The Primordial Noble Gas Content of CR and CI Chondrites

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The volatile element contents (noble gases, HCN), including their isotopic compositions, of the most primitive meteorite classes are necessary to constrain the origin of the volatiles in the terrestrial planets [1-3]. However, data for the primordial noble gases in meteorites, and hence a representative estimate for the early volatile inventory of primitive planetesimals and potential planetary building blocks, are difficult to obtain, as many subsequent processes modify the original gas budget.

Here, we present new noble gas data on >15 CR chondrites (CRs), one of the most primitive meteorite classes. The noble gases were known so far only for a few CRs and a complete overview including an estimate of their primordial noble gas composition, potentially important as input for modelling the volatile inventories of the bodies in the solar system, was lacking. We will compare our new estimates for CRs based on our new data with literature data of CI chondrites.

The Ne isotope data indicate mixing between trapped and cosmogenic Ne. Evidence for solar wind (SW) is found only in 3 new CRs. Combining this with literature data shows that less than 30% of the CRs are regolith breccias, contrasting an earlier estimate of 100% [4]. Expectedly, most non-SW-bearing samples indicate a trapped "Ne-HL" component from presolar diamonds, in agreement with, e.g., CI and CM observations. One of the most altered CRs (type CR1) shows an even lower trapped endmember $^{20}Ne/^{22}Ne$, suggesting more abundant Ne-E (relative to HL) residing in presolar SiC or graphite. A similar trend was observed for the most aqueously altered lithology of Tagish Lake [5]. The trapped Xe composition in all samples but one is dominated by Xe-Q. A heated CR2 shows a clear access of ^{129}Xe due to decay of once live ^{129}I. One of the most severely weathered CRs analysed so far may suggest the presence of terrestrial Xe.

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