THE MEDANITOS FELDSPAR CUMULATE EUCRITE.

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Medanitos is a feldspar rich gabbroic eucrite (1). It is the first brecciated feldspar cumulate eucrite to be recognized. Modally, Medanitos contains (vol%) 41.1% low Ca pyroxene, 10.1% augite, 48% feldspar, 0.25% silica, 0.1% ilmenite, 0.5% chromite and 0.1% troilite (area studied 71mm^2). It is modally similar to the unbrecciated cumulate eucrite Moama (2), but recombination of the low and high Ca pyroxene to determine the original pigeonite composition suggests a slightly more calcic composition (Medanitos Wo_{9-11}, Moama Wo_{8-10}). The bulk composition of Medanitos, by modal recombination, is similar to the analysis of (3).

Pyroxene in Medanitos has well developed planar exsolution lamellae comparable with that in Moore Co. and Nagaria. Occasional grains show 'herringbone' exsolution textures like those in Moore Co. (4) suggesting a complex cooling history of pigeonite crystallization, followed by augite exsolution from the pigeonite, and finally partial to complete inversion of the host pigeonite to orthopyroxene with further exsolution of augite. The pyroxene is more magnesian than any feldspar cumulate eucrite ($En_{61}Wo_2$ with $En_{42}Wo_{44}$ lamellae, Fig. 1). Note that the exsolution patterns in Medanitos pyroxene show more resemblance to the Fe-rich cumulates Nagaria and Moore Co. than to the magnesian cumulates Moama and Serra de Magé (5), presumably because of cooling rate effects. Minor element contents of the pyroxene are very low (TiO_2<0.1%; Al_2O_3<0.3%; Cr_2O_3<0.1%).

Plagioclase in Medanitos has a uniform composition (An_{93-94} $Or_{0.2-0.4}$). In brecciated areas, it shows shock effects with undulose extinction and cracking. A little maskelynite may be present. Gabbroic textured clasts have clear plagioclase, that shows no compositional difference from that in brecciated areas. Slight reverse zoning (∿1 mole % An) is present from center to edge in feldspars from some gabbroic clasts, a feature also found in the plagioclase of Moama. This zoning probably reflects near isothermal growth in the magma chamber sampled by Medanitos. The very sodic feldspar (An_{83}) described by (6) was not found. If these sodic compositions are confirmed then Medanitos may be a polymict feldspar cumulate eucrite. The small size of this meteorite (31gm) may, however, preclude exhaustive study. Minor minerals make up less than 1% of the rock with low Ti, high Al chromite being the most abundant. Chromite may show slight compositional variations related to its textural setting.

Discussion The magnesian composition and brecciated character of Medanitos make it a particularly interesting meteorite. Except for Binda and Y75032 it is the most magnesian of the eucritic meteorites. The gabbroic textures of the clasts, the slow cooling rates necessary for pyroxene exsolution and mineralogical similarities to Moore Co., Moama and Serra de Magé suggest that it is a cumulate. A cumulate origin is also suggested by the enormous positive Eu anomaly (6). Because of the small clast size (1-2mm) and the fairly coarse grain size (200-100 μm) petrofabric study of this meteorite is unlikely to provide convincing evidence for a cumulate origin.

The magnesian pyroxene suggests that Medanitos is similar in composition to the source rock from which eucritic melts might have been extracted by partial melting (7). The very low REE contents, however, do not appear to be compatible with a direct eucritic link. REE data of (6) indicate that Medanitos has the lowest REE abundance of any eucrite (Fig. 2) and indeed has less REE than some diogenites (8). The pattern is roughly flat at 0.2 to 0.4x C1 with an Eu anomaly of 3.5x C1. Comparison with Serra de Magé and Moore Co. (9) indicate an REE depleted source magma. Using distribution coefficients (REE) from (10) a possible equilibrium magma for Medanitos has a flat REE pattern at 1.5 to 3x C1 perhaps with a slight positive Eu anomaly. Such an REE pattern might be considered chondritic but a very large degree of partial melting (50-100%) of the chondritic material followed

by fractional crystallization would be necessary to produce Medanitos. While complete melting of a chondritic precursor and olivine fractionation followed by pyroxene-plagioclase coprecipitation might explain the Medanitos data, this required chondrite has a different composition from the source region of other basaltic achondrites. The large degree of partial melting requires early olivine crystallization that would rapidly force the magmatic REE abundance to levels higher than that at which cocrystallization of pyroxene and plagioclase resulted in the formation of Medanitos. It is more likely that this meteorite crystallized from a liquid produced by partial melting of a source region depleted in REE relative to chondrites. This liquid, perhaps formed by remelting in an early ultramafic cumulate pile from which a major mafic fraction containing most of the incompatible elements had already been removed.

CONCLUSIONS: (1) Medanitos is the most magnesian gabbroic eucrite discovered. **(2)** It is the only known brecciated feldspar cumulate eucrite. **(3)** Although modally like Moama, it is chemically distinct. **(4)** REE data suggest that the formation of Medanitos may have involved at least two stages of melting and fractionation, and that it was probably not derived directly from a chondritic source region. The source region for Medanitos was probably a suite of early formed ultramafic cumulates.

References: (1) Hutchison et al. (1977) Appendix Catalogue Meteorites **BMNH. (2)** Prinz et al. (1980) PLPSC **11**, 1055-1071. **(3)** Symes, Hutchison (1970) Mineral. Mag. **37**, 721. **(4)** Hostetler, Drake (1978) G.C.A. **42**, 517. **(5)** Harlow et al. (1979) EPSL **43**, 173. **(6)** Kiesl et al. (1978) Meteoritics **13**, 513. **(7)** Stolper (1977) G.C.A. **41**, 587. **(8)** Shimizu, Masuda (1981) MNIPRSI **20**, 211. **(9)** Ma, Schmitt (1979) Meteoritics **14**, 81. **(10)** Consolmagno, Drake (1977) G.C.A. **41**, 1271.

Notes: PL(P)SC=Proc. Lunar (Planet.) Sci. Conf. : MNIPRSI=Mem. Natl Inst. Polar Res. (Japan), Spec. Issue : G.C.A.=Geochim. Cosmochim. Acta : EPSL= Earth Planet. Sci. Lett. **Funding** NSG-7258 (M. Prinz, P.I.). We thank W. Kiesl for making the sample studied available.