

The influence of anthropogenic salinization on the clay mineralogy of Seriyogovo soils

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The objects of our investigation are the soils from the Seriyogovo salt plug territory where salt mineral waters deposits are situated. Seriyogovo salt plug is confined to Mezen syncline of Russian platform.

Samples were obtained from 7 soil cross sections near the Seriyogovo salt deposit: R-4, R-6, R-7, PR-1 – uncontaminated (background) and R-5, R-8, R-9 – saline cross sections at the depth 0-103 cm. The mineralogical composition of the clay fraction (<2 μm) of samples was determined by x-ray diffractometry.

X-ray analysis indicates that almost all clay samples of background sections contain smectite, illite, chlorite, kaolinite with dominated smectite. In clay samples of saline soils chlorite, vermiculite, interstratified chlorite/vermiculite, kaolinite, illite and galite are contained. Chlorite became the predominant 14-Å-mineral. We can propose that interlayer octahedral layers are more stable than exchangeable cations of clay minerals' crystal structure in the saline environment.

The XRD patterns for the clay fraction of the uncontaminated section have an intense peak of 1.540 Å and a smaller peak of 1.507 Å. The samples of the saline section also has both trioctahedral and dioctahedral minerals but the intensity of the peak for the dioctahedral mineral, however, is proportionally larger than in the uncontaminated clay.

The investigations display the difference between the clay minerals of saline and background soil samples of Seriyogovo deposits because of their transformation under the environmental changes. Transformation reactions involves the introduction of non-exchangable hydroxyl-Al polymers into the interlamellar space of pre-existing smectite or vermiculite. The results presented suggest that chlorite was formed diagenetically by prolonged periodic percolation of salt brines through pervious layer silicates.

Li isotopes in HP-LT rocks: Insights into the role of sediment-derived fluids

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Lithium (Li) isotopes are a sensitive, T-dependent tracer for subduction zone processes. Most published subduction models of $\delta^7\text{Li}$, however, calculate the effects for dehydration of altered ocean crust (AOC) alone, which does not produce the right combination of high Li concentrations and generally low $\delta^7\text{Li}$ ratios found in HP-LT eclogites, jadeitites and related subduction zone rocks. We modelled HP-LT rocks from central Guatemala and the Franciscan Complex (CA), and have extended this model to explain other published HP rocks (e.g. Syros and Trescolmen).

We propose that HP-LT eclogites are produced by a two-step process of 1) partial dehydration of AOC during prograde metamorphism and 2) sediment fluid metasomatism (rehydration), primarily during collision and exhumation. Jadeitites, which are rocks that have precipitated directly from a fluid, can be modeled more simply as mixtures of sediment fluid and AOC fluids. Dehydration of the slab itself (AOC) results in a mantle reservoir that is isotopically light ($\delta^7\text{Li} \sim \leq -5\text{‰}$) with low Li abundance ($\sim 1\text{-}2\text{ppm}$). Fluids leaving the slab and metasomatizing the subarc wedge and coupled down-dragged mantle (at 15-80 km), need not be heavy, especially with a large sediment load. Instead, fluids leaving the slab would have high concentrations of Li and a range of $\delta^7\text{Li}$, which average out to be similar to average mantle ($\sim +3\text{‰}$). This may explain why few heavy $\delta^7\text{Li}$ samples have been found in arc lavas, as would be the case if metasomatizing fluids were derived from AOC alone. If the mantle that is coupled to the down-going slab is indeed the recycled fertile component in OIBs, then the overall effect is that average $\delta^7\text{Li}$ of MORB, IAB and OIB lavas are similar, which confirms the range of most of these lavas measured to date (+2 to +7‰).