

Alteration of Depleted Uranium Metal

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Depleted Uranium (DU) contamination now exists in diverse environments, for example, agricultural land in Kosovo, and desert in Kuwait due to its use in munitions, and also in the sea following weapons testing. However, the environmental fate of DU following corrosion and oxidation of fragments is not well known. Consequently, a need has arisen for studies on the corrosion of DU under different geochemical conditions. To date, the only documented secondary mineral formed as a result of the alteration of DU metal is schoepite ((UO₂)₈O₂(OH)₁₂(H₂O)₁₂), which is a relatively unstable phase [1,2]. Other solid phases are likely to be formed in situations such as those listed above.

Discs of DU metal from unfired penetrators have been artificially weathered over six months, in order to quantify corrosion rates and to investigate the development of secondary alteration products on the corroding surface. The solutions employed were Ultra High Quality (UHQ) water, as a control, a calcium phosphate-rich solution representing agricultural soils and a silica-rich solution representing desert conditions.

XRD results show that the first phase formed in UHQ water is UO₂ followed after one week by schoepite and, after four months, studtite (UO₄·4H₂O). Surface analysis of the DU in the calcium phosphate solution detected uranyl phosphate hydrate ((UO₂)₃PO₄·4H₂O) after one week with schoepite after eleven weeks. The discs in this solution showed little visible sign of corrosion and the mass did not change significantly during the experiment, suggesting passivation of the surface.

XRD analysis of DU in the silica-rich solution detected a range of uranyl oxides from UO₂ to UO₃, but to date no other minerals have been observed. Corrosion of DU in the silica solution was more rapid and after six months 20% of the original mass had been lost.

References

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Dissolution effects on the surface morphology of mollusk calcitic prisms (*Pinna*)

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Fossils are used as proxies for paleoenvironmental reconstructions, using minor elements contents, isotopic ratios or species ratios. Interpretation of fossil assemblages often overlooks differences in dissolution rates between species. Such differences occur in depositional and post-depositional processes both in terrestrial and marine environments. These effects have been demonstrated in terrestrial paleoenvironments (Dauphin et al., 1999).

Present research aims to understand the underlying mechanisms of fossilization processes in shells. Experimental determination of dissolution behaviours of biominerals are under way, integrating information on structure, biochemistry of organic matrices and composition of mineral phases. In a first approach, relative importance of these parameters are evaluated by localised close observation of the surface of biominerals before and after dissolution.

Calcitic prisms of *Pinna* are monocrystalline units showing transversal growth lines. They contain about 4600 ppm of Mg and 5600 ppm of S. They are biocomposites with intracrystalline organic matrix of acidic glycoproteins and sulfated sugars (Dauphin, 2003). *In situ* mapping using WDS and XANES displays micron scales growth bands in organic sulfates (Dauphin et al., 2003). AFM pictures show that the intraprismatic structures is composed of round granules (diameter 40 nm) surrounded by a thin layer of organic matrix.

Pinna prisms were submitted to a continuous and constant flow of pure water. They were then dried and observed with SEM and AFM. The change in their surface morphology has been interpreted based on their structure and composition.

References

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