THE TERRESTRIAL COMPONENT OF PRIMITIVE CHONDRITE ALTERATION.

P. A. Bland[1,2], K. T. Howard[2], G. Cressey[2] and G. K. Benedix[2]. [1]Impacts & Astromaterials Research Centre (IARC), Dept. Earth Sci. & Eng., Imperial College London, SW7 2AZ, UK. E-mail: p.a.bland@imperial.ac.uk. [2]IARC, Dept. Mineralogy, Natural History Museum, London SW7 5BD, UK.

Introduction: Studies of the terrestrial weathering of meteorites have typically focused on equilibrated ordinary chondrites [e.g. 1-3], principally because it is a simple matter to define an unweathered starting composition. By contrast, in the case of primitive chondrites, it becomes more difficult to deconvolve the effects of terrestrial and pre-terrestrial aqueous alteration. Nevertheless, it is apparent that terrestrial weathering can have a profound effect on the chemistry of these meteorites [4,5]. Here we provide an overview of the terrestrial alteration exhibited by various primitive chondrites.

CI and CM chondrites: It is apparent that mobilization of sulphur in the terrestrial environment (either remobilization of pre-existing sulphates, or oxidisation of sulphides) is occurring in CI chondrite falls [6]. A similar process may well be occurring in the CMs. The mineralogical alteration index (MAI), designed to quantify pre-terrestrial alteration [7], shows an excellent correlation with year of fall [8]. One possible explanation is that phyllosilicate probe data for the MAI algorithm are selected based on sulphur content, and as we have seen, sulphur is readily mobilized in the terrestrial environment.

CO chondrites: Colony and ALH 77307 are both finds, and two of the most primitive CO chondrites. An ^{57}Fe Mössbauer spectrum of Colony reveals that 55.3% of the Fe in the sample is present as Fe^{3+}-bearing phyllosilicate. Most CO falls have <10%. The difference is likely due to terrestrial alteration.

CV chondrites: Allende contains minor aqueous alteration products. X-ray diffraction indicates minimal alteration [9], and ^{57}Fe Mössbauer spectra of Allende show no paramagnetic Fe^{3+}-component [10]. In contrast, the $CV_{Ox(a)}$ Axtell shows abundant Fe^{3+}-bearing phyllosilicates [11], with similar Mössbauer parameters to terrestrial weathered ordinary chondrites [1].

Ungrouped carbonaceous chondrites: An ^{57}Fe Mössbauer spectrum for Acfer 094 shows abundant Fe^{3+}-bearing phyllosilicate (65.4% of total Fe). As sub-µm matrix metals are well preserved [12], this may be attributable to weathering of amorphous matrix phases. XRD analysis of Adelaide indicates significant goethite (6.7 wt%), likely a result of terrestrial weathering.

Conclusion: Primitive chondrites have experienced terrestrial alteration. Defining the degree of alteration is clearly of value.

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