NC–CC DICHOTOMY INFERRED FROM RU/RH AND IR/RH MASS RATIOS OF BULK CHONDRITES

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Introduction: Large difference in condensation temperature of about 200 K [e.g. 1] between Rh and Ir, have led to some variation in platinum group element (PGE) composition in chondrites during solar nebula condensation processes.

PGE concentrations of chondrites: Differences of some PGE ratios exist between the database by Tagle & Berlin [2] and reviewed chondrite data by Lodders [3]. For example, the Ir/Rh ratio of CV chondrites derived by Lodders [3] is 4.14, the value for Ir/Rh derived by Tagle & Berlin [2] is 3.63. The mean Ru/Ir ratio of all chondrite groups from both studies is 1.49 ± 0.06 (n=20). Some of the spread in mass ratios of Ru/Rh and Ir/Rh for some chondrite groups may depends on how many meteorites are included for each group [3]. Another reason for the scatter could be that Rh still cannot be determined as well as Ir or Os, since most analytical mass spectrometry techniques, with few exceptions, do not measure the monoisotopic element Rh, or as shown in a recent study, non-representative aliquot sizes of sample powder <0.1 g were used for bulk analysis of meteorites [4]. The scatter could also be due to terrestrial alteration, as seen in some EH and R chondrites.

The striking bimodality on the Ru/Rh vs. Ir/Rh diagrams: Figures 1 and 2 show Ru/Rh vs. Ir/Rh from carbonaceous (CC, blue symbols) and non-carbonaceous chondrites (NC, green symbols) from different studies. Carbonaceous chondrites (CO, CM, CV, CK, CI) can be clearly distinguished from NC chondrites (L, LL, EL, EH, H) by their high Ir/Rh and Ru/Rh mass ratios. Baedecker and Wasson [5] reported that carbonaceous, ordinary, and enstatite chondrites exhibit successively greater degrees of reduction in combination with successively lower contents of refractory elements. These features are most likely associated with formation at successively smaller radial distances from the Sun in hotter portions of the solar nebula, as was discussed by Baedecker and Wasson [5]. As already reported by John Wasson, progress can only be made by combining meteorite research and astrophysics.

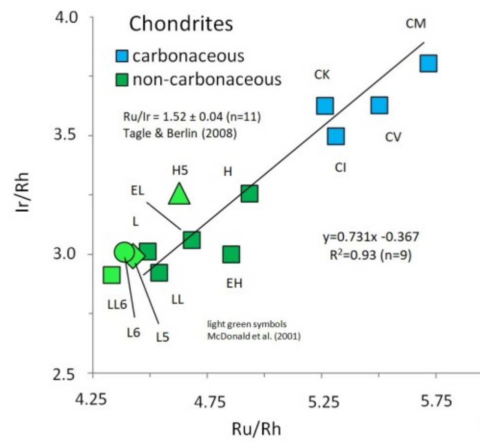

Fig. 1

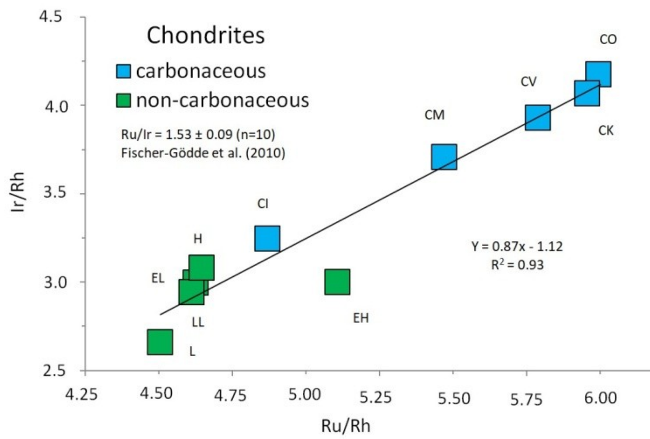

Fig. 2

A similar bimodality on isotopic ratios were detected by Warren [6] “The striking bimodality exhibited by planetary materials on the ε^{50}Ti vs. ε^{54}Cr and Δ^{17}O vs. ε^{54}Cr diagrams suggests that the highest taxonomic division in meteorite/planetary classification should be between carbonaceous and noncarbonaceous materials.” Kruijer et al. [7] report "Recent work has shown that meteorites exhibit a fundamental isotopic dichotomy between non-carbonaceous (NC) and carbonaceous (CC) groups, which most likely represent material from the inner and outer Solar System, respectively.”

Conclusion: The fundamental dichotomy between CC and NC groups in the isotopic ratios [e.g. 6-10] can also be shown by element ratios of Ru/Rh and Ir/Rh. Ruthenium/Rh and Ir/Rh ratios are the best to distinguish chondrite groups [e.g., 2,11,12]. For additional figures, the reader is referred to the web version (R^G) of this abstract.

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