IS THE EOS FAMILY DERIVED FROM THE BREAKUP OF A STRATIFIED CV-CK PARENT BODY?

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Introduction: The relationship between each of the principal carbonaceous chondrite groups (CI, CM, CR, CO, CV, CK, CH and CB) [1] is poorly understood. In particular, the nature of the asteroidal sources from which they are derived is uncertain. It has been proposed that CV and CK chondrites may have originated from a single thermally stratified parent body [2]. Here we examine the possibility that the Eos asteroid family formed by collisional disruption of this common CV-CK parent body.

The relationship between CV and CK chondrites: CK chondrites are highly oxidized meteorites containing abundant magnetite and trace amounts of Fe,Ni-metal [2]. Although predominately composed of equilibrated meteorites (types 4 to 6), a significant number of type 3 CKs have now been identified and these share many common characteristics with CV chondrites [2, 3]. A close affinity between CV and CK chondrites is confirmed by oxygen isotope analysis [2]. Magnetites in both groups show significant compositional similarities [2]. Major and trace element analysis demonstrates that both CVs and CKs display overlapping variation. CVs and CKs appear to form a continuum and by implication could be derived from a single asteroidal source [2, 3]. The similar cosmic ray exposure age distribution of both CVs and CKs is further evidence that they are derived from a common parent body [4].

Identifying the source of CV and CK chondrites: If the CV and CK chondrites come from a single asteroid, where is it? One possibility is that it was disrupted 1,300 Ma ago during the collisional event that formed the Eos family [5, 6]. Eos family members (termed K class asteroids) have been matched to the CV and CO chondrites [7]. However, more recent analysis indicates a closer match to R and CK chondrites, and to a lesser extent CVs and olivine-rich achondrites [5]. This new data has been interpreted as indicating that the Eos family is derived from a partially differentiated ordinary chondrite-like body [5]. However, this view is at odds with the location of the Eos family in the outer asteroid belt (2.95 to 3.13 AU), a region dominated by C class asteroids. The distinct oxygen isotope compositions of carbonaceous and R chondrites also excludes the possibility of a common source for these meteorites. It would appear more likely that the Eos family is composed primarily of CV and CK material. While it is not possible to rule out additional parent bodies [8], it seems likely that the disrupted asteroid from which the Eos family formed was the primary source of the CV and CK meteorites.

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