FRACTIONATION IN ELTANIN IMPACT SPHERULES.
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Introduction: Eltanin impact deposits record the only known km-sized asteroid impact into a deep-ocean (5 km) basin (at 2.5 Ma [1]). Two oceanographic expeditions explored ~80,000 km² of the impact region. Locally, meteoritic ejecta (mm-sized shock-melted asteroid and unmelted meteorites; a low-metal mesosiderite) can be 5 to 50 kg/m². Here we report new geochemical data on impact meltrock and spherules.

Impact meltrocks: Iridium concentrations have played a key role in our understanding of the ejecta. This deposit was initially discovered as an Ir anomaly in a sediment core and the discovery that Ir was largely contained in non-chondritic, mm-sized meltrock led to the discovery of meteorite fragments. The meltrock provides the best estimate of the bulk composition of the asteroid and the 187 ng/g average Ir concentration in 55 specimens was important in concluding that the asteroid was a mesosiderite with only 4% metal [2]. We have now analyzed samples from 10 new sites, and size fractions from one site sieved at 63, 125, 250, 500, 1000, and 2000 µm. Microprobe data on bulk Fe and Ni will be needed to complete this study, but initial NAA Ir, Fe, Ni and Co are consistent with the earlier work and we expect the final data will support the low-metal mesosiderite conclusion from samples across the strewnfield.

Impact spherules: Our initial work on the spherules (a trace component in the ejecta) showed that in fractions sieved at 125 and 250 µm ~4% were composed of a transparent to translucent glass lacking any crystallites, such as pyroxenes or spinel rims that are ubiquitous in the rest of the spherule population. We have now sampled the 63-125 µm fraction and found that they are 30% of the population in one sample. The glass spherules typically have refractory compositions and can be highly enriched in Al, Ca, and Ti. An analogue might be CAT-type cosmic spherules that experienced significant fractional distillation during ablation. For example, CAT spherule Al/Si ratios are up to 2.3 times those in CM chondrites [e.g., 3]. Such ratios are common in the Eltanin glass spherules. The very transparent glass spherules have Al/Si ratios up to 10 times that in Eltanin meltrocks. Interestingly, our limited data on Ir in Eltanin spherules show that this refractory element is strongly depleted in spherules. Margolis et al [4] found concentrations of only 5 ng/g in a bulk sample of ~100 spherules. So Ir must be present in some spherules but depleted on average by a factor of ~40. We attempted to measure Ir in three large (>500 µm) spherules but were unable to detect it with a 2 ng/g detection limit. Apparently there are at least two processes affecting spherule compositions: 1) fractional distillation/condensation resulting in a population of refractory and reduced (spinel-free) glasses, and 2) siderophile depletion, possibly by metal-silicate separation. This siderophile depletion is not sufficient to challenge our model for the metal content of the Eltanin asteroid, but it is an intriguing problem.