Source area processes and the regional distribution of orogenic gold deposits

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Orogenic gold deposits have provided over 25% of the World's gold, but our understanding of their formation is poor. Recent research in the Otago Schists of New Zealand has shown that the metals may be sourced from within the metamorphic rocks that host the ore deposits through leaching by metamorphic fluids produced during prograde devolatilisation. The 'Otago model' provides a fantastic opportunity to identify the controls on the regional and global distribution of orogenic gold deposits. The 'Otago model' has been tested in two different orogenic belts, the Dalradian metasedimentary belt in Scotland which represents a very poorly mineralised belt, and the Victorian goldfields, Australia which contains extremely abundant mineralization.

Results will indicate whether gold and associated metals are commonly mobilized during prograde metamorphism or whether specific hydrothermal and tectonic conditions are required. This has significant implications for the distribution of orogenic gold deposits and will elucidate the relative importance of factors such as tectonic setting, source-rock composition, timing of deformation and hydrothermal fluid flow, and efficiency of chemical and structural trapping mechanisms in the formation of large orogenic gold deposits.

Effect of physical reworking and bioturbation on sedimentary reactive iron within a microtidal estuary

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Iron redox cycling in surface sediments can enhance the remineralization of sedimentary organic carbon. In part this may occur because easily reducible iron oxides can be used by heterotrophic bacteria to remineralize the organic carbon. This phenomena has been observed in bioturbated sediments and in areas where physical factors (such as strong bottom currents) constantly rework the sediments. To specifically determine the effects of physical reworking and bioturbation on concentrations of easily reducible iron oxides, reactive iron concentrations were measured in surface sediments taken from two contrasting sites in the York River, a Chesapeake Bay tributary. Box core samples were collected between March 2007 and December 2007.

Operationally defined iron fractions as well as total iron concentrations were measured using chemical extraction methods. A selection of sediments were also further analyzed using X-ray diffraction (XRD) and Mössbauer Spectroscopy (MBR).

Concentrations of easily reducible iron oxides and total iron at the site experiencing physical reworking were higher than those at the bioturbated site. XRD analysis did not indicate the presence of iron oxides due to interferenceby the high concentrations of major mineral species such as quartz. Preliminary results from room temperature MBR indicate the presence of paramagnetic iron minerals with iron spectra patterns similar to those observed by van der Zee *et al*. [1] in Canadian boreal lake sediments. Further analysis of sediments at 4.2 K will be performed using MBR, a temperature at which crystalline iron oxides such as 2-line and 6-line ferrihydrite and nanogoethite become magnetized. MBR results will be compared with results from the chemical extraction sequence to better define the relationship between the concentration of iron in different chemical extracts and the concentrations of individual iron minerals determined by MBR.

[1] van der Zee *et al*. (2003) *Geology* **31**, 993-996.