High-resolution chemo- and biostratigraphic records of the Early Aptian Oceanic Anoxic Event in Cantabria (northern Spain)

I. ROSALES¹, M. NAJARRO¹, J.A. MORENO-BEDMAR², G.A. DE GEA³ AND M. COMPANY⁴

 ¹Instituto Geológico y Minero de España. Rios Rosas 23, 28003 Madrid, Spain (m.najarro@igme.es)
²Universitat de Barcelona. Martí i Franquès s/n, 08028

Barcelona, Spain (j.a.moreno@ub.edu)

³Universidad de Jaén. Campus Universitario Las Lagunillas, 23072 Jaén, Spain (gadegea@ujaen.es)

⁴Universidad de Granada. Av. Fuentenueva s/n, 18002 Granada, Spain (mcompany@ugr.es)

The Early Aptian Oceanic Anoxic Event (OAE1a) is one of the most widespread and best-defined OAE of the Cretaceous. This event was associated to abrupt perturbations of the carbon cycle as indicated by both negative and positive $\delta^{13}C$ excursions in organic mater and carbonate records. The $\delta^{13}Ccar$ record of the OAE1a has been subdivided in a series of segments, labelled C3–C7 [1], that can be regionally reproducible. Most of the studies come from hemipelagic and pelagic sections but only few studies exist on the reproducibility of these C-isotope shifts in shallow water settings.

New detailed litho- bio- and chemostratigraphic (TOC, δ^{13} Ccar, δ^{13} Corg, δ^{18} O) investigation of the Lower Aptian succession of northwestern Cantabria, allowed to recognize the local expression of the OAE1a in shallow platform carbonates of northern Spain. The event is characterized by a ~ 40 m thick marly interval (Patrocinio Fm) that records an abrupt negative δ^{13} C excursion in both bulk organic matter (up to 5‰) and carbonates (up to 6‰, mean 3‰). The negative shift is attributed to the δ^{13} Ccar curve segment C3 [1]. It is followed by a positive shift recorded in carbonates, attributable to the curve segment C7 [1]. These records can be accurately calibrated against new ammonite and nannofossil biostratigraphy, which allow a confident attribution of the OAE1a to the middle part of the Hayesites irregularis calcareous nannofossil Zone, and to the Deshayesites weissi ammonites Zone. Our data help to refine the age of the OAE1a [2, 3] and reveal the existence of a stratigraphic gap in these carbonate series that could cover the record of the C4-C6 segments of the δ^{13} Ccar curve.

Menegatti *et al.* (1998) *Paleoceanography* **13**, 530–545.
Moreno-Bedmar *et al.* (2009) *Cretaceous Research* doi: 10.1016/j.cretres.2009.02.004.
Aguado *et al.* (1999) *Cretaceous Research* **20**, 663–683.

CO₂ sequestration by basalt: Experimental studies and geochemical modeling

R.J. ROSENBAUER* AND J.L. BISCHOFF

U.S. Geological Survey, 345 Middlefield Rd., Menlo Park, CA (*correspondence: brosenbauer@usgs.gov) (jbischoff@usgs.gov)

Basaltic rocks are potential repositories for sequestering carbon dioxide (CO₂) because of their capacity for trapping CO2 in carbonate minerals. We carried out series of geochemical models and experiments, reacting basalt with CO₂-charged fluids over a range of conditions from 50°C to 150°C and from 100 to 300 bars. Experiments were carried out in flexible gold-cell apparatus with a serial online sampling capability of the fluids to permit monitoring reaction progress. Results indicate basalt has a high reactivity to supercritical CO₂ and carbonic acid. Initial reactions caused a rapid drop in pH and an increase in cations including Ca, Mg, Fe, and Mn followed by a decrease to steady-state values. CO₂ decreased asymptotically to steady-state concentrations in experiments that were under-saturated with CO2, a repeatable pattern following re-injection of CO₂ into the experiment. These results showed that the basalt continued to have a capacity to react with CO₂. In experiments that were supersaturated with CO₂ containing a separate supercritical CO₂ phase, the rock took up over 10% of its weight in carbonate.

Reaction path simulations predicted calcite would initially precipitate then later dissolve in the sequential addition of P_{CO_2} to be replaced by dolomite and siderite at equilibrium. SEM analyses of the solid reaction products found only Fe and Mg bearing phases consistent with the kinetic barriers to forming dolomite. Experiments are currently underway to find the optimal conditions for CO₂ sequestration in basalt.