Subduction eroded continental crust and sediment derived fluids in the genesis of arc magmas in the SVZ, Andes

PAUL MARTIN HOLM[1*], NINA SØAGER[1], CHARLOTTE THORUP DYHR[1]

[1] University of Copenhagen, Copenhagen, Denmark, paulmh@geo.ku.dk (*presenting author)

New Sr, Nd and Pb isotope and trace element data is presented from young volcanic rocks from Maipo and Laguna del Maule Transitional and Northern Southern Volcanic Zone (SVZ) of the Andes, respectively. The trace element enrichment of many of the volcanic rocks from the 34-38^{o}S in the Southern Volcanic Zone, SVZ, display a relative enrichment of Th to Ba indicating that source enrichment by fluids is not the most important process. All rocks have negative Nb and positive Pb anomalies indicating that the magmas have an important component of continental crust or/and had a fluid-enriched source.

To avoid most effects on incompatible trace element ratios from fractional crystallization and from afc processes we used only incompatible element ratios of the most primitive rocks in our modelling (Mg# > 60).

Nb/Th, Ba/Th and La/Th ratios in rocks from the Central-Transitional-Northern SVZ correlate well and suggest that two components dominate their compositions. In this respect the Andes rocks with the relatively highest ratios are comparable to the Marianas and Tonga, which have been argued to be derived from a fluid-enriched source [2,3]. The low Ba/Th component has lower Ba/Th and La/Th than GLOSS, local trench sediments and average continental crust. This end-member most resemble average upper crust, and its relatively low Ba/Rb and La/Rb suggest it to be of evolved magmatic composition. Volcan Maipo rocks approximates this end-member for the Northern SVZ and very little fluid-borne enrichment is required to generate these magmas. This is in accord with the radiogenic Sr (^{87}Sr/^{86}Sr = 0.7049-0.7055) and unradiogenic Nd (^{143}Nd/^{144}Nd = 0.5125-0.5126) of the Maipo rocks, lower than 0.5127-.5128 of Chile Trench sediments. For the Transitional and Central SVZ crust with similar geochemistry but different isotopic composition is indicated. We suggest that the subducting Nazca plate abraded the South American upper crust at the leading edge and transported it below the lithosphere where it partially melted, as also suggested by e.g. [4]. The fluid-borne enrichment is characterized by its Sr and Nd isotope composition of ^{87}Sr/^{86}Sr around 0.7040 and ^{143}Nd/^{144}Nd 0.5128. This composition is common for several SVZ volcanoes and isotopically overlap with Chile Trench sediments in Sr, Nd and Pb isotopic composition, and is very different from both Pacific MORB and the OIB-type source of the back-arc magmas which probably is an important end-member in the local asthenosphere. The fluid borne enrichment is therefore indicated to be derived from subducted sediments. The well defined trend towards higer Nb/Th for the rocks rich in this end-member show that they were derived from a rather fixed proportions of fluid plus mantle.

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Organic geochemical insights into the formation of the Here's Your Chance lead-zinc-silver deposit

ALEX HOLMAN[1*], KLITI GRICE[1], CAROLINE JARAULA[1], JEFFREY DICK[1], ARNDT SCHIMMELMANN[2] AND KATY EVANS[3]

[1]WA Organic and Isotope Geochemistry Centre, Department of Chemistry, Curtin University, Perth, Australia, A.Holman@curtin.edu.au (* presenting author)
[2]Department of Geological Sciences, Indiana University, Bloomington, United States of America
[3]Department of Applied Geology, Curtin University, Perth, Australia

The Here's Your Chance (HYC) lead-zinc-silver deposit is located in the Barney Creek Formation (BCF), a 1639 ± 2 Ma carbonaceous marine deposit in the Northern Territory of Australia. The HYC deposit has been extensively studied as an example of hydrothermal alteration of well-preserved Proterozoic organic matter [1,2].

Samples were collected from five sites along the flow path of hydrothermal fluid. The freely-extractable hydrocarbons (Bitumen I) from these samples have been analysed by Williford *et al.* [2]. This study has investigated hydrocarbons that were occluded within the kerogen/mineral matrix (Bitumen II), following hydrofluoric acid digestion and extraction as per Nabbefeld *et al.* [3].

Bitumen II n-alkanes display a markedly different distribution to those of Bitumen I, characterised by an unusual even-over-odd distribution and the preservation of long-chain alkanes up to n-C$_{38}$, indicating a biological source such as sulfate-reducing bacteria [4]. It is believed that hydrocarbons in Bitumen II have been protected from alteration by the kerogen / mineral matrix; hence it is likely that these bacteria were associated with the depositional environment. Bitumen II n-alkanes are 5 ‰ more negative in δ^{13}C compared to Bitumen I, suggesting that Bitumen I hydrocarbons originate from a different source. Other explanations for the origin of Bitumen II are also under investigation.

The isomer ratios of Polycyclic Aromatic Hydrocarbons (PAHs) in sediments are temperature dependant, and are widely used to estimate thermal maturity [3]. Bitumen I PAH ratios indicate a higher maturity than Bitumen II, supporting the theory that PAHs were generated at higher temperatures below the BCF, then transported up with the mineralising fluid [2]. Preliminary thermodynamic calculations based on PAH distributions in these proceedings [5] have placed an upper limit on mineralising fluid temperature which is in agreement with previous studies [2].

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