

Tracer application of chemical speciation of ^{129}I in Arctic seawater

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Anthropogenic ^{129}I discharged from European reprocessing plants has widely dispersed in the Nordic waters including the Arctic. Due to the high solubility and long residence time of iodine in seawater, anthropogenic ^{129}I has become an ideal oceanographic tracer for investigating transport pathways and the exchange of water masses. Iodine is a redox sensitive element, existing mainly as iodide and iodate, with minor amounts of organic iodine in marine water. The chemical speciation analysis of ^{129}I in seawater can be used not only to investigate the marine geochemical cycle of iodine, but any variation in the chemistry of a particular marine system.

Depth profiles of seawater were collected from 60 locations in the Arctic in four Arctic expeditions during 2005-2008. Collected seawater samples were stored in plastic bottles without any treatment until analysis. A volume of 1 l of each sample was used for the chemical separation of iodine species. Iodide and iodate were separated using anion exchange chromatography. The separated iodine species, as well as total iodine were separated from the water matrix component and all interfering elements by solvent extraction and were then precipitated as AgI for measurement of ^{129}I by accelerator mass spectrometry. The ^{127}I of different species separated from each water sample was measured using inductively coupled plasma mass spectrometry. The analytical results on the concentrations of chemical species of ^{129}I and ^{127}I as well as $^{129}\text{I}/^{127}\text{I}$ ratios of different species of iodine for these water samples will be presented. The spatial variations of ^{129}I , ^{127}I and their speciation in seawater in the Arctic will be derived. Sources and transport pathways of ^{129}I in the Arctic, the transformation process of chemical species of iodine and their mechanism will be discussed.

Colloidal processes in gold transport and deposition

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New studies of gold are revealing how metallography is a key component of our understanding of the deposition of precious alloys in primary ore systems. Alluvial gold nuggets once thought to be secondary in origin have now been shown to be the erosional residue of hypogene systems, i.e. primary. A new frontier in both hypogene and supergene systems is the nano domain. In hypogene settings gold at all scales can be metallic and particulate as has been directly observed in refractory ores, or the so called “invisible gold“ in pyrite and arsenopyrite. Such nanoparticulate and colloidal transport of gold is a viable mechanism of dispersing the gold during weathering of ore deposits. Deposition of supergene (secondary) gold in the regolith is a product of the dissolution of hypogene gold from the a primary deposit (hosted by sulphides or quartz), transportation in solution and then re-precipitation elsewhere in the weathering profile. The natural nanoparticulate fraction of Au in these environments probably occurred as a colloidal suspension before final deposition as metallic particles and raises the question of how common a process is this in all gold depositional settings? These gold nanoparticles, long known about in materials sciences and manufacturing have now been seen in these natural environments as pure Au nanotriangles, hexagons and spheres. The destabilisation of the colloid will produce rapid deposition of the Au, potentially through evaporation in a single drying even meaning Au deposition can be a rapid event in the critical zone. The regularly heterogeneous distribution, trace concentration and nanoparticulate grain size of metallic gold in all ore systems has made it difficult for direct observation. Yet, it is critical to be able to establish a broad view of the microstructural/microchemical residence of the actual gold in a given sample. New generation element mapping (e.g. Maia on the Australian Synchrotron) tools now allow us to ‘see’ this invisible gold component and detect its wider distribution for the first time and to probe its chemistry and controls on deposition. These studies have the potential to provide a new approach and view of the formation, deposition and provenance history of the metal in all gold deposits.