Re-evaluation of the genesis of Kambalda-style komatiite-hosted Ni-Cu-(PGE) ore deposits

S.W. BERESFORD[1], Y. LAHAYE[1], R.A.F. CAS[1], M. JANE,[1]
D.D. LAMBERT[1], W.E. STONE[2]

[1]School of Geosciences, Monash University, Australia
(Steve.Beresford@mail.earth.monash.edu.au)
[2]Centre for Global Metallogeny, University of Western Australia

Nickel sulphide mineralisation is located in structural embayments or troughs at the base of the basal komatiite lava flow at Kambalda, Western Australia. Kambalda is the type locality for komatiite-hosted NiS ore deposits. A spectrum of trough types exists between strongly structurally modified volcanic channels and troughs of clearly structural origin in which no primary volcanic features are preserved and the present geometry is largely a function of the differing phases of post-emplacement deformation. The troughs in no way reflect thermally eroded channels.

Primary contact relations, geochemistry, and textural and vesicle distribution of komatiites is consistent with emplacement of komatiite lava flows under laminar flow conditions. However the absence of sedimentary units beneath komatiites with coherent flow tops in ore environments, seems contradictory and suggests both turbulent and passive laminar emplacement respectively. The absence of platinum group element (PGE) depletion in the host komatiite crust (and core) and presence of erosive basal contacts, suggests the komatiite lava was initially turbulent and probably open channel fed. It is during this initial stage that deposition of the NiS deposits occurred. As the flow evolved, widened and thickened, laminar flow conditions prevailed and the komatiites are inferred to have flowed through the development of interior magma tubes. The constant lava flow-through or recharge is consistent with the ore-lava geochemical disequilibrium. Associated with the master flow are lateral breakouts, most of which are barren and define what is called the flanking facies. These breakouts exhibit characteristics typical of inflated laminar flowing, non-erosive passive lava flows.

Primary whole rock and grain scale trace element and isotopic geochemistry (when screened through significant alteration affects) indicates limited (<3%) to no silicate assimilation and is at odds with prevailing ground melting models. However the absence of sedimentary units in the ore environment indicates syn-emplacement erosion. We propose that wet unconsolidated sediments were lost to the overlying water column during physical erosion by the early turbulent channelised komatiite pulses. The origin of S is attributed to devolatisation (S and water) of the sedimentary substrate and explains the striking association of sulphide-infilled vesicles and ore in proximal ore shoots.

Use of calcite for the retention of phosphorus in lake sediments and P-recovery applications

UTE BERG[1], DIETFRIED DONNERT[1], YONGHUI SONG[1], THOMAS NEUMANN[2] , MIRIAM REINHARDT[2] AND PETER G. WEIDLER[1]

[1]Institute for Technical Chemistry, Section of Water- and Geotechnology, Forschungszentrum Karlsruhe GmbH, D-76021 Karlsruhe, Germany
[2] Institute for Mineralogy and Geochemistry, University of Karlsruhe (TH), Kaiserstraße 12, D-76128 Karlsruhe, Germany

Phosphorus in the environment is both a curse and a benediction. On one side P is a essential element for plant nutrition, on the other side it can be the cause for the eutrophication of lakes. Furthermore, sewage treatment plants (STP) are a huge sink for P. Unfortunately, the P retained in sewage sludge in order to meet the run off concentrations, is mostly incinerated and transferred into deposit or land fills, thus removed from a P cycle. This P-cycle used to be closed by the application of bio-solids as fertilizer in agriculture.

In order to get a hand on the fate of phosphorus in some environmental related compartments such as lakes and STPs, calcite was considered to be an effective and inexpensive material for the controlled retention of phosphorus.

The in situ ecotechnology “sediment capping with calcite” aims to reduce the phosphorus flux from organic-rich sediments into the water column in order to improve the water quality of eutrophic lakes. The influence of calcite barriers varying in calcite material on the phosphorus retention in the sediments and the phosphorus fixation mechanisms, which considerably influence the sustainability of this technique, were studied. Calcite barriers reduced the phosphorus release at least to 80 % compared to sediments without calcite covers. In addition, industrial calcites with grain sizes of less than 0.1 µm inhibited phosphorus release for a minimum of 130 days of sediment incubation.

The difference in efficiency is ascribed on one hand to material properties such as the grain size, the specific surface area (SSA), and the roughness of the mineral surface, and on the other on hydrochemistry properties, such as calcite saturation index .

In addition, batch experiments with various calcite materials revealed the importance of Ca release kinetic in the P-removal process. The efficiency in P recovery by these materials increased with repeated usage.

The applicability of such materials for STP usage was proven in long term column experiments.