Tracing groundwater transport underneath a landfill with SF_6, Br, and $^3H/^3He$

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Redox manipulations of highly reducing and As-enriched groundwater underneath a landfill are currently evaluated as an alternative to a pump and treat operation. To better constrain the flow regime of the heterogeneous aquifer, groundwater was analyzed for ^3H and ^3He, and two SF_6 forced-gradient tracer experiments were conduced. $^3H/^3He$ ages range from 0 to >40 years, and the age distribution confirms the extreme heterogeneity of the site and the influence of reinjection from the treatment system.

SF_6 is a new tracer in groundwater contaminant studies and has the advantage of relatively easy detection by GC-ECD with a dynamic range of at least five orders of magnitude, and a low environmental background level (<2 fmol L^{-1}). During the first experiment, SF_6 was injected primarily into high permeability zones via a single well and almost 100% of the tracer were recovered in the pumping well. During the second tracer experiment, SF_6, bromide, and an oxidizer were injected uniformly at a series of points along a line over the entire thickness of the aquifer. SF_6 and Br breakthrough curves measured in the monitoring well array were very similar, indicating that both tracers behaved conservatively. Only 50% of the tracer were recovered during the second experiment, probably as a consequence of continued retardation in low-permeability zones. SF_6 transport patterns were instrumental in the interpretation of the redox manipulation experiments.

Mantle metasomatism and platinum-group elements fractionation: Evidence from deep-source xenoliths at Liuhe, Yunnan , China

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Two types of xenoliths of garnet diopsidite and amphibolite (equivalent to pargasite) have been recognized in Cenozoic alkali-rich porphyry bodies at Liuhe, Yunnan Province, China. Both unmetasomatised and metasomatised xenoliths and the host rocks were analyzed by ICP-MS techniques for their PGE and trace element concentrations. The unmetasomatised xenoliths of garnet diopsidite and amphibolite are relatively depleted in LILE and LREE with relatively low ratios of $(La/Yb)_n$ (1.16—1.51), $(Pd/Ir)_n$ (3.09—5.69) and $(Pd/Pt)_n$ (1.16—1.85) ,but relatively enriched in MgO , Ni and Cr . However, the metasomatised ones, in which Na-rich microlite-glasses and phlogopite , albite and apatite were filled in fractures or interstices and amphibole replaced diopside as a result of mantle modal metasomatism , are relatively enriched in LILE and LREE with relatively high ratios of $(La/Yb)_n$ (1.88—11.23) , $(Pd/Ir)_n$ (3.75—42.0) and $(Pd/Pt)_n$ (1.45—10.88) . The ratios of $(La/Yb)_n$ and $(Pd/Ir)_n$ or $(Pd/Pt)_n$ are systematically increased from the unmeta-somatised xenoliths through various metasomatised xenoliths to the host rocks. Therefore, it is considered that mantle metasomatism resulted not only in the enrichment of alkaline and large-ion elements in the xenoliths but also played an important role on PGE fractionation, especially for palladium and platinum. Consequently, a time interval of nearly 80 Ma between the formation of the xenoliths and the alkali host rock implies that prolonged mantle metasomatism could generate alkaline magmas which were intruded extensively during the Himalayan orogeny with extensive copper, gold and molybdenum mineralization.

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