CONDENSATION FROM THE PLUME OF AN OBLIQUE CHICXULUB IMPACT.

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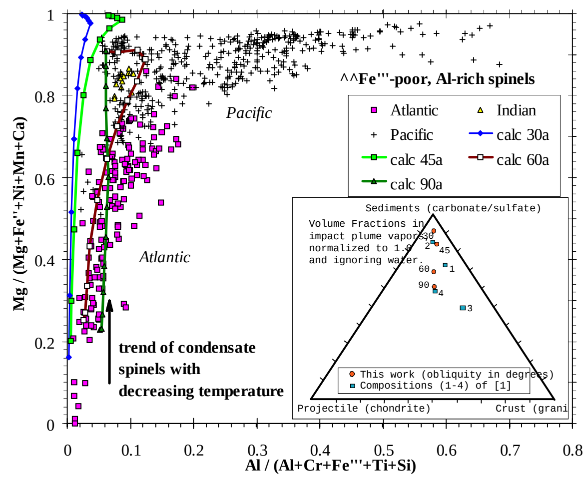
Introduction: In 1999 we calculated the production of spinel-bearing silicate liquid droplets from the condensing fireball produced in the Chicxulub Cretaceous/Tertiary impact [1], based on predicted plume compositions for 4 vertical impacts [2]. Recent calculations for oblique impacts [3], following only the first 5 post-impact seconds, predict the contributions of impactor [4], continental crust, and sediments [5] to the initial vapor plume.

Technique: Condensation calculations were performed as in [1, 6, 7], with elements H, C, N, O, Na, Mg, Al, Si, P, S, K, Ca, Ti, Cr, Mn, Fe, Co, and Ni, and a spinel model for $(Mg,Fe^{2+})(Fe^{3+},Ti,Cr,Al)$, so we do not address the mean ~3 wt% Ni of the K/T spinels [8]. The projectile is taken as CV chondrite [9], and crust as granite [G2 of 10], and averaged measured sections yield sediment volume fractions 0.568 calcite, 0.270 dolomite, 0.112 anhydrite, 0.036 sand, and 0.013 shale, significantly less sulfate than in [2]. The P-T path [Melosh, pers. comm.] is for an expanding vaporized dunite sphere.

For 90, 60, 45 and 30° impacts, vaporized target [5] and projectile [4] volumes are compared with previous work [1] in the figure inset. Increasing obliquity of impact increases the sediment component, resulting in a more oxidizing plume. For calculations illustrated here, it was assumed that vaporized material is homogeneously distributed in the plume, but maybe dynamic processes at scales not explored by the hydrodynamics codes [3] create very compositionally heterogeneous portions of the vapor plume. Relaxing the homogeneity assumption, we're investigating condensation of vapors compositions throughout the inset ternary, and with different sediment compositions.

K/T boundary spinel compositions (Kyte, pers. comm.), differ from Atlantic (low Mg, Al), to an Indian Ocean, to Pacific sites (high Mg, Al), perhaps reflecting spatial and temporal evolution of plume chemistry as the plume spread across the upper atmosphere, cooled, and precipitated spinel-bearing spherules. Calculated spinel composition trends (plotted) are relatively insensitive to obliquity. None is a "best fit" to the entire observed field. As T falls in the calculation, spinels become richer in ferric iron (Fe'''), so their compositions do not extend to the Fe'''-poor, Al-rich region.



Conclusions: Atlantic spherules may record an early, higher T state of the plume. In that case, the Pacific spinels may record a later state of the plume. If so, then the plume chemistry was reduced in that later state, for some unknown reason. All calculated plume chemistries are simply too oxidizing to produce the Fe'''-poor, Al-rich spinels found in the Pacific sites.

References: [1] Ebel D.S. & L. Grossman (1999) *LPS, XXX*, Abs.#1906. [2] Pierazzo E. *et al.* (1998) *JGR 103*, 28607. [3] Pierazzo E. & Melosh H.J. (2000) *Icarus, 145*, 252. [4] same (2000) *MaPS, 35*, 117. [5] same (1999) *EPSL, 165*, 163. [6] Ebel D.S. *et al.* (2000) *J. Computational Chem., 21*, 247. [7] Ebel & Grossman (2000) *GCA, 64*, 339. [8] Kyte F.T. & Bostwick J.A. (1995) *EPSL 132*, 113. [9] Wasson J.T. & Kallemeyn G.W. (1988) *Phil. Trans. R. Soc. Lond. A 325*, 535. [10] Flanagan F.J. (1967) *GCA 31*, 289.