

Surface composition of fossil coccoliths from chalk

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Chalk is predominantly calcite, CaCO₃, in the form of skeletal remains called coccoliths, produced by some species of algae. Chalk is permeable and can hold large volumes of oil but pore spaces are small and the particle surface properties control oil adhesion, hence reservoir productivity. Our goal was to investigate the surface composition of chalk particles as a clue for elucidating the controls on oil retention.

Using a new method, we 'fished' individual coccoliths from weakly consolidated chalk, using a silicon tip and an atomic force microscope (AFM). We isolated individual grains and placed them on transmission electron microscopy (TEM) grids. TEM showed intact coccoliths with a discontinuous layer (~25 to 50 nm thick) covering the individual elements. Energy dispersive X-ray spectrometry (EDXS) indicated Fe, K and Si:Al = 3:1, clear evidence for clay. It has grown over the calcite elements, implying that surfaces in contact with reservoir fluids, at least in some cases, are not calcite but clay. This would change wetting behaviour and may inhibit the recrystallisation necessary for diagenesis.

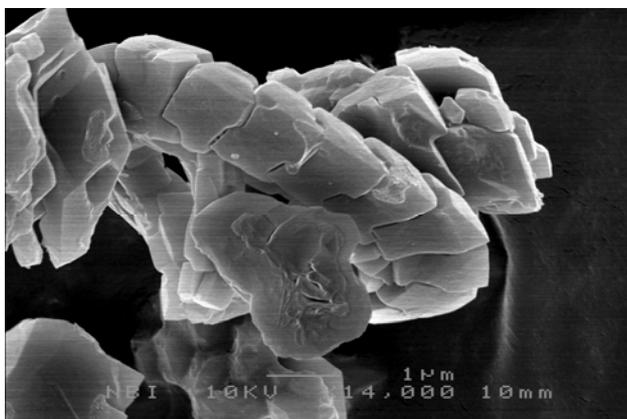


Figure 1: SEM image of a 60 million year old coccolith showing the individual elements whose bulk composition is calcite.

Source apportionment and chemical features of the organic aerosol using aerosol mass spectrometers

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Organic aerosols comprise a large fraction of the submicron aerosol mass concentration. The Aerodyne aerosol mass spectrometer (AMS) is a highly suited instrument for the source apportionment of this organic aerosol as well as for the determination of related chemical features. Using positive matrix factorization (PMF), Lanz *et al.* were able to quantify various fractions of the organic aerosol, including hydrocarbon-like organic aerosol (HOA) and two different types of oxidized organic aerosol (OOA) [1]. Several other studies then found a similar discrimination into two different OOA fractions. Secondary organic aerosol (SOA) formed by photooxidation of gaseous precursors (e.g., α -pinene) also exhibited very similar features as these two OOA fractions found in the ambient aerosol. Using a high-resolution time-of-flight AMS (HR-ToF-AMS), Aiken *et al.* quantified the elemental composition of the organic aerosol, including the atomic oxygen-to-carbon (O/C) ratio [2]. This approach allows for example to follow the O/C ratio during aging of SOA in smogchamber experiments.

This presentation will give an overview on the results of various field and smogchamber campaigns. The smogchamber AMS data will be compared to other techniques such as the hygroscopic growth factor determined with a hygroscopicity tandem differential mobility analyzer (HTDMA).

[1] Lanz *et al.* (2007) *Atmos. Chem. Phys.* **7**, 1503-1522.

[2] Aiken *et al.* (2008) *Environ. Sci. Technol.* **42**, 4478-4485.