Miocene radiolarians, and marl at site 771 contains radiolarians and nannofossils of this age, the same as that of the Sulu Sea and the cessation of volcanism on Cagayan Ridge. We also found volcanic tuffs at site 769 beneath the brown claystone, but these tuffs are basaltic to andesitic in composition, indicating a different source from the rhyolitic to dacitic tuff in the deep Sulu Sea.

Logging at sites 770 and 768 included use of the borehole televiwer, which measures the shape and roughness of the hole in the basement. The holes tend to be elliptical, with their long axes lying perpendicular to the direction of maximum horizontal stress. In places the long axes tend to develop small 'breakouts', which are easily visible in the record. The method thus gives a measure of stress direction. Preliminary results at both sites indicate that the maximum horizontal stress direction trends to the north-east, which is consistent with the expected stresses related to the Miocene and Pliocene collisions of the Sulu, Cagayan and Palawan ridges with the Philippine mobile belt.

PALAEONTOLOGY

Sea-dragons all aswim

Michael A. Taylor

THREE major finds of fossil marine reptile on display in a new exhibition* in Bristol will fuel the current revolution in marine reptile studies. The existence of several different kinds of large predator in the same sea poses difficult questions about their ecological partitioning. Two of the new finds are ichthyosaurs from the Lower Liassic (about 200 million years ago) and the third is the skull of a pliosaur, from the rather younger Kimmeridge Clay of Westbury, Wiltshire, UK (see figure).

A virtually complete skeleton of an ichthyosaur from Charmouth¹ in Dorset, UK was about 9 m long in life. Although comparable in length with other large Liassic ichthyosaurs, its long, delicate snout and tiny, sharp teeth contrast with their robust snouts and heavier teeth. The large size of the Charmouth ichthyosaur combined with a narrow snout suggests a diet of small, abundant prey near the base of the food chain. But marine reptiles never seem to have exploited filter-feeding on even smaller prey, as do the modern mysticete whales, filter-feeding sharks and the newly reinterpreted giant teleost fish *Leedsichthys*² from the Jurassic Period.

The only known specimen of the much smaller ichthyosaur *Excalibosaurus costini*³ is also on display in Bristol. This

A short, normally polarized, full-reversal event within the Matuyama chron is evident in the palaeomagnetic record. Occurring just below the Jaramillo sub-chron 1.1 Myr ago, this reversal corresponds to the Cobb Mountain event documented by E.A. Mankinen *et al.* (*Geology* **6**, 653–656; 1978) and is supported by marine magnetic-anomaly profiles described by D.K. Rea and R.J. Blakely (*Nature* **255**, 126–128; 1975).

Maturity of the terrestrial type of organic matter at Site 768 reaches the stage of thermal hydrocarbon generation at a shallow sub-bottom depth, indicating a thermal gradient greater than 100 °C km⁻¹. We even observed some thermogenic generation of gas at this site.

Calcium and magnesium in interstitial waters show positively correlated increases with depth in the lower parts of the sedimentary sections of sites 767–770. Because normal alteration products of basalt scavenge magnesium, these observations suggest the presence of a chemical mechanism of crustal alteration previously unsuspected in the oceanic crust. □

Restoration of the pliosaur *Liopleurodon macromerus*, a 7.5-m-long oceanic predator of 150 million years ago (courtesy of John G. Martin and Bristol City Museum and Art Gallery).

of fast teleost fish has been implicated in the marine reptiles' decline: many had disappeared from the seas long before the end of the Cretaceous period (65 million years ago).

The exhibition celebrates Bristol Museum's acquisition and curation of these three major finds. But it also narrates the museum's key role in the history of research on marine reptiles, and laments the destruction, in an air raid in 1940, of the original collection of marine reptiles, the finest in Britain outside London^{12,13}. It was here during the 1820s that W. D. Conybeare and H. T. De la Beche carried out the first accurate assessments of ichthyosaurs and plesiosaurs, interpreting them as links in the "great chain of being" between fish and reptiles¹⁴. These marine reptiles helped to popularize palaeontology, and — ironically — to give the impetus leading to the replacement of the paradigm of the great chain by darwinian evolution. Now the cycle is complete and the marine reptiles are once again receiving well-deserved attention. □

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*The Great Sea Dragons, City of Bristol Museum and Art Gallery, Queen's Road, Bristol BS8 1RL, 17 February–6 May 1989.