Chlorine isotope systematics of a back-arc spreading system

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Lau Basin is a triangular extensional zone located east of the active Tonga arc. Using SIMS [1,2], we have determined $\delta^{37}Cl$ in submarine glasses and melt inclusions from the three major active spreading ridges in the southern portion of Lau Basin (Central Lau Spreading Centre [CLSC], Eastern Lau Spreading Centre [ELSC], Valu Fa Ridge [VFR]) and from the Mangatolu Triple Junction [MTJ] in the northern portion.

Using detailed trace element and [Cl] data, Kent *et al.* [3] demonstrated that two distinct types of Cl enrichment occur in Lau Basin lavas – both involving addition of Cl-rich components to mantle source or mantle derived melts. VFR and MTJ lavas reflect the addition of a subduction related component from the adjacent arc. Pearce *et al.*[4] and Peate *et al.*[5] considered this component to be a water-rich fluid – implying addition of a saline brine[3]. CLSC and ELSC lavas also display elevated [Cl], however, the inferred input of subduction-derived components is minimal along these latter two spreading centres [3] – with Cl enrichment ultimately derived from the surrounding seafloor hydrothermal system. $\delta^{18}O$ and $^{87}Sr/^{86}Sr$ compositions of CLSC and ELSC glasses suggest this enrichment is consequent to bulk assimilation of 10-15% altered oceanic crust (AOC)[3][6].

VFR glasses and melt inclusions display a continuum of $\delta^{37}Cl$ values, ranging from -3.0 to +1.0, with a near vertical trend versus [Cl]. There is no clear evidence that Cl contributed by a slab-derived flux has distinctive $\delta^{37}Cl$. MTJ samples show a range of $\delta^{37}Cl$ from -4.0 to near 0 values, coupled with an increase in [Cl} from <100 ppm to >500 ppm – mimicking the curved trajectory expected from progressive contamination by a seawater or AOC source.

Mafic CLSC and ELSC samples show $\delta^{37}Cl$ uniformly close to 0 and more evolved samples have $\delta^{37}Cl$ up to +3. This is consistent with substantial assimilation of AOC and minimal involvement of a subduction-derived component.

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Carbon isotope composition in microbial mats and travertine of BRZ

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Microorganisms play a dominating role in exogenous geochemical cycle of elements as a result of characteristic catalytic properties of biochemical reactions. At present time microbial mats in some hot springs are the model object of paleo-geological processes [1].

At the beginning of the streamlet in Garga hot spring (hydrothermal system of the Baikal Rift Zone (BRZ)) travertine formation zone have been found. We studied C isotope composition in system: solution - microbial community – biominerals - travertine. Garga hot spring water has $Na\text{-}SO_4$ composition (TDS = 1 g/l, T=77°C, pH-8.2). The travertine thickness is 3-5 m, at the surface of which cynobacterial mat (T 54-49°C) is being developed and with *Phormidium, Mastigocladus* and *Oscillatoria* dominating. These mats periodically dried when the stream changes its bed. The $\delta^{13}C$ is different in parts of the live mat. -18.1‰ is in the middle part of the mat where *Ph. angustissimum* and *M. laminosum* are present. For remout part from the beginning of the streamlet where *Ph. angustissimum* makes 98 % the $\delta^{13}C$ = -12.5‰ is determined. Calcite crystals up to 30 µm are formed in the live cyanobacterial mat. The mat being dried, these crystals are conserved in it. $\delta^{13}C$ vary in these crystals from 0.2 to 1.8‰. Silication is observed in the mats, especially in the dried ones, where amorphous SiO_2 replace the finest structures of the microbial matters. The travertine profile has a distinct zone structure, its base being formed by two calcite generations: 1) macrocrystalline aggregate, with $\delta^{13}C$ up -0.2 to -2.0‰; 2) fine-grained aggregate interstratified with silica and compose stromatolite columns, with $\delta^{13}C$ up +0.2 to +1.8‰. The data obtained that a part of the carbon in the profile is evident to be formed as the result of microbial mat activities.

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[1] Dobretsov (2005) *Vestnik VOGS* **9,** 43-54.