Constraining deep mantle contributions to Canary Island lavas

J.M.D. DAY[1], R.J. WALKER[1], D.R. HILTON[2], J.-C. CARRACEDO[3] AND E. HANSKI[4]

[1]Dept. Geology, Univ. Maryland, College Park, MD, USA
[2]Scripps Institution of Oceanography, La Jolla, CA, USA
[3]Estación Volcanológica de Canarias, Tenerife, Spain
[4]Dept. Geosciences, Univ. Oulu, FIN-90014 Finland

Much debate surrounds the original interpretation of coupled ^{186}Os-^{187}Os enrichments in ocean island basalts (OIB) as deriving from core-mantle interaction. Alternate models proposed to explain ^{186}Os-^{187}Os signatures include melting of pyroxenite-peridotite mixtures, or base metal sulphides, with long-term (Re+Pt)/Os enrichment. Canary Island lavas offer a means to test these models because they are characterised by radiogenic ^{187}Os/^{188}Os and Pb isotopes, and MORB-like ^{3}He/^{4}He – characteristics which can be interpreted as originating from a predominantly upper mantle source that includes recycled crust/lithosphere, rather than a 'deep plume' component. We present new coupled high-precision ^{186}Os-^{187}Os isotope and highly siderophile element (HSE) abundance data on picrite and ankaramite lavas from the islands of El Hierro, La Palma, La Gomera, Tenerife, Lanzarote, and on harzburgite xenoliths from Lanzarote.

Lavas analysed in this study have 0.15 to 1.2 ppb Os, and ^{187}Os/^{188}Os ranging from 0.137 to 0.166. These ratios are at the extreme radiogenic range of OIB. The Os concentrations are similar to rocks with comparable MgO worldwide, so there is no evidence of derivation from an HSE-depleted source. The harzburgite xenoliths are characterised by >1 ppb Os, chondritic to sub-chondritic ^{187}Os/^{188}Os and Re depletion ages consistent with their origin as lithospheric refractory melt residues. ^{186}Os/^{188}Os data for three aliquots of a Lanzarote harzburgite yield a ratio of 0.1198361±9; indistinguishable from estimates for the convecting upper mantle. Analysed Canary Island lavas have ^{186}Os/^{188}Os ratios that are also within the upper mantle range.

The observation that ^{186}Os/^{188}Os of Canary Island lavas are typical of the upper mantle points to a lack of long-term Pt/Os enrichment, but the extreme range in ^{187}Os/^{188}Os indicates a source with long-term Re/Os enrichment. Combined, these characteristics are consistent with a mantle source containing variable proportions of recycled material within a peridotitic, depleted-MORB mantle. Such pyroxenite-peridotite, 'layer-caked' sources have been suggested as the cause of coupled ^{186}Os-^{187}Os enrichments in other OIB mantle sources. The new data obtained on Canary Island lavas do not appear to support this view.

Search of hydrocarbon in Mesozoic sediments below the Deccan basalt, India

A.M. DAYAL, D.J. PATIL AND S.V. RAJU

National Geophysical Research Institute Hyderabad 500 007, India (dayalisotope@yahoo.com)

The Cretaceous Deccan basalt is one of the larger and better-preserved continental flood basalt (CFB) provinces of the world (Fig.1). Based on DSS studies, Kaila (1988) indicate a hidden sedimentary basin trending E-W near Tapti River bound by E-W faults, named the Tapti graben, with its thickness of 1.8 km decreasing to 400 meters near Surat and Akola. To search the presence of hydrocarbon in hidden Mesozoic sedimentary basin below the Deccan basalt geochemical study of soil samples was carried out for the light hydrocarbon (C_1-C_4).

The light gaseous hydrocarbons were extracted from soil by treating sample with orthophosphoric acid. C_1-C_4 was measured using gas chromatograph. The accuracy of measurement of C_1 – C_4 components is < 1 ng/g. Carbon isotopic composition of $\delta^{13}C_1$ (methane), $\delta^{13}C_2$ (ethane) and $\delta^{13}C_3$ (propane) was measured using GC-C-IRMS. The precision of the isotopic analysis for CH_4 is ± 0.5‰.

The adsorbed soil gas analysis for Deccan Syneclise indicates that the concentrations of methane, ethane propane and butanes are moderate to low Fig 2a, 2b, 2c). The cross-plots (Fig. 3) between C_1-C_2, C_1-C_3, C_2-C_3 and C_1-ΣC_{2+} show excellent correlation (r = >0.9) and suggest that these hydrocarbons are genetically related not effected by secondary alteration during their migration from subsurface and have been generated from a thermogenic source because of the presence of C_2 & C_3 components. The compositional signatures displayed by methane to ethane (C_1/C_2), methane to propane ratios (C_1/C_3), as defined by Pixler (1969) is shown in Fig. 4, it can be seen that majority of the samples fall in oil window and oil & gas window.

The relationship between $\delta^{13}C_1$ and gas wetness $C_1/(C_2+C_3)$ indicates that majority of the samples fall within the thermogenic field (Fig. 5). The adsorbed soil gas data as well as $\delta^{13}C_1$ signatures suggest that the light gaseous hydrocarbons (C_1-C_3) are derived predominantly from thermogenic source.

The main objective of this work was to search the presence of hydrocarbon in the hidden basin of Mesozoic age below the Cretaceous Deccan basalt. The region in and around Upper Godavari lineament, Tapti graben and north of Tapti Graben indicate anomalous concentration of hydrocarbon gases.

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