

## Microbially mediated formation of gold in calcrete anomalies in Australia

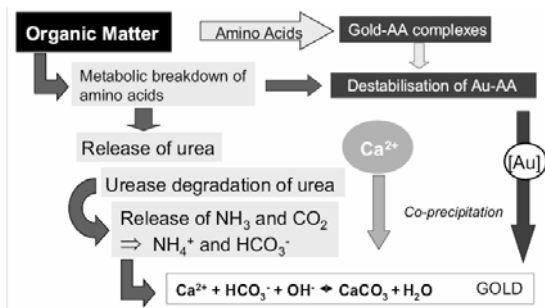
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Regolith carbonates (calcrete) are widely used in Au exploration in Australia, because Au, which is often finely dispersed in calcrete, and Ca are highly correlated suggesting co-precipitation. The genesis of carbonates in pedogenic environments is dominantly ascribed to microbial processes, in particular to microbially mediated carbonate precipitation via ureolysis. Contrary to a genesis model recently published by Lintern *et al.* (2006), Schmidt Mumm and Reith (2007) proposed a comprehensive coupled model that includes a microbial component, which may control Au and Ca co-precipitation (Fig. 1).

**Figure 1: Model for the microbially mediated formation of gold in calcrete anomalies (Schmidt Mumm and Reith, 2007).**



Using microcosms and microbial enrichment culture experiments to assess the ureolytic capacity of the bacterial community combined with molecular profiling (shotgun cloning and DGGE of 16S rDNA), showed that *Bacilli* spp. resident in calcareous materials at the Barns anomaly are capable of producing Au anomalous Ca-carbonates. Within 96 to 240 h from the start of the incubation the urea was turned over to  $\text{NH}_4^+$ , the pH in solution rose by approximately 1 unit to pH 9 and  $\text{Ca}^{2+}_{\text{aq}}$  was precipitated as Ca-carbonate crystals; in sterile the controls no carbonates were precipitated. Gold (been added as Au-aspartic acid complexes to the growth medium) was co-precipitated with Ca and uniformly dispersed in the dominantly vaterite crystals, as shown by laser ablation ICP-MS and SEM. These results suggest that microorganisms play an important role in the formation of Au anomalies in calcrete in Australia.

### References

- Lintern M.J., Sheard M.J., Chivas, A.R., (2006), *Chem. Geol.* **235**, 299–324.
- Schmidt Mumm, A. Reith, F., (2007), *J. Geochem. Explor.* **92**, 13-33.