Geochemistry and petrology of lower crustal xenoliths from Udachnaya and Komsomolskaya kimberlite pipes, Siberia

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Lower crustal xenoliths from Siberian kimberlites are mainly mafic Grt-granulites, with subordinate felsic Grt-granulites and eclogites. We speculate on the origin of these rocks on the basis of their composition. To obtain unambiguous data we have considered changes in major, trace element and isotope compositions caused by interaction with the host kimberlite. We have also calculated composition of selected samples using modal analyses, microprobe and LAICPMS data for minerals.

Most samples are similar to volcanic rocks having smooth REE patterns with small negative or absent Eu-anomalies. The xenoliths are divided into 3 groups: “Fe-tholeiites”, “Mg-tholeiites” and basaltic andesites and andesites. Mg-tholeiites and intermediate rocks have characteristics of subduction-related magmas whereas Fe-tholeiites are similar to flood basalts and passive margins volcanics. However almost all xenoliths have low Rb, Th and U contents that could be the result of partial melting. The presence of garnet and ilmenite in the residue matches the observed relatively high Ti, Nb, HREE and Y in some samples. Partial melting does not explain the observed variations of other elements. Probably most samples lost a small melt fraction before the last metamorphic event 1.8 Ga ago (youngest metamorphic zircon). The magmatic protoliths of these rocks cannot be younger than 1.94 Ga (oldest metamorphic zircon). The ages of oscillatory zoned zircon cores are up to 2.7 Ga for an andesitic sample and 3.2 Ga for an “Fe-tholeiite” sample, similar to their Nd DM model ages. The decrease of HFSE, εNd and appearance of a Pb-anomaly in some samples of Fe-tholeiitic group may be due to addition of Archaean crustal material. But the “Mg-tholeiites” have the lowest incompatible element concentrations among studied samples that is difficult to explain in a similar way. We suggest that the lower crust underneath this kimberlite field is composed of Archaean former arc basalts and andesites and abundant plume-related volcanic and intrusive rocks.

Influence of macrophytes and macrofauna on saltmarsh porewater and sediment geochemistry

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Four study sites in a saltmarsh at Sapelo Island, GA were chosen to represent a gradient of bioturbation and macrophyte type (*Spartina alterniflora* or *Juncus roemarinus*) and density. Pore waters collected at 1-2 cm depth intervals to 50 cm were analyzed for pH, alkalinity, DOC/DIC, dissolved Mn^{+2}, Fe^{+3}, Fe^{+2}, H_2S, SO_4^{-2}, PO_4^{-3}, NH_4^+, Ca^{+2}, Mg^{+2} and K^+. Sediments were analyzed for C/N, TOC, $\delta^{13}C_{org}$, and trace metal associations using a 4-step sequential extraction. Results demonstrate that injection of oxygen into the subsurface via roots and burrows increases organic matter degradation, creates more oxidized pore waters and limits the accumulation of sulfide-bearing solids and associated trace metals. Operationally-defined sequential extractions yield results that are in surprisingly good agreement with variations in pore water redox chemistry. Results suggest that in suboxic sediments, Fe, Mn, Cr, Ni Co and Zn occur in association with Fe and Mn oxyhydroxides. In sulfidic sediments, Fe, Co and Ni probably occur mostly in pyrite, Mn may associate with pyrite or rhodochrosite, Cr associates mostly with organic matter and Zn, Cu and Pb occur with both sulfides and in association with organic matter. Mixing calculations using C/N, TOC, and $\delta^{13}C_{org}$, indicate that a significant portion of the organic matter in these sediments is derived from phytoplankton and also that organic matter degradation rates are especially low, with little inclusion of C3-derived organic matter, at sites lacking significant macrofaunal and macrophyte activity.