THE KAROONDA (CK) GROUP OF CARBONACEOUS CHONDRITES: A NEW GROUP FOUND EXCLUSIVELY IN AUSTRALIA AND ANTARCTICA.

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CK chondrites have textural and chemical properties that are most similar to those of CV chondrites, but they contain few refractory inclusions and have lower abundances of refractory lithophiles and higher abundances of Mn and Na. Their O-isotope compositions are unresolvable from those of CO chondrites and are within the ^{16}O-rich extreme of the CV field. All normal CK chondrites are metamorphosed; petrographic types range from 4 to 6. Some contain shock veins and all exhibit various degrees of blackening due to dispersed particles of sulfide and magnetite in silicates. Metallic Fe-Ni, an important phase in CO3 and CV3 chondrites, is rare in CK chondrites. Chondrules (~10-15 vol.%) average 500-750 μm in apparent diameter; CO3 and CM2 chondrules are smaller, and CV3 chondrules are slightly larger. Nonporphyritic chondrules are very rare in CK and CV chondrites. Mean olivine Fa contents range from 28.8 to 33.3 mol%.

CK chondrites have been recovered from five sites in Antarctica. Petrographic evidence indicates multiple falls at some sites; we count 11 independent falls. In contrast only 5 CV and 5-6 CO chondrites have been found in Antarctica. The median size of the 11 Antarctic CK chondrites is ≈40 g; those with masses >150 g are ALH85002 (438 g) and the EET87507 shower (246 g). If these are representative of the masses of the original meteoroids, it is unlikely that they could have been found in locations other than Antarctica. The only non-Antarctic CK chondrites are from Australia: Karoonda (42 kg, the only fall) and Maralinga (>34 kg).

Why have CK chondrites been recovered only from the Southern Hemisphere, and mainly from Antarctica? Wasson (1990) inferred that the high abundance of ungrouped iron meteorites in Antarctica is related to their small size; the smallest size fraction originated on a larger and more diverse set of parent bodies. The high abundance of CK chondrites in Antarctica also appears to be size related. It does not seem to be related to a recent near-Earth breakup, because the highly weathered condition of several Antarctic CK suggest long terrestrial residence periods, and the terrestrial age of CK4,5 PCA82500 is 280 ka (Nishiizumi et al., 1989). If the breakup of a CK Earth-crossing asteroid occurred >100 ka ago, roughly equal numbers should have fallen in the northern and southern hemispheres (Halliday and Griffin, 1982).

Although a priori we would expect that the preatmospheric size distribution of CK chondrites would have been about the same as those for CV and CO chondrites, this need not have been the case. The (Antarctic) CK chondrites may have been produced by the breakup of an Earth-crossing body under circumstances (e.g., small size of target body, high impact velocity of projectile) that produced a size distribution biased toward the small-mass extreme. This may, in fact, be the explanation for the exceptionally high abundance of several rare groups (e.g., ureilites) in Antarctica.

If the Antarctic CK meteoroids were generally small, this should be recognizable in their contents of certain cosmic-ray produced isotopes. In particular, their ^{26}Al contents should be low and their ^{3}He/^{21}Ne ratios should be high. No data are yet available to carry out this test.

References: Halliday I. and Griffin A.A. (1982) Meteoritics 17, 31; Nishiizumi K., Elmore D. and Kubik P.W. (1989) Earth Planet. Sci. Lett. 93, 299; Wasson J. T. (1990) Science 249, 900.