Tracing arc-like volatiles into Panama using helium and CO_2

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Western Panama represents the transition between subduction of the Cocos Plate and strike-slip movement of the Nazca Plate relative to the common adjacent Caribbean Plate. The boundary between the Cocos and Nazca plates is being subducted close to the Costa Rica-Panama border. We report He and CO_2 data for geothermal fluids and cold seeps located along two parallel west-to-east trends to discern the spatial extent of subduction-related volcanism into western Panama.

Helium isotope ($^3He/^4He$) values at Baru, La Yeguada, and El Valle volcanoes are high (5-8R_A), consistent with results from other Central America volcanoes [1-2]. However, $CO_2/^3He$ values are highly variable (from > 10^{12} to < 10^8). Baru has an arc-like $\delta^{13}C$ of - 4‰, whereas the other volcanoes have $\delta^{13}C$ < -10‰. Cold seeps collected in the coastal forearc show decreasing He-isotopes from west (~6R_A) to east (~1R_A). This trend is mirrored by $\delta^{13}C$ (-5‰ to <-20‰) values. $CO_2/^3He$ values of the seeps fall within a narrow range between 5 x 10^8 and 10^{10}.

Using $CO_2/^3He$-$\delta^{13}C$ mixing plots with conventional endmember values for Limestone, Organic Sediment and Mantle CO_2, we show that several samples have been extensively modified by crustal processes. However, there are clear west-to-east trends (volcanoes and coastal seeps), whereby L dominates the CO_2 inventory in the west and S CO_2 increases eastward. We conclude that arc-like volatiles characterise western Panama, but this signature dissipates within 400 km eastwards.

[1] Shaw *et al* 2003, *EPSL* [2] De Leeuw *et al* 2007, *EPSL*.
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