# Non-chondritic Sm/Nd ratios in the terrestrial planets

G. CARO[1], B. BOURDON[2], A.N. HALLIDAY[3] AND G. QUITTE[4]

[1]CRPG-CNRS, 15 rue Notre-Dame-des-Pauvres, 54501 Vandoeuvre-les-Nancy, France, (caro@crpg.cnrs-nancy.fr)
[2]Institute of isotope geochemistry and mineral resources, ETH Zurich 8092 Zurich, Switzerland
[3]Dpt. of Earth Sciences, University of Oxford OX13PR, UK
[4]Laboratoire des Sciences de la Terre, ENS Lyon, F-69364, Lyon, France

The super-chondritic $^{142}$Nd signature measured in terrestrial rocks may indicate early differentiation and segregation of a crustal reservoir. Alternatively, this isotopic anomaly could indicate that the Earth accreted from material with Sm/Nd ~5% higher than chondritic. We present high-precision $^{142}$Nd data for Martian meteorites showing that Mars is also characterized by super-chondritic $\varepsilon^{142}$Nd. The shergottites Zagami, Shergotty and Los Angeles have nearly chondritic $\varepsilon^{142}$Nd but show negative $\varepsilon^{143}$Nd (-7 ε-units) and $\varepsilon^{176}$Hf (-15 ε-units) indicating derivation from an ancient (~4.5 Gyr) enriched reservoir. This observation strongly argues against a chondritic composition for Mars. Application of coupled $^{146,147}$Sm-$^{142,143}$Nd chronometry to Shergotittes yields a planetary isochron with a model age of differentiation of 40±20 Myr. This isochron does not pass through the chondritic composition (i.e. $\varepsilon^{142}$Nd=-0.2 and $^{147}$Sm/$^{144}$Nd=0.1966) but intersects the lunar and terrestrial isochrons at $^{147}$Sm/$^{144}$Nd=0.206±0.005 and $\varepsilon^{142}$Nd~0. This result suggests that the radiogenic $^{142}$Nd signatures in Earth and Mars reflect fractionation of the light REE during, or prior to the accretion of the terrestrial planets. The $\varepsilon^{143}$Nd of +5±3 corresponding to closed-system evolution of a mantle with $^{147}$Sm/$^{144}$Nd=0.206±0.005 over 4.56 Gyr is indistinguishable from the values observed in OIBs with high $^{3}$He/$^{4}$He, suggesting that undegassed mantle sources did not experience depletion in REE. Further implications of these results for global geodynamics will be discussed during the meeting.

# Pb-Nd isotopic constraints on sedimentary input into the Lesser Antilles arc system

M. CARPENTIER[1]*, C. CHAUVEL[1] AND N. MATTIELLI[2]

[1]LGCA, Grenoble University, Grenoble, 38041 France (*correspondence: marion.carpentier@ujf-grenoble.fr)
[2]DSTE, Bruxelles University, Bruxelles, 1050 Belgium

The chemical composition of the Lesser Antilles arc is highly influenced by material with a continental crust origin. Moreover, it is characterized by a clear north-south chemical zoning, where southern island lavas, with generally more variable and more Pb radiogenic signature, are more influenced by this continental contaminant. In order to evaluate a potential north south change in the subducted sediment chemical compositions (in particular Pb-Nd isotopes), we focused on sediments from three sampling sites in the forearc region, at various latitudes: two DSDP sites were selected, Site 543, east of Dominica Island (15.7°N) and Site 144, further south (9.5°N) on the edge of the South American rise. Some sediments from Barbados island (13.2°N), at intermediate latitude, were also analysed.

Pb and Nd isotopic data obtained on the three sites reveal strong influence of old crustal material within the source of all sediments, as previously suggested for Site 543 sediments [1]. However significant difference must be noticed: samples from sites 543 have relatively uniform isotopic composition and $^{206}$Pb/$^{204}$Pb does not exceed 19.53; sediments from Site 144 and Barbados display larger variations, from more to less radiogenic values. In particular, a 60 m thick black shales formation present in the ~ 95 to 84 Ma horizon of the Site 144 sedimentary pile exhibit highly radiogenic $^{206}$Pb/$^{204}$Pb ratios, between 21.6 and 27.7. These compositions reflect the radioactive decay of authigenic U concentrated in organic rich layers. These observations parallel the geographical isotopic changes known along the arc, with much more variable and more radiogenic values in lavas from the southern islands than in lavas from the northern islands. For northern island lavas, incorporation in the mantle source of subducted sediments as drilled at Site 543 can produce their isotopic signature. In the south, less than 10% of sediments like those of Site 144 or Barbados can explain the most Pb radiogenic composition of the southern islands. The north-south isotopic change known along the Lesser Antilles arc can therefore be simply explained by geographical changes in the composition of the subducted sediment pile.

[1] White *et al*. (1985) GCA **49**, 1875-1886.