ELTANIN METEORITE AND IMPLICATIONS FOR THE MESOSIDERITE PARENT BODY. Frank T. Kyte[1] and Rainer Gersonde[2], [1]Center for Astrobiology, Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA 90095-1567, USA (kyte@igpp.ucla.edu). [2]Alfred Wegener Institut fur Polar- und Meeresforschung, Postfach 120161, D-27515 Bremerhaven, Germany (rgersonde@awi-bremerhaven.de).

Specimens of the Eltanin meteorite are sub mm- to cm-sized fragments recovered from the coarse ejecta of a late Pliocene (~2.4 Ma) deep-ocean (5 km) asteroid impact into the Bellingshausen Sea. Ejecta has now been recovered from at least 24 deep-sea sediment cores, covering over 80,000 km^2 of ocean floor. Ejecta is almost entirely meteoritic in origin, being composed of ~10% meteorite fragments and ~90% impact melt rocks. The latter are composed of melted asteroid material mixed with ~3% salts (Na, Cl, K) from a seawater target. Estimates of the mass of meteoritic material are ~2 x 10^{15}g. This is by far the largest known meteorite fall and this is also the most meteorite-rich region known on Earth.

Eltanin was originally classified as an anomalous, low-metal mesosiderite. This classification is now confirmed. Meteorite fragments are mostly polymict breccias compositionally similar to mesosiderite silicates, with low molar Fe/Mn ratios in pyroxenes and at least one basaltic clast with a strong positive Eu anomaly (Eu/Sm 40 x CI). Thus, they are from a highly evolved asteroid, and experienced a significant redox event due to mixing of metal and silicates. Metal is rare, comprising only trace amounts of the ejecta, but common patches of Fe-oxides attached to ejecta particles indicate that at least small amounts were deposited by the impact.

The amount of metal in the precursor asteroid is estimated indirectly from siderophiles in the meteoritic melt rock. Fe/Si ratios of 0.76 in the melt rock are significantly higher than in mesosiderite silicates (<0.45) or howardites (0.6). This "excess" Fe (35 mg/g) and the average Ni (4.2 mg/g) and Ir (187 ng/g), are all consistent with a contribution from ~4% metal with a composition similar to that in mesosiderite metal nodules. It is highly implausible that the asteroid that produced the Eltanin meteorite had a significantly higher metal content than this, or anything approaching the 50% metal typical of other mesosiderites. Our current exploration of numerous sediment cores over a large area shows no significant variation in the siderophile content of the ejecta. There is no known mechanism to fractionate metal from the rest of the ejecta during the impact. Post-depositional removal by diagenetic alteration of large volumes of metal is ruled out, as this would be evident from redox reactions and large volumes of residual Fe-oxides at localities where the ejecta was buried almost immediately by 10s of cm of disturbed sediments.

Most likely, the Eltanin asteroid was derived from the same object as other mesosiderites. Hack et al. (2003 LPSC) point out that it's difficult to justify the presence of two very large, differentiated objects as separate sources for the mesosiderites and the HED meteorites. A third such object is even more implausible. Our results indicate that large regions of the mesosiderite parent body, at least 1 km in size, had relatively low metal content. We also suggest it's possible that meteorites with 50% metal may not be representative of the parent body surface. Although Eltanin is only a single meteorite, by mass it is many orders of magnitude more significant than the rest of the mesosiderites in captivity. Perhaps, the high metal content of most mesosiderites reflects the high survival rate of metal-rich portions after disruption, subsequent impacts in space, and atmospheric breakup during fall. Models of mesosiderite formation should allow for the possibility that only a small fraction of the parent body surface is composed of metal.