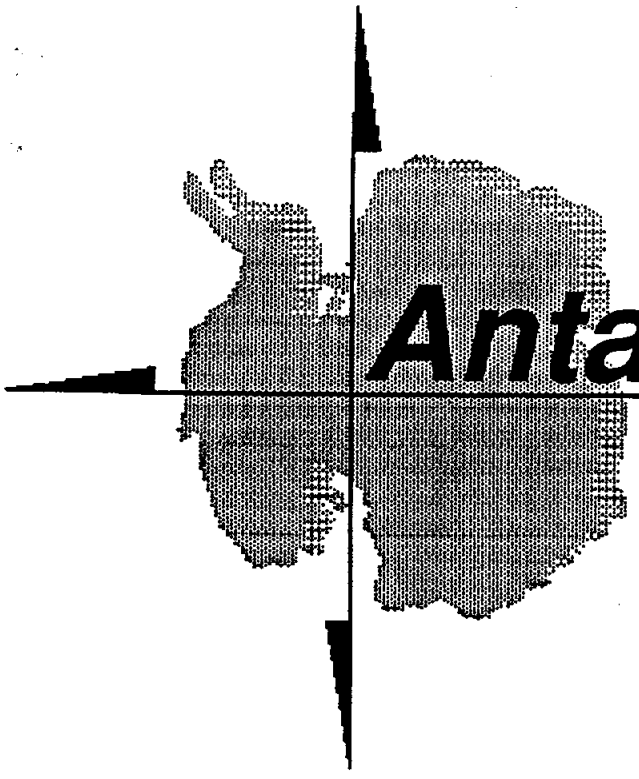

Antarctic Meteorite NEWSLETTER

SPECIAL EDITION
ANNOUNCING . . .

The Reclassification and Availability of a New SNC Meteorite!

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A periodical issued by the Meteorite Working Group to inform scientists of the basic characteristics of specimens recovered in the Antarctic.

Edited by Roberta Score and Marilyn Lindstrom
Code SN2, NASA
Johnson Space Center,
Houston, Texas
77058

SAMPLE REQUEST DEADLINE FOR THIS METEORITE

JANUARY 21, 1994

A New SNC Meteorite!

This special edition of the newsletter presents the reclassification of ALH84001 as a new type of SNC meteorite. The 1.9 kg specimen was collected during the 1984-1985 ANSMET field season and classified as a diogenite. During his recent studies of diogenites, D. Mittlefehldt discovered mineralogical evidence that suggested that ALH84001 was more closely related to SNC meteorites than to diogenites. He informed the meteorite curator and she asked R. Clayton to do an oxygen isotope analysis to resolve the issue. Clayton's analysis confirmed the relationship to SNC meteorites. This newsletter presents Mittlefehldt's petrographic description and Clayton's confirming oxygen isotope analysis, and reclassifies ALH84001 as neither a shergottite, nakhlite or chassignite, but instead as the first SNC orthopyroxenite.

Mix-up in Labeling of ALH84001 and EETA79002 Thin Sections

Mittlefehldt also discovered a mix-up that has confused the scientific study of ALH84001. In 1986, new potted butts of ALH84001 and EETA79002 were labeled with the wrong sample numbers. All thin sections subsequently made from those two potted butts are thus labeled with the wrong sample numbers. There are several other potted butts of both meteorites from which thin sections were correctly labeled. All investigators having incorrectly labeled thin sections have been informed of the mislabeling by the curator. Unfortunately, some of these mislabeled samples have already been described in the literature. Sack et al (1991) describe ALH84001 as an olivine diogenite, but their sample was a mislabeled thin section of EETA79002. Papike and colleagues reported on ALH84001 in recent LPSC and Meteoritics abstracts, but it too was a mislabeled EETA79002 thin section. We apologize for the confusion that our mislabeling has produced.

Curatorial Allocations of ALH84001

ALH84001 is a large meteorite which has already been allocated to a number of investigators under the guise of a diogenite. The MWG Guidelines for Curatorial Allocations allow the JSC curator to allocate thin sections and chips up to 5 g of this reclassified meteorite to investigators without waiting until the April 1994 MWG meeting. In order to expedite distribution of this unique meteorite and be fair to all investigators, the curator will accept requests for curatorial allocations of ALH84001 until **January 21, 1994** and will provide samples for all approved requests during February. Requests received after that date will probably not be allocated until after the next MWG meeting.

Sample No.:	**ALH84001**
Location:	Allan Hills - Far Western Icefield
Dimensions (cm):	17 x 9.5 x 6.5
Weight (g):	1930.9
Weathering:	A/B
Fracturing:	B
^{26}Al (dpm/kg):	61 ± 2
NTL (krad at 250°C):	1.3 ± 0.1
Meteorite Type:	**SNC orthopyroxenite**

Brief descriptions of ALH84001 have previously been given in *Antarctic Meteorite Newsletter* 8(2) in 1985, and by Berkley and Boynton (1992), *Meteoritics* 27, 387-394. The description of Sack *et al.* (1991), *Geochim. Cosmochim. Acta* 55, 1111-1120, was of a mislabeled section of EETA79002 (see News and Information on page 2 for more information).

Macroscopic Description: Roberta Score

Eighty percent of this rectangular shaped achondrite is covered with dull black fusion crust. Remnants of flow marks are visible on two exterior surfaces. Areas not covered by fusion crust have a greenish-gray color and a blocky texture. Cleavage planes are obvious on some large crystal faces and the stone has a shocked appearance.

Small areas of oxidation are present in the interior of ALH84001. Abundant small, black chromite grains are scattered throughout the stone. Small fractures are numerous.

Thin Section (,64) Description: David W. Mittlefehldt

The section consists of a coarse-grained, cataclastic orthopyroxenite. The orthopyroxene is generally anhedral and up to 3.5 mm across. Common minor minerals are euhedral to anhedral chromite grains up to 500 m across and interstitial maskelynite typically 100-300 m in size. Accessory phases are augite, calcium phosphate, iron disulfide, and probable carbonates (by petrography, EDS spectra) of Mg, Ca, Mn and/or Fe. The sample shows cataclastic texture, with common veins of crushed orthopyroxene plus chromite (grain size up to ~30 m) transecting coarse orthopyroxene. The latter exhibits patchy extinction. The original texture shows common 120° triple junctures between coarse orthopyroxene grains. Many orthopyroxene and chromite grain boundaries exhibit offsets along fractures. Mineral compositions are: orthopyroxene $Wo_{3.3}En_{69}Fs_{27}$; augite $Wo_{42}En_{45}Fs_{13}$; maskelynite $An_{31}Ab_{63}Or_6$; chromite 100 $Mg/(Mg+Fe^{2+})$ ~19, 100 $Cr/(Cr+Al+Fe^{3+})$ ~70, TiO_2 ~2.2 wt%, Fe_2O_3 (from stoichiometry) ~7.7 wt%. Orthopyroxene and chromite are relatively homogeneous in composition.

Although originally classified as a diogenite, there are several petrologic features which indicate that ALH84001 is not a diogenite. Iron disulfide has not been reported from diogenites, or any HED meteorite; troilite is the sulfide phase. Plagioclase as sodic as Ab_{63} has not been reported from any HED meteorite; the most sodic plagioclase from diogenites is about Ab_{35}, but most are Ab_{20}. Carbonate has not been found in diogenites or other HED meteorites, including as Antarctic weathering products. Diogenite spinels typically contain <1 wt% TiO_2 (except Yamato 75032-type diogenites, ~1.8 wt%), and Fe_2O_3 from stoichiometry is < 1 wt%. Diogenites are typically monomict or polymict breccias composed dominantly of orthopyroxene clasts in a matrix of comminuted orthopyroxene. The original grain size of diogenites was of the order of cm, not mm. The cataclastic texture of ALH84001 is uncommon in other diogenites. Tatahouine does exhibit patchy extinction, but does not contain crushed zones. Only ALHA77256 has a texture resembling that of ALH84001. Maskelynite is rare in HED meteorites, although eucrites Padvarninkai and ALHA81313 contain it.

The mineralogic and petrographic features of ALH84001 are more in accord with those exhibited by the SNC meteorites. Iron disulfide is present in several SNC meteorites. The composition of maskelynite in ALH84001 falls within the range of other SNCs, and SNC plagioclase is commonly maskelynite. Calcium carbonates have been identified as pre-terrestrial aqueous alteration in

some SNCs. Spinels in SNC meteorites commonly contain substantial calculated Fe^{3+}. SNC meteorites show a wide variety of shock textures, including patchy extinction of coarse-grained orthopyroxene in EETA79001, similar to that in ALH84001, although transecting crushed zones have not been described.

Based on its petrography, ALH84001 is a new, and unusual, SNC meteorite classified as a SNC orthopyroxenite.

Oxygen Isoptope Analysis: Robert Clayton

The oxygen isotope composition of ALH84001 is: $\delta^{18}O = +4.60$; $\delta^{17}O = +2.65$, excess $^{17}O = 0.25$. These analyses are indistinguishable from those of Nakhla and Lafayette.

M. Lindstrom/SN2
NASA Johnson Space Center
Houston, Texas 77058