

LETTER

The Mars/Earth dichotomy in Mg/Si and Al/Si ratios: Is it real?

JUSTIN FILIBERTO,* HANNA NEKVASIL, AND DONALD H. LINDSLEY

¹Department of Geosciences, SUNY Stony Brook, Stony Brook, New York 11794-2100, U.S.A.

ABSTRACT

The apparent dichotomy of Mg/Si and Al/Si ratios between terrestrial rocks and Martian meteorites has been interpreted as indicative of major differences between the terrestrial and Martian magma source regions. We suggest that this apparent dichotomy is not robust when compared with partly cumulate and non-cumulate terrestrial igneous material. Terrestrial cumulate intra-plate nodules with similar mineralogy to the SNC meteorites plot in the SNC field in this compositional space and far removed from the “terrestrial geochemical fractionation” line (Earth’s crust line) of Jagoutz et al. (1979). As is the case for terrestrial partly cumulate igneous rocks, the bulk compositions of cumulate SNC meteorites such as Chassigny and Nakhla are dominated by the chemical characteristics of the accumulated minerals, minerals compositionally similar to those found in terrestrial intra-plate magmas. Therefore, the minor amounts of liquid involved play an insignificant role in the Mg/Si and Al/Si signature and no special Martian chemical characteristics can be identified. SNC meteorites considered as possibly representative of liquid compositions are similar in composition and Mg/Si and Al/Si to terrestrial ferropicrites, suggesting that even “liquid” compositions within the SNC space are not uniquely Martian. Therefore, the Mg/Si and Al/Si ratios cannot clearly distinguish Martian from terrestrial rocks.

Keywords: Meteorite, Martian, igneous petrology, Mg/Si vs. Al/Si, lunar and planetary studies, Mars, major and minor elements, Mars rocks