

MagellanPlus Workshop Reports

:: Advancing our Understanding of Cretaceous Ocean Dynamics by Scientific Drilling April 15-17, 2013, London (UK)

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Understanding the response of Earth's climate and ocean system to elevated levels of atmospheric CO₂ is a key theme for the next phase of scientific ocean drilling. Marine environmental conditions during the middle Cretaceous (Barremian through Turonian; ~130-88 Ma) provide insights into the possible state of future oceans influenced by globally increasing temperature and major changes in ocean chemistry. This preview includes ocean dynamics driven by reduced thermal gradients and episodic ocean acidification together with hypoxia, anoxia and euxinia (including Oceanic Anoxic Events, OAEs). High profile and novel research has demonstrated that the middle Cretaceous oceans record the 'end-member' conditions of an ocean-atmosphere system forced by rapid and extreme climate change. Studying the environmental conditions of the Cretaceous provides complementary, yet contrasting, views of greenhouse climates compared to the much better-studied Paleogene. However, although considerable progress in our understanding of Cretaceous oceans was derived during the early stages of ocean drilling (*right*), especially the DSDP, further advances are severely limited by a lack of material to which new proxies and techniques can be applied. With few oceanic records from the high latitudes, particularly in the Northern Hemisphere, and the Pacific Ocean, and spot coring of many 'classic' Cretaceous sites drilled during the DSDP, the limitations of the archive are both geographic and stratigraphic in scope.

In order to address the deficiencies in our understanding of Cretaceous climate and ocean dynamics, new drilling projects, both on land and at sea, are required. With support from IODP-MI, USSSP, Magellan+ and UK-IODP, a workshop was held at University College London in April 2013, with the specific goal of instigating new drilling projects designed to further our understanding of Cretaceous ocean circulation and climate, acidification and deoxygenation, and the impact of these conditions on life at the surface of the ocean and at depth.

The workshop was size limited to encourage dynamic and focused discussions in breakout groups that led, over three days, to preliminary

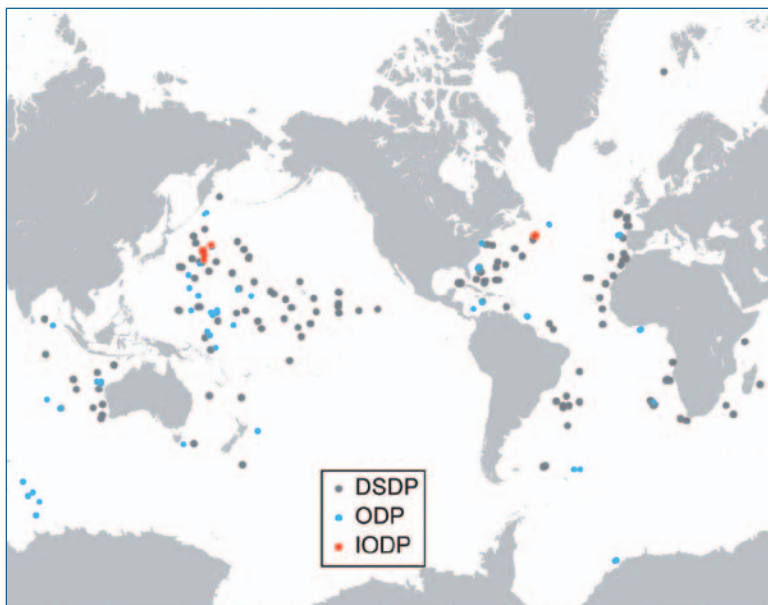
drafts of drilling proposal summaries. The workshop was attended by 47 participants (including 22 from ECORD countries), including representatives from the modelling, geochemical, geophysical and palaeontological communities and ranging from PhD students just embarking on IODP careers to senior professors, with memories of life aboard *GLOMAR Challenger*! In order to allow the maximum time for discussion, presentations were limited to introductory talks by the convenors covering the major themes, overviews of the IODP proposal and site-survey requirements (vital to ensure attendees were aware of the requirements of the IODP proposal process and that, by highlighting such critical issues now, future delays in the progression of the proposals might be avoided), and poster presentations by attendees.

Prior to the workshop, invited participants completed a questionnaire describing their areas of scientific interest and where they would like to drill. On the basis of this information, four breakout groups of approximately equal size were organised along geographical lines - Arctic, North and South Atlantic, Southern Ocean, Indian and Pacific Ocean. These groups met to discuss science questions pertinent to their area, and, from the beginning of the second day, potential

drilling targets. By the plenary session on the third day, each group had identified key objectives and had drafted documents describing the aims, justification, and drilling strategies for their region. Within these documents, detailed descriptions of specific target areas were given, which range from re-drilling of areas explored by the DSDP to new drilling in places for which seismic data have only recently become available. Furthermore, the projects outlined during the workshop require a range of platforms both for onshore and offshore drilling.

We hope that the information drafted in London will form the basis of many pre-proposals that will be submitted in Autumn 2013 and Spring 2014 to the Science Evaluation Panel and that eventually these will lead to exciting new opportunities to reveal the secrets of the Cretaceous world.

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Map showing sites that recovered Cretaceous-age sediments during DSDP, ODP and IODP drilling