Assessment of the nanoscopic dissolution rate of basic lead carbonate (hydrocerussite)

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Hydrocerussite ($Pb_3 (CO_3)_2 (OH)_2$), related to shannonite and plumbonacrite phases, is reported to be a characteristic secondary mineral [e.g. 1] particularly associated with the weathering of industrial metallic Pb (e.g. bullets, shots, pipes) and the oxidation of Pb-Zn-Ag ore deposits. Such processes exhibit a straightforward connection between the dissolution-precipitation of hydrocerussite ($\log K_{sp}$=-43.7) and the mobility of Pb contaminants in the environment. Synthetic hydrocerussite (basic lead carbonate known as 'white lead' [e.g. 2]) has been broadly used in pigments and cosmetics. In this study, we present *in situ* AFM experiments that provide evidence of the nanoscopic reactivity behaviour of hydrocerussite {0001} surfaces in contact with deionized water. The AFM study shows that the edge pits, with initial depth ~1 nm, exhibit random shapes with flattened bottoms. However as the dissolution proceeds, terrace adatoms, corresponding approx. to the *c* unit cell parameter of hydrocerussite, appear near the edges of deeper etch pits (~3 nm, Fig. 1).

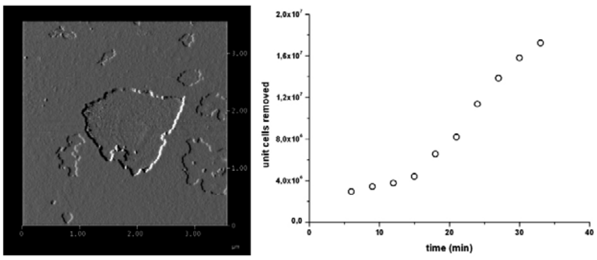

Figure 1: Nanoscopic dissolution rate of hydrocerussite

Following the methodology described by Rufe & Hochella [3], an assessment of the nanoscopic dissolution rate of hydrocerussite was obtained (**Fig. 1**) for the first time in the literature.

[1] Kokkoros P. & Vassiliadis K. (1953) *Tsch. Min. Petr. Mitt.* **3**, 298–304. [2] Martinetto P. *et al.* (2002) *Acta Cryst.* **C58**, i82-i84. [3] Rufe E. & Hochella F.Jr (1999) *Science*, **285**, 874–876.

The origin of Naxos migmatites: SIMS U-Pb and O isotope analysis of zircon

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The Naxos (Aegean Sea, Greece) structural and thermal dome is cored by migmatites that record the peak P-T conditions (6-8 kbar; ≤700°C) of a late Alpine (18 Ma) Barrovian type metamorphism [1]. The 'leucogneiss core' comprises various types of anatectic gneisses thought to derive from either 'pre-Alpine basement' or Mesozoic sedimentary protoliths or both. Early Miocene intense deformation and metamorphism has obliterated most prior evidence, leaving zircon as the major tool for unveiling the pre- and early-Alpine history of the Naxos core. SIMS U-Pb dating of zircons from the four major types of gneisses in the core shows that oscillatory zoned domains yield concordia ages of ca. 326, 315, 312 and 300 ± 5 Ma with inherited cores of ca. 500-2500 Ma. Clear overgrowths yield ages between 17 and 20 Ma. Intermediate ages between ca. 300 and 17 Ma are restricted to blurred or porous zircon domains and are aligned on discordia lines connecting these end points. The age data indicate that the protoliths of the migmatites were Variscan igneous intrusions with inheritance of Pan-African and older detritus. Zircons from a pelite raft within the core yield the same age pattern as the migmatites suggesting that these sediments were derived from a similar basement.

SIMS O isotope analysis of oscillatory zoned zircon domains of Variscan age yielded $\delta^{18}O$ (Zrn) of 6.5-8.5‰. However in each sample these values vary within a 1‰ range, further supporting the igneous origin of the Naxos migmatites.

[1] Buick & Holland (1989) *Geol Soc London Spec Publ* **43**, 365–369.