Prospector Pool	Eastern Goldfields, Western Australia	Nov-2003	Find	29°21′S	121°46′E	2678	1	Ungrouped member of IAB complex	2678	UCLA1	*WAM*	*

UCLA1-Type specimen at *WAM*, classified by A. W. R. Bevan *WAM*, J. T. Wasson, *UCLA*.
*Ni = 89.4, Co = 4.35 (both mg/g), Cr = 331, Cu = 397, Ga = 22.7, Ge = 130 ± 32, As = 12.2, W = 0.97, Ir = 4.45, Pt = 9.2, Au 1.227 (all µg/g), Sb = 180, Re = 517 (both ng/g).

Table 7. Meteorites from Europe.

Name	Location of recovery	Date of recovery	Find/fall	Latitude	Longitude	Total known mass (g)	Number of pieces	Class	Type specimen mass (g)	Shock stage	Weathering grade	Fa mol%	Fs mol%	Wo mol%	Magnetic sus.	Location of type specimens and classifiers	Location of main mass	Comments, additional data
Święcany	Jasło, Poland	Sept-2004	Find	49°47′29″N	21°15′28″E	8	1	L/LL5	6.62	S2	W3	25.5–26.4	22–22.8	3.15		USil1	USil	

USil1-Type specimen at *Usil*, classified by Ł. Karwowski *USil*.

GUIDELINES FOR METEORITIE NOMENCLATURE

Committee on Meteorite Nomenclature, The Meteoritical Society.

Created: February 1980. Revised: October 2000; October 2004; April 2005; October 2006.

Introduction

Objectives

These Guidelines are designed to provide a rational system of nomenclature to be adopted by the discoverers of new meteorites which will avoid confusion and ambiguity in published reports on existing meteorites. The Guidelines should also be acceptable for common-place usage in the field or laboratory and will assist the prompt announcement of new meteorites. In addition, the Guidelines are intended to ensure that type specimens of all new meteorites are preserved in collections that make material available for research.

Scope

a) These Guidelines provide a framework for naming objects that are commonly recognized to be meteorites.a) Meteorites to be named under the Guidelines include objects found on the Earth as well as on other solar system bodies during the course of space exploration.
b) The following types of materials are NOT to be named under these Guidelines: micrometeorites and interplanetary dust particles; xenolithic clasts in other meteorites; artificial meteorites; pseudometeorites; impact craters, tektites, and other impact-produced materials; and, meteoroids or other small bodies in space.
c) Special provisions are made in these Guidelines for highly altered materials that may have a meteoritic origin, designated relict meteorites, which are dominantly (>95%) composed of secondary minerals formed on the body on which the object was found. Examples of such material may include some types of "meteorite shale," "fossil meteorites," and fusion crust.

Application and Requirements of a Meteorite Name

Unique Names

A unique name shall apply to:

a) the set of all individual bodies recovered from a single observed meteorite fall or meteorite shower. Each individual shall carry the same name as the set;
b) a meteorite find that cannot be related with certainty to other falls or finds recovered from the same vicinity;
c) several meteorite finds, or a fall and one or more subsequent finds, whose geographical relationship and inherent characteristics establish, after careful evaluation of all evidence available, that they belong to a single occurrence (with the exception stated in §4.2 for finds in dense collection areas).

Distinctive Names

A meteorite name must clearly distinguish the occurrence to which it refers from other meteorite names, and should convey the geographical location of the fall or find. Names should be as brief as possible, but abbreviations (e.g., St. and Mt.) should be spelled out unless special circumstances warrant their usage in the name.

Precedents

An established meteorite name shall remain unchanged, whether the spelling or name of its locality is subsequently altered or was originally assigned in error, or whether it becomes obsolete with respect to current conventions of transliteration or transcription. Earlier meteorite names that do not conform to these Guidelines will not be changed unless the Committee for Meteorite Nomenclature (hereafter called The Committee) rules that this is necessary to avoid confusion. Changes to the names of meteorite falls or important meteorite finds (e.g., Canyon Diablo; Leoville) should be avoided except under extraordinary circumstances (e.g., §3.3a).

International Usage

Meteorite names should be rendered according to local spelling at the time, but in Roman script, including diacritical marks where appropriate. New Chinese meteorite names will be transcribed according to the Pinyin system.

New Meteorite Names

Geographic Features

A new meteorite shall be named after a nearby geographical locality. Every effort should be made to avoid unnecessary duplication or ambiguity, and to select a permanent feature such as a town, village, river, bay, cape, mountain or island which appears on widely used maps and is sufficiently close to the recovery site to convey meaningful locality information. In sparsely populated areas with few place names, less permanent features such as ranches or stations or, in extreme cases, local unofficial names of distinctive quality may be used, provided the latitude and longitude of the recovery site are well determined. The names of large geographic features such as continents, countries, provinces, states, and large counties should be avoided if names that are more specific are available, except as specified in §3.3 and §3.4. In general, the selected feature should be the closest such feature to the site of the recovery. If, for example, the name of the nearest town is already used, the meteorite should not be named for the next nearest town. In such a case, a different geographic feature (e.g., a stream) should be selected, if available (if not, §3.3 applies)."

Duplicate Place Names

Duplication of a place name previously used for a meteorite from another country, state or province should be avoided. If it cannot be avoided, both names may be amplified as in Edmonton (Kentucky) and Edmonton (Canada).

Sparse Place Names

The following rules apply to cases involving insufficient numbers of unique place-names:

a) Coincidental falls. In the event that a meteorite falls near the same locality as an existing named meteorite, the new fall should not be assigned a letter designation as in §3.3b, or a numeric designation as in §3.3c. If an appropriate, unique name cannot be found for the new fall, then it should receive the suffix (year), as was done for Wethersfield (1982) and Monahans (1998). If there is only one pre-existing meteorite from this location, then the older one should also be given a (year) suffix, e.g., Wethersfield (1971) and Monahans (1938). This is one of the rare situations wherein an existing meteorite fall or an important find may be renamed. If there are multiple existing meteorites with the same name followed by numeric or lettered suffixes, then the fall should still get the year suffix, but the older meteorites do not need to be renamed.
b) Coincidental finds. Where several meteorites are found near the same locality and alternative place names are not available, each separate meteorite shall bear the name of the locality followed by a parenthesized lower-case letter, e.g. Kress (a) and Kress (b). Letters shall be assigned alphabetically in order of recognition. If an earlier meteorite from the same locality already exists, e.g. Kress, its name does not need to be changed to Kress (a) (although this can be designated as a synonym). In this case, the first new name should be Kress (b).
c) Dense collection areas. If particularly numerous recoveries are made in one region, as for instance in Antarctica and the Sahara, a generic prefix (conveying geographic information) and a suitable series of numeric suffixes should be applied. New meteorites found within the designated region will be named by combining the prefix with the next available suffix.

Meteorites of Unknown or Poorly Known Provenance

a) Withheld information. Where the source of a new meteorite cannot be determined due to the withholding of geographic information by a collector or other party, the name should be chosen to reflect the smallest geographic feature identifying the collection location with certainty. If the location information is too vague, or is uncertain or disputed, the name Nova followed by the next available three-digit number should be adopted as the permanent name.
b) Transported meteorites. When the provenance of a new meteorite cannot be determined due to a lack of sufficient historical information, it should be named after the locality where it was first recognized. For meteorites found in institutions such as universities and museums, the name may be either that of the institution, the collection, or the city in which the institution is located. In accordance with §3.6, the names of people, even if part of the official name of the collection, should be avoided.
c) Meteorites found in large numbers. In cases where many meteorites are found and distributed or sold without careful documentation of provenance, a numbered sequence of generic names should be used as in §3.3c, wherein the prefix reflects the geographic area in which the meteorites were most likely recovered (e.g., Northwest Africa, for meteorites coming from marketplaces in Morocco).

Meteorites from Morocco and Surrounding Areas

All meteorites found, reported to be found, or purchased in Morocco and adjacent parts of the surrounding countries shall be named according to the following special rules:

a) Falls. Observed falls will be named the same way as they are in other areas (§3.1–3.3).
b) Finds and purchased meteorites. These meteorites will all be numbered in a "Northwest Africa" (NWA) series unless they are accompanied by documentation including the date of find, name and address of finder, and reasonable proof of the find location (e.g., a single photograph showing the meteorite in situ, a length-scale, and an active GPS unit displaying the geographic coordinates). If so documented, the meteorites may be given locality-specific names as in §3.1–3.3. If a meteorite bearing a provisional NWA number is later given a formal locality-specific name, the NWA number will become a synonym for the new name.

Prohibited Terms

Neither a person's name, the classification, nor an unofficial directional term (for example North Haig) should be used in a meteorite name. However, the Committee may rule that such practices are permissible in exceptional situations. Names given under this section should not be changed retroactively, even given the eventual resolution of the true provenance.

Paired and Separated Meteorites

Sparse Collection Areas

a) Level of scrutiny. A reasonable effort should be made to ensure that a new recovery does not belong to a previously named meteorite (see also §2.1).
b) Paired meteorites. If two meteorites previously thought to be separate are subsequently found to be paired after

comprehensive studies (preferably of the main masses), one name should be abolished and one retained.

c) Separation of meteorites. If several individuals previously regarded as a single meteorite prove to be distinct, with no reasonable expectation of genetic affinity, then one or all should be renamed in accordance with the provisions of §3. If the original name designates a fall, then every attempt should be made to preserve that name without change.

Dense Collection Areas

In areas of dense meteorite concentrations such as those covered under §3.3 c and §3.4 c, the following guidelines apply:

a) Level of scrutiny. Sequential names comprising a prefix and numeric suffix will be given to new meteorites without checking for possible pairings, although a single (collective) name may be given in cases where fragments fit together or similar-looking fragments are found within a few meters of each other.

b) Pairing groups. Two or more newly discovered meteorites in dense collection areas may be considered paired with each other or with another formally named meteorite if there is overwhelming evidence, including geographic data, that is consistent with the meteorites being part of a single fall. The evidence must be evaluated by the Committee. All approved members of a pairing group will be named with a geographic prefix plus a number in the same way as are unpaired meteorites; special type-specimen requirements will apply to newly paired meteorites (section 7.1f). If two or more numbered meteorites with formal names are subsequently determined to be paired, their names should not be changed. Pairing groups may be referred to collectively by the lowest specimen number, the most widely studied mass number or the largest mass number (e.g., the EET 87711 pairing group).

c) Separation of meteorites. If several individuals previously regarded as a single meteorite prove to be distinct, with no reasonable expectation of genetic affinity, then lettered suffixes in parentheses may be applied, as in section 3.3 b (e.g., Place 95035 (b)).

Synonyms and Discredited Meteorite Names

Synonyms

Synonyms are unofficial names of meteorites, and their use is discouraged. They may be created when:

a) Popular usage or existing publications have caused confusion through the introduction of alternate names or alternate spellings of the names of approved meteorites.

b) A meteorite name is abolished after a determination of pairing with a second meteorite, or a meteorite name is modified through the addition of a suffix.

Discredited Names

Meteorite names that are abolished or discredited, or that have been modified through the later addition of a suffix shall not be reused for the naming of subsequent falls or finds.

Meteorite Abbreviations

Abbreviations for meteorite names with numeric suffixes (i.e., those named under §3.3 c and §3.4 c; e.g., ALH = Allan Hills) should be unique and different from all unabbreviated meteorite names (disregarding case). Such abbreviations should be used with a space separating the abbreviated prefix and the numeric suffix (e.g., ALH 84001); the exception to this is certain Antarctic meteorites with names approved prior to 1981, which should have an "A" in place of the space (ALHA, BTNA, DRPA, EETA, MBRA, META, OTTA, PGPA, and RKPA; e.g., ALHA77005). Authors should avoid the use of abbreviated meteorite names in titles and abstracts of publications, and should introduce them in text as they would any other abbreviation. A complete list of abbreviations approved by the Nomenclature Committee, demonstrating proper usage, will be maintained by the editor of the Meteoritical Bulletin.

Approval, Revision, and Announcement of Meteorite Names

New Meteorites

All new meteorite names must be approved by the Committee. The minimum information required to name a meteorite, which the Committee should only modify under special circumstances, is: The location, preferably as geographic coordinates, of the fall or find; The circumstances of the fall or find (narrative); The total known mass and number of pieces recovered; An authoritative classification; The location of the main mass; The location of a type specimen. Type specimens must be deposited in institutions that have well-curated meteorite collections and long-standing commitments to such curation. The minimum mass of a type specimen should be 20% of the total mass or 20 g, whichever is the lesser amount. For newly paired meteorites from dense collection areas (§4.2 b), the minimum required mass shall be whatever is needed to bring the aggregate mass of existing type specimens (if any) to 20% of the aggregate mass of the entire pairing group or 20 g, whichever is less.

Numbering Systems

The Committee must approve all new prefixes, abbreviations,

and proposed numbering schemes for meteorites in dense collection areas.

Pairing Issues

Proposals to pair or separate meteorites that would result in the abolition or creation of meteorite names under §4 must be reviewed and approved by the Committee.

Announcements

Information about all new meteorites, paired and separated meteorites, name changes to existing meteorites, synonyms, and abbreviations will be published at least once per year in the Meteoritical Bulletin in *Meteoritics & Planetary Science*.

Authoritative Information

The authority for existing meteorite names shall be the current edition of the *Catalogue of meteorites* of the Natural History Museum, London, supplemented by published appendices to the Catalogue and by ensuing numbers of the Meteoritical Bulletin. However, the Committee may overrule priority for a particular name if strict application of this or other sections contradicts the general objectives of these Guidelines.

Provisional Names

New numbers may be assigned to meteorites in dense collection areas with approved numbering systems prior to analysis and classification. Allocation of numbers will be coordinated by the Editor of the Meteoritical Bulletin. Names assigned in this way will be considered provisional until the Committee grants formal approval.

In the special case of meteorites found in large numbers and for which accurate geographic information is lacking (e.g., many Northwest Africa meteorites and others covered by §3.4c), provisional names may be assigned with the following minimum information:

The mass of the specimen;

A physical description (e.g., crusted stone, broken fragment, etc.);

An approximate (visual) classification (e.g., stone, iron, chondrite, achondrite, etc.);

An account of how the specimen was obtained (e.g., place and date of sale);

The location where the specimen is believed to have been found (if known).

A list of provisional names will be maintained by the Editor of the Meteoritical Bulletin. The names of meteorites on this list remain provisional even if printed as an appendix in future editions of the *Catalogue of meteorites*, and should not be used in publications.

Relict Meteorite Names

A special type of name should be assigned to relict meteorites (see §1.2 c for definition). The documentation required for these names must include a description of the material, the location and date of the find, the approximate mass or size, the location of the main mass, and the type of meteoritic material it is suspected to represent. The name must conform to all applicable parts of §2–§6 above, and must be approved by the Nomenclature Committee prior to publication. Relict meteorite names may be converted to formal meteorite names by a second vote of the Committee, subject to the requirements of §7.1.

Use of Catalogue Numbers

Acknowledgments—Although application of these Guidelines should in the future decrease the risk of confusion, authors are nevertheless encouraged to cite catalogue numbers from established collections in their publications on meteorites, and curators are urged to catalogue individual masses separately.