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John G. Malpas and Paul T. Robinson

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New Series

The Origin and Evolution of Oceanic Lithosphere

John G. Malpas
Department of Earth Sciences, The University of Hong Kong, Hong Kong

Paul T. Robinson
Centre For Marine Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5

The earth sciences have changed in their approach over the last few years from investigation of individual processes and local relationships to studies of the integrated earth system. Nevertheless, as in any system, it is the individual components and phases that are important and relationships can only be fully comprehended when these are understood. Of all of the components of the earth system, the oceans play a focal role, but are still one of the least understood. This is because of the unique challenges that face any study of this subsystem, particularly the requirement for advanced technology and the expenditure of large amounts of time and money compared to land-based investigations. In addition, the very extent of the ocean basins means that often we are dealing with global spatial scales and temporal scales that can vary from milliseconds to millions of years. These factors have led to the development over the last three decades of a number of multi-disciplinary, multi-national, large-scale programmes aimed at understanding this fundamental part of the earth system.

Amongst the oldest and most successful of these international programmes is the Ocean Drilling Program (ODP). Now in its 13th year, ODP is the successor to earlier ocean drilling programmes, Deep Sea Drilling Project (DSDP) and International Phase of Ocean Drilling (IPOD). The results from more than 30 years of ocean drilling have been at times startling, at times confusing, but always exciting. These investigations, combined with high-resolution surveying of the sea floor, have provided a wealth of new data about the framework of the ocean basins. The activities and successes of ODP and its predecessors have promoted an increase in oceanic investigations by more classical means and led to co-operation among specialists from disparate disciplines that was not in evidence a few decades ago. Perhaps more than any other area, the study of the oceans has led to the paradigm shift in the earth sciences toward a global systems approach.

With the establishment of this trend toward a multi-disciplinary approach to ocean systems, it seems appropriate at this time to summarize the present state of knowledge of at least some of the sub-components of the ocean system. This is the aim of this new series of articles "The Origin and Evolution of Oceanic Lithosphere." Formation of the lithosphere is a fundamental process in the earth system. It accounts for most of the volcanism on earth and results in the greatest amount of heat loss from the earth's interior. The latter, as recognized by James Hutton, is the driving force for the whole earth system, from core to atmosphere. Interaction between the lithosphere and hydrosphere controls the composition of seawater and eventually forms the basis of the chemosynthetic food chain. Return of altered oceanic lithosphere to the mantle in subduction zones is fundamental to the production of new continental crust.

We anticipate that future articles in this new series will include discussions of bathymetry and morphology of the ocean basins; geochemistry of the oceanic crust and mantle; magma generation and evolution in the ocean basins; tectonic processes at spreading centres; hydrothermal processes and crustal aging; ocean sedimentation; and geophysics and physical properties of ocean lithosphere. We expect to conclude the series by examining oceanic lithosphere now above sea level as represented by the Troodos Ophiolite Complex of Cyprus; and consideration of collisional tectonics and ophiolite emplacement.