

25. DATA REPORT: CHEMISTRY OF PORE FLUIDS IN SEDIMENTS OF HOLE 893B, SANTA BARBARA BASIN¹

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MINERALS AND METHODS

Hole 893B was drilled in the central Santa Barbara Basin, a few hours before port call. Therefore, these Ocean Drilling Program Leg 146 pore fluids, which were obtained by routine shipboard squeezing of whole-round sediment samples immediately after retrieval, were analyzed aboard the ship only for alkalinity. The remaining pore fluids were sealed and analyzed in the shore-based laboratories of Scripps Institution of Oceanography. The shipboard procedures involved squeezing the sediments in titanium squeezers at ambient temperature and at pressures of 135–205 MPa (140–210 kg/cm²).

The methods used for the chemical analyses are described in Gieskes et al. (1991). Table 1 is a summary of the pore fluid chemical data from Hole 893B. Only four pore fluid samples were obtained. Except for Sample 146-893B-5H-5, 140–150 cm, from a bioturbated sediment section, the other three samples are from laminated sediment sections.

SUMMARY OF RESULTS

Despite the very high methane concentrations of about 80,000 ppmv already at ~10 meters below seafloor (mbsf) (pers. comm., Shipboard Organic Geochemists, 1992), sulfate reduction is incomplete in the uppermost ≤20 m drilled, suggesting either intensive irrigation in the suboxic to oxic bottom-water environment or, more likely, advection of methane from greater depths into the sulfate reduction zone where pyrite forms. The high alkalinities reflect the intensity of organic matter remineralization and the high sedimentation rates, effecting carbonate diagenesis. The significantly lower-than-seawater calcium concentrations even at 1.5 mbsf indicate that a Ca-rich mineral is precipitating. Calcium may be consumed by francolite (carbonate-F-apatite) precipitation; however, the high alkalinity con-

centrations would destabilize francolite, favoring carbonate formation (Kastner et al., 1984). On the basis of the high Mg/Ca ratios of 2 to almost 4 times the seawater ratio, the very high alkalinity and low sulfate concentrations, in addition to calcite, Mg calcite, and/or dolomite, are most likely actively forming in these sediments (Baker and Kastner, 1981; Kastner et al., 1984). Active carbonate precipitation is also supported by the lower-than-seawater strontium concentrations. The higher-than-seawater potassium and sodium concentrations strongly suggest that both have been expelled from clay exchange sites, most likely by ammonia, a by-product of organic matter remineralization. Silica concentrations are high; already at the shallowest sample, at 1.5 mbsf, the pore fluid is almost saturated with respect to opal-A. It reaches saturation at ~55 mbsf. The origin of the rather low silica concentration at 20.8 mbsf (Sample 146-893B-3H-6, 140–150 cm) of 336 mM is unclear. A sandy horizon at this depth may be responsible for it.

REFERENCES

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Table 1. Chemistry of interstitial water samples from Hole 893B.

Core, section, interval (cm)	Depth (mbsf)	pH	Alkalinity (mM)	Salinity (g/kg)	Cl (mM)	Mg (mM)	Ca (mM)	Mg/Ca	SO ₄ (mM)	SiO ₂ (μM)	K (mM)	Na (mM)	Na/Cl	Li (μM)	Sr (μM)
146-893B-															
1H-1, 140–150	1.5	7.9	42.63	33.5	557	49.13	4.49	10.9	3.6	917	12.09	488	0.88	17.1	73.1
3H-6, 140–150	20.8	7.6	57.21	34.5	561	51.03	2.56	19.9	0.6	336	13.04	499	0.89	17.7	59.0
5H-5, 140–150	38.3	7.7	43.64	33.5	563	42.62	2.18	19.6	0.7	944	13.79	505	0.90	30.5	56.7
7H-6, 106–116	58.4	7.7	44.99	33.5	557	39.85	2.13	18.7	0.8	1081	13.99	506	0.91	28.2	59.0

¹Kennett, J.P., Baldauf, J.G., and Lyle, M. (Eds.), 1995. *Proc. ODP. Sci. Results*, 146 (Pt. 2): College Station, TX (Ocean Drilling Program).

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