NWA 2999 AND OTHER ANGRITES: NO COMPELLING EVIDENCE FOR A MERCURIAN ORIGIN.

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Introduction: NWA 2999 is the tenth known angrite, and contains disequilibrium textural features which recently led to the suggestion that it and other angrites were derived from Mercury [1,2]. These features include diopsidic-augitic clinopyroxene (*cpx*) + spinel (*sp*) symplectites around plagioclase (*plag*), and discontinuous coronas of *plag* around *sp*. The textures were interpreted by Irving et al. [1,2] as having formed by crossing the olivine (*ol*) + *plag* = *sp* + orthopyroxene (*opx*) + *cpx* reaction boundary twice, with the symplectites forming by transition to higher pressure (>6.7 kb), and the *plag* coronas forming upon pressure release. We suggest instead that these textures were more likely produced during low pressure crystallization.

Melting and crystallization in angrite systems: Partial melts of carbonaceous chondrite precursors under relatively oxidizing conditions at 1 bar produce angrite-like melt compositions and mineralogies [3,4]. The low-pressure liquidus phase diagrams of Longhi [4] show that *sp* and *plag* can either appear or disappear as temperature is changed under relatively oxidizing conditions. For an Allende (CV3) oxidized composition with no Fe removed, initial melting begins at ~1130 ºC with co-existing *ol*, *cpx*, and *sp*. *Plag* forms and *cpx* disappears after ~4% melting at ~1162 ºC and *plag* disappears after 19% melting at ~1248 ºC. For an Allende composition with 10% Fe removed, *ol* + *cpx* + *plag* + *sp* coexist with the first melt, *sp* disappears after ~1% melting, *cpx* disappears after ~1.7% melting at ~1166 ºC, and after 22% melting *plag* disappears and *sp* reappears. We suggest that *plag* coronas around *sp* in NWA 2999 formed as temperature dropped to ~1250 ºC when *plag* began to crystallize. *Cpx* + *sp* symplectites around *plag* probably formed as temperature dropped to ~1165 ºC, when both *cpx* and *sp* were stable. Thus, cooling during crystallization can explain the disequilibrium textures. Pressure changes and large planetary bodies are not required.

Angrites from Mercury? In contrast to Irving and coworkers [1,2], we find no compelling evidence that angrites were derived from Mercury. Arguments against a mercurian origin for angrites were given previously [5] and include their old crystallization ages (4.56 Ga) and ferrous compositions. In particular, the ferrous compositions and reflectance spectra of angrites are completely at odds with spectral data for Mercury [6,7]. The minimal shock and metamorphic effects experienced by most angrites are also inconsistent with their derivation from a large body [8]. Finally, NWA 2999 contains ~8% metal [2], unlike what one would expect for Mercury's crust or mantle.

References: [1] Irving T. et al. (2005) *Eos Trans. AGU* 86 (52). [2] Kuehner S.M et al. (2006) *LPS XXXVII*, #1344. [3] Jurewicz A. et al. (1993) *Geochim. Cosmochim. Acta* 57, 2123-2139. [4] Longhi J. (1999) *Geochim. Cosmochim. Acta* 63, 573-585. [5] Love S. and Keil K. (1995) *Meteoritics* 30, 269-278. [6] Burbine T. et al. (2002) *Meteorit. Planet. Sci.* 37, 1233-1244. [7] Burbine T. et al. (2001) *LPS XXXII*, #1857. [8] Mittlefehldt D. et al. (2002) *Meteorit. Planet. Sci.* 37, 345-369.