PETROGRAPHY AND MINERAL CHARACTERIZATION OF LUNAR MARE BASALT METEORITE LAP 02-224.

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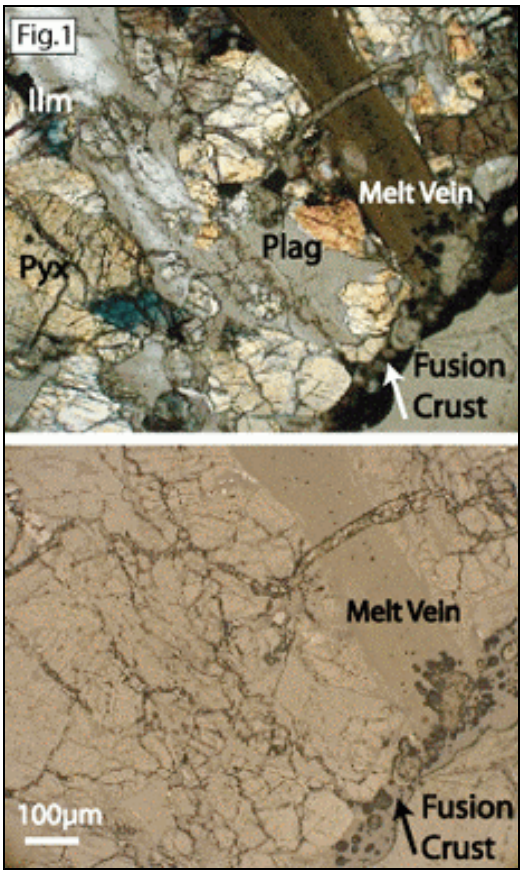
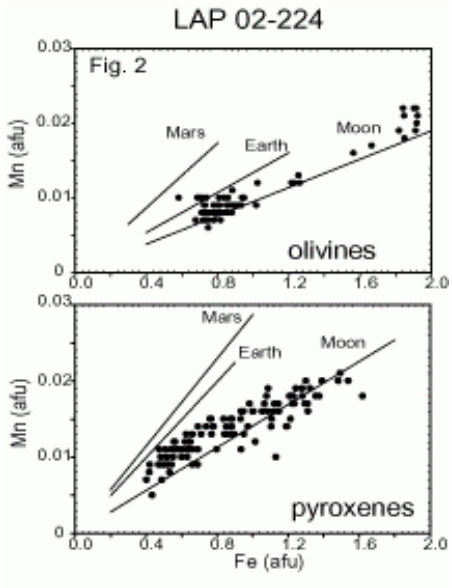
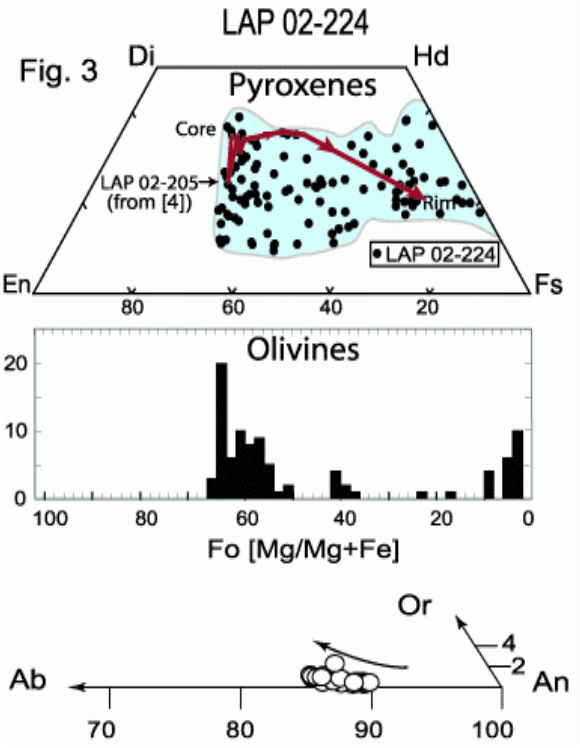
Introduction: LAP 02-224 is a low-Ti mare-basalt meteorite discovered in the LaPaz Ice Field, Antarctica in 2002 [1]. We report on polished thin sections of this meteorite. LAP 02-224 is part of a suite of meteorites discovered in the same locality that are thought to be paired [1,2].



Petrography and Mineral Chemistry: LAP 02-224 displays a broadly holocrystalline texture (Fig. 1). In decreasing abundances, phases include: pyroxene (55.7%), plagioclase (32.2%), ilmenite (3.8%), melt glass (2.1%), olivine (2%), silica (possibly tridymite, 1.9%), fayalite (1.4%), K-Ba-rich glass (0.7%), spinel (0.7%), troilite (0.2%), phosphate (0.2%) and FeNi metal. The meteorite contains abundant (~2%) late-stage mesostasis, composed largely of fayalite and K-Ba- rich glass, with trace amounts of phosphate. Shock effects are evident in the form of extensive cracking of mineral grains, plagioclase partially converted to maskelynite, undulatory extinction in pyroxene, and shock-induced melt veins.

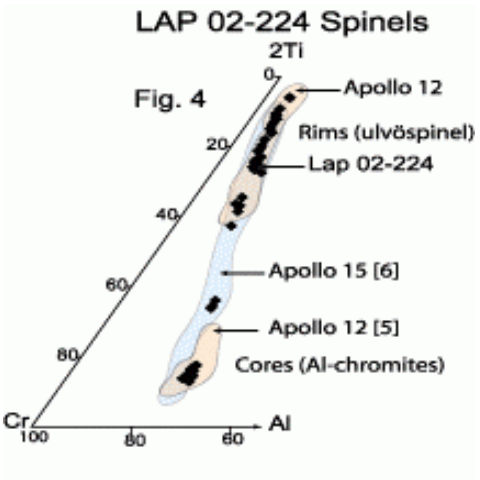


Molar Fe/Mn in pyroxene and olivine (Fig.2, after [3]) and the presence and composition of FeNi metal provide evidence of a lunar parentage for this meteorite.



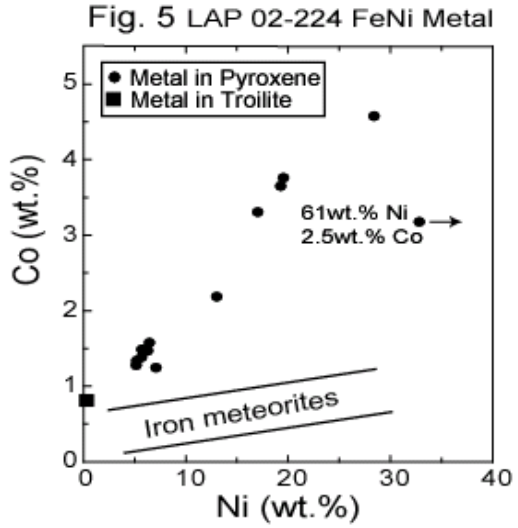
Petrographically, LAP 02-224 has similarities to Apollo 12 and 15 basalts, as well as the other LaPaz mare basalts to which it is paired [1,2]. The modal

mineralogy of LAP 02-224 is presented by Day *et al*. [2] and demonstrates the predominance of pyroxene and plagioclase (px:plag 56:33). Pyroxenes (≤ 0.7mm) show extreme variation in chemistry mimicking typical evolved, low-Ti mare-basalt trends (Fig. 3). Olivine grains (≤ 0.7 mm) range from Fo_{40-64}; mesostasis fayalite ranges from Fo_{0-10}. Plagioclase grains (≤ 1mm) in LAP 02-224 have been partially maskelynitized, and their compositions vary from An_{85-90}. LAP 02-224 also contains a high abundance of late-stage mesostasis, which is distributed in pockets throughout the section. Ilmenite is the most common opaque mineral, and exists as lath-shaped grains (≤ 0.6mm). Chromium spinel (0.2%) is rimmed by ulvöspinel (0.5%), and these show fractionation trends similar to those of Apollo 12 and 15 low-Ti mare basalts (Fig 4).



FeNi metals exhibit an unusually large range in Ni and Co contents (0.3-30wt.% Ni; 0.85-5.6wt.% Co; Fig.5, [7]). A single metal grain coexisting with troilite contains the highest Ni content yet reported for mare basalts (61wt.% Ni and 2.5wt.% Co, [7]).

Bulk-rock Major-Element Composition: The calculated major-element composition of LAP 02-224,26 is presented in Table 1, and is compared with elemental compositions for the shock-induced melt vein and the fusion crust. Major-element compositions were calculated from the modal abundances of minerals (e.g., [2]) and average mineral compositions. The melt vein and fusion crust were analyzed using a 10µm spot size, and have compositions, within error, of the calculated major-element composition. The Mg# (36) of LAP 02-224 is at the more primitive range of the LaPaz mare basalts [2], consistent with a higher abundance of olivine in this rock.



Summary: LAP 02-224 is an evolved low-Ti mare basalt that contains an abundance of late-stage mesostasis. LAP02-224, as well as being paired with LAP02-205, -226, -436 and 03-632, is similar to the Apollo 12 and 15 basalts (Fig. 4). From remote sensing of the lunar surface [8], LAP 02-224 is representative of the more predominant lunar basalt type.

References: [1] Ant. Met. Newsletter, Vol. 27 No.1 (2004). [2] Day J.M.D. *et al.* (2005) *LPSXXXVI*, this volume. [3] Papike J.J. (1998) In: *Planetary Materials*, MSA, pp 7.1-7.11. [4] Anand M. *et al.* (2004) *LPS XXV* Abstract 1626. [5] Taylor L. A. *et al.* (1971) *LPS II*. pp. 855-871. [6] El Gorsey A., Prinz M., Ramdohr P. (1976) *LPS VII* pp. 1261-1279. [7] Taylor L.A. and Day J.M.D. (2005) *LPSXXXVI*, this volume. [8] Spudis P. *et al.* (2002) *LPSXXXIII*, Abstract 1104.

Table 1: Calculated, fusion crust, and melt vein major-element compositions for LAP 02-224, 26.

	Calculated	Melt Vein (n=153)		Fusion Crust (n=8)	
wt.%		Average	2SD	Average	2SD
SiO_2	46.8	44.7	2.48	44.9	4.96
TiO_2	2.45	3.15	1.37	3.45	2.74
Al_2O_3	11.8	11.6	4.29	9.40	8.57
FeO	19.3	21.1	4.01	22.8	8.02
MnO	0.26	0.27	0.11	0.31	0.22
MgO	6.09	6.84	3.55	7.00	7.10
CaO	12.2	11.1	1.54	10.9	3.07
Na_2O	0.44	0.41	0.19	0.37	0.38
K_2O	0.09	0.13	0.07	0.12	0.14
P_2O_5	0.12	0.15	0.19	0.23	0.38
Cr_2O_3	0.30	0.27	0.15	0.26	0.30
SO_2	0.14	0.34	0.75	0.08	1.50