NEW LOW-Ni (IGNEOUS?) PARTICLES AMONG THE C AND C? TYPES OF COSMIC DUST;
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Low-Ni particles with major element abundances, optical properties and morphologies sufficiently similar to chondritic IDPs to receive JSC Cosmic Dust Catalog classifications of C or C?-types have been shown to have trace element contents (1, 2, 3) and mineralogies (4, 5) similar to igneous material. Examination of the JSC Catalog EDX spectra by Cooke et al. (6) has shown that 13% of the C-type and 38% of the C?-type particles are potentially low-Ni particles. We have identified two new low-Ni particles, and shown that an additional fragment from the L2002*C cluster has an igneous composition. A newly analyzed fragment of the W7066*A cluster has a chondritic composition. The W7066*A cluster is important because it has yielded a fragment of igneous composition (1) and another fragment having high concentrations of He and Ne (7) suggesting an extraterrestrial origin.

Six particles with very low Ni abundances (Ni/Fe $\leq$0.1xCI) have previously been identified among the stratospheric dust analyzed by Synchrotron X-Ray Fluorescence (SXRF) (1, 2, 3). These particles are usually depleted relative to the CI meteorite composition in Cr, Ge, and Se, but enriched relative to CI in Rb, Sr, Cu, and Ga in a pattern similar to that seen in igneous material (1). Transmission Electron Microscope (TEM) examination of four low-Ni particles (4, 5) revealed mineralogies consistent with igneous material. Rietmeijer (5) suggested that L2002*C is a terrestrial volcanic particle but he left open the possibility of a Martian volcanic origin.

To better constrain their source(s), we have attempted to identify and characterize additional low-Ni particles by examining particles showing no Ni peak in their JSC Catalog EDX spectra. SXRF analysis allows precise measurement of Ni at low abundances, which is important since small particles with Ni/Fe ratios near CI frequently show no Ni peak in their JSC Catalog EDX spectra. We have identified two new low-Ni particles (L2006F7 and L2006G14) and examined two new fragments (L2002*C5 and W7066*A6) of clusters from which other fragments (L2002*C1 and W7066*A4) had been identified as low-Ni (1, 2).

L2006F7, classified C-type, has a Ni/Fe ratio = 0.069. The trace element abundance pattern is unusual, having a relatively flat depletion of siderophile elements, differing from the igneous pattern in that Sr, Cu, and Ga are depleted below their chondritic abundances. This trace element pattern is similar the pattern in U2022B2 (1), a low-Ni particle dominated by a large olivine crystal (4). However, L2006F7 differs from U2022B2 in Ca content, with Ca having been detected in the JSC EDX spectrum of U2022B2 but being present at 0.05xCI in L2006F7.

L2006G14, classified C?-type, has a Ni/Fe ratio = 0.021 and a trace element abundance pattern similar to those previously reported for igneous particles (see Figure 1). TEM examination of a small area of L2006G14 showed it to be very fine-grained like the "granular units" of primitive IDPs, but individual phases have not yet been identified.

L2002*C5 is a second fragment of the L2002*C cluster, related to L2002*C1, previously examined by SXRF, which has Ni/Fe

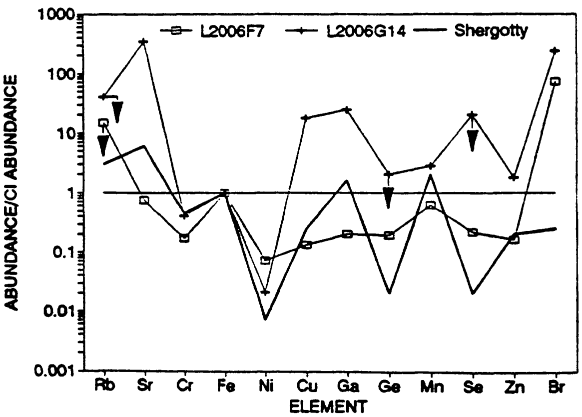

Figure 1: Trace element contents of L2006F7 and L2006G14 compared to CI and the basaltic meteorite Shergotty.

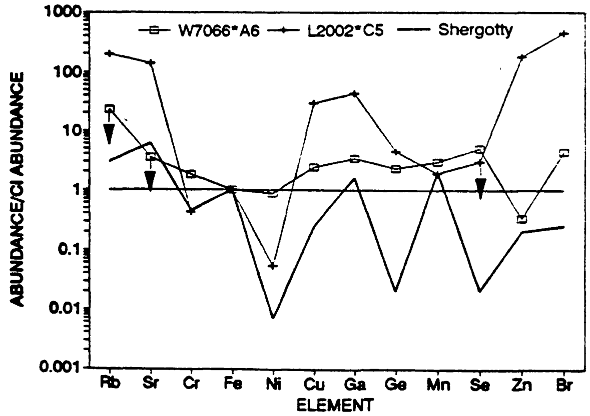

Figure 2: Trace element contents of L2002*C5 and W7066*A6 compared to CI and the basaltic meteorite Shergotty.

= 0.05xCI and an igneous trace element abundance pattern (2). This cluster is not cataloged, but Hartmetz et al. (8) called L2002*C4, another fragment of this cluster, chondritic based on major element abundances. Rietmeijer (5) has reported another fragment of this cluster, L2002*C2, is likely to be volcanic ejecta on the basis of its layer-silicate mineralogy and major element chemistry. L2002*C5 has a Ni/Fe ratio = 0.054, and a trace element abundance pattern (shown in Figure 2) very similar to the one previously reported for L2002*C1, suggesting the cluster is relatively homogeneous.

W7066*A4, a fragment of the W7066*A cluster, was identified as a low-Ni particle with an igneous trace element pattern (1), and mineralogy consistent with an igneous origin (4). Nier and Schlutter (7) found He and Ne in concentrations comparable to those detected in extraterrestrial particles in W7066*A5, another fragment of the cluster. This observation suggests that the W7066*A cluster is an extraterrestrial particle of igneous composition. However, all cataloged fragments of the W7066*A cluster except W7066*A4 show Ni in their JSC EDX spectra. We have examined another fragment of this cluster, W7066*A6, and found Ni/Fe = 0.86xCI and a trace element pattern having all detected elements except Se within a factor of 3 of their CI element/Fe ratios (see Figure 2). This pattern is consistent with other chondritic particles but quite distinct from the igneous pattern which shows both positive and negative deviations by factors of 100 or more from CI. We suspect the chondritic composition of W7066*A6 is more representative of the W7066*A cluster than is the igneous composition of W7066*A4 because W7066*A4 is the only fragment of the cluster to show a low Ni content. If so, then either the igneous material of W7066*A4 exists as a clast within the otherwise chondritic IDP or W7066*A4 is not related to the W7066*A cluster. We note other evidence for contamination of the W7066*A cluster, since W7066*A5 consists of a chondritic fragment attached to an aluminum oxide sphere.

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