Highly equilibrated carbonaceous chondrites

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Most carbonaceous chondrites have primitive, unequilibrated textures of petrologic type 3 and lower. Recently a number of extensively metamorphosed carbonaceous chondrites of types 6 were identified. They have O isotopes similar to CR chondrites and were classified as CR metachondrites [1]. The CR relationship is supported by the similarity in bulk compositions of major elements. The FeO-rich mafic mineralogy (Fa~36) distinguishes these meteorites from CR-chondrites. Northwest Africa (NWA) 6901 and those described by [1] are potentially paired meteorites with identical O isotopic composition, mineralogy, and highly equilibrated texture and old single grain phosphate U-Pb age of 4563 ± 13 Ma [2].

We performed analyses of major and trace elements of bulk NWA 6901 by ICP-AES and ICP-MS [3] and of trace elements of merrilites by LA-ICPMS. Bulk NWA 6901 is different from CR chondrites with depletions of refractory elements (Al, Ca and Sc) and moderately volatile elements (K, Na, Ga, and Zn). The phosphates are strongly enriched in LREE with a positive Ce anomaly, a negative Eu anomaly and a subchondritic U/Th ratio. The pattern is the same as the pattern of bulk NWA 6901. Phosphates of basaltic achondrite NWA 011 have a similar pattern suspected to be caused by terrestrial alteration [4]. The absence of common Pb in single phosphate grains suggest, however, that terrestrial alteration in NWA 6901 is at most minor [2].

The fractionated trace elements of phosphate and bulk NWA 6901 are not in accordance with isochemical metamorphism on the CR parent body and can also not be explained by loss and/or gain of trace element rich partial melts. Chemistry and ^{54}Cr [5] indicate that NWA 6901 is a new type of carbonaceous chondrite derived from a parent body that formed in a chondritic source region unknown so far.

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Silver enrichment in rain under different cloud conditions

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This study follows and records the arrival and activity of AgI in seeded clouds. During four winters while cloud seeding took place, precipitation was collected at three stations in the catchment area of the Sea of Galilee (target stations) and in one station west of the seeding line (control station). Chemical analysis of 23 metals was carried out on more than 4000 rain samples in order to determine the major and trace metal concentrations and enrichment factor with respect to Al (EF), where Al was assumed to represent natural dust. In addition, satellite images were analyzed to characterize the cloud phase (liquid, ice, mixed liquid-ice) and the temperature of the clouds using the EUMETSAT second generation geostationary satellite.

It was found that AgI arrives to the targeted clouds, as indicated by significantly higher EF_{Ag} values there compared with the control station. We found significantly higher EF_{Ag} values in precipitations from mixed-phase clouds compared with precipitation from warm or fully glaciated clouds. This difference was observed only at the target stations and only for Ag (Fig. 1). The observation is consistent with the assertion that AgI contributes actively to the formation processes of precipitation in mixed-phase clouds, where ice nuclei concentrations can be rate determining in precipitation formation. This is also consistent with theoretical predictions about the activity of AgI in clouds.

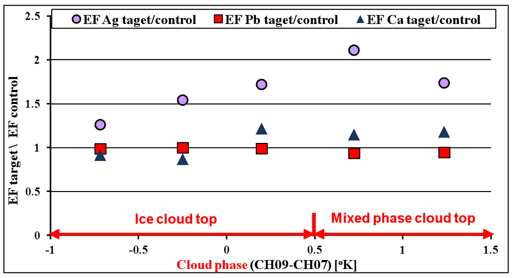

Figure 1: Ratios of EF_{Ag}, EF_{Ca} and EF_{Pb} between the target and the control station at different cloud phase intervals. Liquid clouds > 2, icy clouds ≈ 0.5-0, mixed-phase clouds 0.5 - 1.5. Negative BTD(CH09-CH07) values indicate convective clouds.

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