

## In-situ isotopic and trace elemental analysis of teeth by LA-(MC)ICPMS

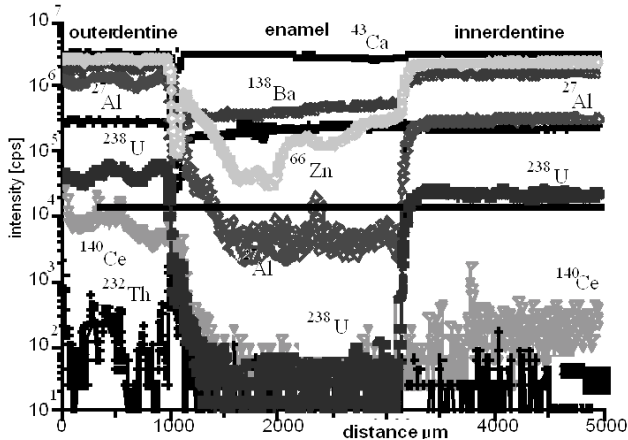
WOLFGANG MÜLLER AND STEPHEN EGGINS

Research School of Earth Sciences, The Australian National University, Canberra (wolfgang.mueller@anu.edu.au)

The post-mortem preservation of biominerals as inorganic constituents of living organisms make them the often on-ly source of chronological, dietary, morphological, or genetic information in anthropology, archaeo-logy, or palaeontology. Buried bio-minerals, however, are subject to post--depositional al-te-ra-tion and consequently, no accurate in-vivo com-po-sitional signatures can often be retrieved from bulk analysis.

This work focuses on high-spatial resolution isotopic analy-sis and trace elemental profiling of both modern and archaeo-logical / fossil teeth. The first aim is to understand the sus-cep-tibility to and nature of postmortem alteration of the two dental tissues, enamel and dentine. Secondly, since enamel grows sequentially without later compositional remodelling (in contrast to bones), spatially-resolved analysis can poten-tially de-tect secular changes over lifetime in dietary habits (using e.g. Ba/Ca ratio) or place of origin (using e.g. Sr-O isotopes).

The experimental setup used herein includes an ArF excimer laser system coupled to either a quadrupole ICPMS (Agilent 7500s) or a MC-ICPMS (Finnigan Neptune). Laser-ablation of both circular or rectangular pits (0.3\_0.03 mm) occurs under a stratified He-Ar atmosphere.



**Fig. 1:** Spatially-resolved compositional analysis from outer dentine across the inter-nal enamel layer into inner dentine of a bovid tooth from the hominid site at Tabun (Israel).

The example in Fig. 1 shows the contrasting susceptibility of enamel vs. dentine to post-mortem alteration. Such diffe-ren-ces are frequently encountered at various sites and for teeth from different species. In this (and other) cases, enamel at least in part appears to preserve in-vivo trace elemental concentrations even of alteration-prone elements like U, Ce, Al etc. The consequences and prospects of such in-situ analyses for U-series dating, tracing of migration, and reconstruction of palaeodiet will be discussed.

## Chemical evolution at magma ocean

TATSUSHI MURAE, DAIKI SATO, KANA DAITOH, AND MASASHI KONO

Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University, Hakozaki, Fukuoka, 812-8581 Japan (mure@geo.kyushu-u.ac.jp)

Most of the carbonaceous components (usual organic compounds and kerogen-like compounds) were brought in before the stage of the magma ocean in the history of the Earth formation. In the stage of the magma ocean, it is surmised that the temperature of the Earth was over 1200 °C. All of organic compounds thermally decompose at this temperature. However, at the warming stage before magma ocean many of organic compounds have probably vaporised along with water. An vigorous convection took place over the magma ocean, and the organic compounds activated in this stay in the convection are considered to have carried out various reactions. If the products of these reactions go down near the surface of the magma ocean, thermal activation of the products will be caused. The activated components are cooled again in an ascending current, and it is thought that other compounds are formed by re-combination reactions. Repetition of these reactions yields very complicated mixture of organic compound. It is thought that composition of this mixture differs significantly from that brought with carbonaceous chondrites..

Glycine is the simplest amino acid, and it is also a major component in the amino acids found in carbonaceous meteorites. Formaldehyde is a fundamental component of many alcoholic compounds such as sugars, Formaldehyde is observed as an interstellar molecule, and it is also found in a carbonaceous chondrite. Therefore, the chemical evolution of glycine and formaldehyde at the stage of magma ocean may have greatly contributed for initiation of life activity at later stage than magma ocean. So we examined reactions of aqueous glycine solution and aqueous formaldehyde solution in an instrument simulating magma ocean. In the presence of calcium carbonate as an alkaline catalyst, glycine yielded alanine which has one more carbon than glycine along with aliphatic and aromatic compounds. Under similar conditions formaldehyde gave a complex mixture, which contains hexose, pentose, compounds having aliphatic carbon-chain, polyoximethylenes and so on.