

ACAPULCOITE PCA 01026 AND OTHER METEORITES COLLECTED IN A 2002 EXPEDITION TO PECORA ESCARPMENT, ANTARCTICA. P. P. Sipiera^{1,2}, A. J. Irving^{1,3}, S. M. Kuehner³ and R. Tanaka⁴

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Introduction: To expand upon the knowledge gained from its January 2000 expedition to the Moulton Escarpment in the Thiel Mountains, Antarctica, the Planetary Studies Foundation (PSF) chose the Pecora Escarpment as the research site for its January 2002 expedition. The expedition's goals were to search for meteorites and to collect additional ice samples for biological studies. The team (comprised of two scientists, seven volunteers and three professional field guides) were successful in finding and documenting a total of 34 meteorites, including 27 ordinary chondrites (of various types), 3 enstatite chondrites, a pallasite, a monomict eucrite, a polymict diogenite and an acapulcoite. Initial findings were reported by [1] and classifications of the first 11 meteorites appeared in [2].

Collection and Curation: The collection procedures included precise GPS location coordinates, in-situ photographs, and placement in contamination-free specimen bags. Preliminary field identification concluded that there were no carbonaceous chondrites among the 34 specimens that would warrant any special contamination-free procedures for biological studies. Ice samples taken at the South Pole, Pecora Escarpment, and Patriot Hills were studied at the University of Innsbruck by Dr. Birgit Sattler, and provided evidence for the presence of micro-organisms at each location, suggesting the possibility of in-situ biological contamination of Antarctic meteorites without human contact. The 34 specimens along with the other 20 meteorites collected during the 1998 and 2000 PSF expeditions are currently being curated in the Robert A. Pritzker Center for Meteoritics and Polar Studies at the Field Museum of Natural History in Chicago.

Monomict Eucrite PCA 01021 and Polymict Diogenite PCA 01030: PCA 01021 is a very fresh fusion-crusted specimen (see Figure 1), and is very fine grained with ophitic texture and vesicles. It is composed of exsolved pigeonite (with very fine clinopyroxene lamellae), calcic plagioclase ($An_{81.8-88.4}Or_{1.4-0.7}$), silica polymorph, ilmenite and troilite. Pigeonite grains consist of clinopyroxene lamellae ($Fs_{38.5-44.8}Wo_{31.1-24.7}$, $FeO/MnO = 31-32$) in host orthopyroxene ($Fs_{61.7-62.2}Wo_{2.5-3.3}$, $FeO/MnO = 33-34$).

PCA 01030 is a fragmental breccia consisting mostly of disaggregated material from several different

List of Specimens and Major Mineral Compositions

Name	Type	Olivine			Orthopyroxene	
		Fa	Fs	Wo	Fs	Wo
PCA 01002	H5	18.9-19.0	16.4-16.5	1.4		
PCA 01005	L6	24.3-24.7	21.1-21.3	1.3		
PCA 01007	H5	20.5-20.6	16.0-16.3	1.0-1.3		
PCA 01008	H5	18.5-18.6	16.0-16.1	1.0-1.2		
PCA 01009	H4	18.8-19.1	16.1-16.4	1.5		
PCA 01012	L5	24.9-25.0	20.5-21.1	1.6-1.7		
PCA 01015	H4	18.6-19.1	16.8-17.5	1.1-1.2		
PCA 01016	H4	18.8-19.1	16.6-17.6	1.5-1.4		
PCA 01018	L6	24.6-25.2	21.5-21.7	1.2-1.0		
PCA 01019	H5	19.2-19.4	16.8-17.2	1.4-1.0		
PCA 01020	H6	18.9-19.0	17.4-17.5	1.5-1.7		
PCA 01021	EUC-mmict					
PCA 01022	H6	18.4-19.0	15.9-16.2	0.3-1.0		
PCA 01023	EH4					
PCA 01024	H5	17.7-17.8	15.4-15.6	0.4		
PCA 01025	H5	19.6-19.7	16.6-17.0	1.5-1.1		
PCA 01026	ACAP					
PCA 01027	EH4					
PCA 01028	LL4	27.8-27.9	22.3-22.4	1.3-1.4		
PCA 01029	H melt rock 17.3;14.3 15.3±0.0 0.7-1.4					
PCA 01030	DIO-pmict					
PCA 01032	L5	23.5-23.6	19.8-20.1	1.3		
PCA 01033	L5	24.6-24.9	20.4-20.6	1.3-1.2		



Figure 1. Whole PCA 01021 eucrite stone, showing the glossy fusion crust and light gray interior.

diogenite protoliths, plus sparse grains of calcic plagioclase and exsolved pigeonite derived probably from cumulate eucrites (see Figure 2). Accessory minerals include chromite, ilmenite and troilite. Orthopyroxene exhibits undulose extinction and plagioclase is partly recrystallized (exhibiting complex twinning and some polygonal subgrains). Diagenitic orthopyroxene ranges in composition from $Fs_{18.7}Wo_{1.3}$ to $Fs_{24.4}Wo_{3.0}$ (with more ferroan rims up to $Fs_{34.0}Wo_{3.5}$); FeO/MnO is 28-32. Exsolved pigeonite consists of clinopyroxene exsolution lamellae ($Fs_{20.9-25.3}Wo_{43.9-41.3}$) within host orthopyroxene ($Fs_{51.2}Wo_{1.6}$); FeO/MnO is 27-36.

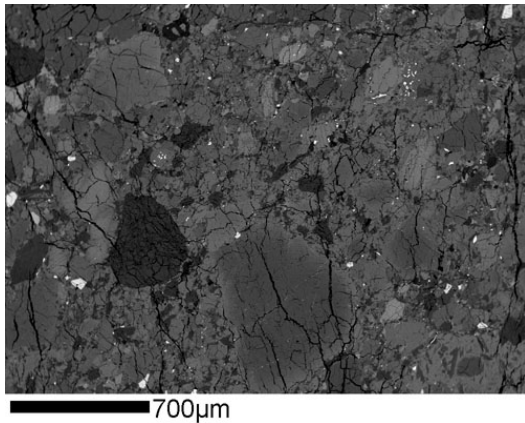


Figure 2. Back-scattered electron image of polymict diogenite PCA 01030.

Acapulcoite PCA 01026: The specimen is relatively fine grained (grainsize mostly 0.2-0.4 mm, with a few grains up to 1 mm) and has a metamorphic texture with triple grain junctions (see Figure 3). It is composed of olivine ($Fa_{7.4-7.6}$, FeO/MnO = 17), orthopyroxene ($Fs_{8.1-8.4}$, FeO/MnO = 11), clinopyroxene ($Fs_{3.9\pm 0}Wo_{42.3-42.6}$, FeO/MnO = 7-8), kamacite (~15 vol.%, with cusped grain shapes), merrillite, troilite and twinned sodic plagioclase ($An_{18.8}Or_{2.9-3.2}$).

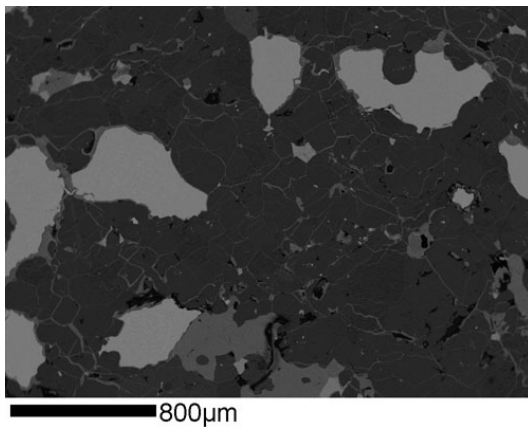


Figure 3. Back-scattered electron image of acapulcoite PCA 01026.

Unequilibrated Enstatite Chondrites PCA 01023 and PCA 01027: Two likely paired stones consist of small, separated, round RP chondrules and some mineral fragments set in a dark red-brown to black matrix (see Figure 4). Most orthopyroxene is very magnesian enstatite ($Fs_{0.5-0.9}Wo_{0.5-0.1}$), but more ferroan enstatite ($Fs_{4.5-6.2}Wo_{4.7-3.7}$) occurs in the matrices. A single grain of forsterite ($Fa_{0.05}$) was found in PCA 01023. Accessory minerals include kamacite (2.8-3.1 wt.% Si, 2.8-3.5 wt.% Ni), daubreelite, troilite (containing Cr, Ti and/or Ni), caswellsilverite, schreibersite, perryite (some as exsolution lamellae in kamacite) and albite.

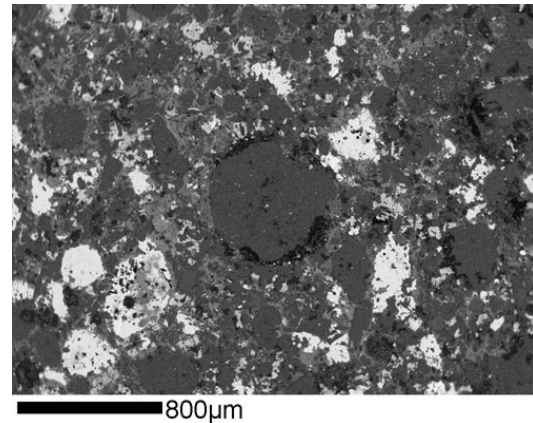


Figure 4. Back-scattered electron image of EH4 chondrite PCA 01023.

Oxygen Isotopes: Two achondrites were analyzed for oxygen isotopes by laser fluorination. Bulk samples were first acid-washed, and replicate analyses performed with the following results (all in per mil):

	$\delta^{18}O$	$\delta^{17}O$	$\Delta^{17}O$
PCA 01021	3.981,3.831	1.873,1.740	-0.223, -0.276
PCA 01026	1.103,1.244	-0.580,-0.538	-1.161,-1.193

The results for PCA 01021 plot within the established field for eucrites [3], and those for PCA 01026 plot within the established field for acapulcoites and lodranites [4 and references therein].

References: [1] Sipiera P. et al. (2002) *Meteoritics Planet. Sci.* **37**, A131 [2] Russell S. et al. (2005) *Meteorit. Bull.* **89** [3] Wiechert U. et al. (2004) *Earth Planet. Sci. Lett.* **221**, 373-382; Greenwood, R. et al. (2005) *Nature* **435**, 916-918 [4] Bunch T. et al. (2010) *Lunar Planet. Sci.* **XLI**, #1281; Bunch T. et al. (2011) *74th Meteorit. Soc. Mtg.*, #5225.