Sulfide-oxidizing bacteria mediate authigenic apatite formation in phosphorite-containing sediments of the Namibian upwelling system – Evidence from ^{33}P-labeling experiments

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We show results of ^{33}P-phosphate radiolabeling experiments and sequential phosphate species extractions, which demonstrate the bacterial control on ^{33}P-phosphate uptake into authigenic and organic phosphorus compounds in organic-rich, phosphoritic sediments of the Namibian upwelling system. Beta imaging of single cells of the sulphide-oxidizing bacterium *Thiomargarita namibiensis* revealed that ^{33}P-phosphate uptake occurred preferentially under oxic conditions. Under anoxic conditions and in killed controls, minimal uptake was observed. Recovery of ^{33}P-phosphate from authigenic apatite was higher under anoxic conditions than under oxic conditions, and insignificant in killed controls. In contrast, the ^{33}P-activity of organic- and microbially-bound phosphorus was higher in oxic incubations. These observations indicate alternating intracellular uptake and concentration of phosphate in sulfide-oxidizing bacteria under oxic conditions, and the release of phosphate and saturation of porewaters with respect to apatite under anoxic conditions. The substantial recovery of ^{33}P-phosphate from the organic fraction indicates that organic and microbially bound phosphorus play a key role in phosphorite formation.

In situ laser ablation (LA-) ICP-MS zircon dating on thick sections: An example from the Lagoa Real area (South Bahia, Brazil)

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The advent of high spatial resolution geochronological techniques (e.g. SHRIMP and LA-ICP-MS) makes it possible to unravel complex micro-scale histories recorded by many U-Pb geochronometers such as zircon, monazite or sphene by direct dating of intra-cristalline domains. In most studies however, extraction of the accessory minerals by standard separation techniques is required and minerals are therefore decoupled from their textural context. This hinders correlations between the ages and the mineral growth events. An alternative approach is to use standard thick sections to analyse directly accessory minerals, thus allowing to link the dated minerals to their textural environment and to integrate them into the metamorphic or magmatic history of the neighbouring major phases. This study presents *in situ* thick section U-Pb laser ablation ICP-MS analyses of zircons from deformed granitoids and a plagiogranite from the Lagoa Real area. One sample of subalkaline orthogneiss contains two zircon populations that can be distinguished from a chemical and textural point of view. Large (up to 500 μm) euhedral zircon phenocrysts, sometimes showing embayments are preserved throughout the whole thick section but often occur in domains where K-feldspar porphyroclasts is present, suggesting they are inherited from the magmatic protolith. On the contrary, strings of small (< 100 μm) euhedral zircons are observed in leucocratic domains where albite and quartz are predominant. Large zircon phenocrysts have low U (40 to 70 ppm) and Th (20 to 50 ppm) contents and yield an age of 1767±31 Ma (n = 11) related to the crystallisation of the subalkaline granite. Small euhedral zircons, have comparable U but lower Th (1 to 6 ppm) contents and thus low Th/U ratios (0.04 to 0.10). They yield an age of 490±7 Ma (n = 6) which is related to crystallisation during incipient anatexis. The Paleoproterozoic age is evidence for a magmatic activity of subalkaline affinity within the Sao Francisco craton whereas the Cambro-Ordovician age recorded by the small zircons is tentatively related to thrusting of the crystalline units over the Espinhaço metasediments. The capability of the *in situ* approach to provide fast and texturally related analyses constitutes a significant improvement in geochronological studies were zircon populations, associated with different growth events can be readily identified.