



Environmental management frameworks for offshore mining: the New Zealand approach



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ABSTRACT

The New Zealand region contains untapped natural mineral, oil, and gas resources while also supporting globally unique and diverse faunal communities that need to be managed sustainably. In this paper key information from the international literature is reviewed that can underpin an Environmental Mining Management System which includes elements of Environmental Risk Assessment, Environmental Impact Assessment and Environmental Management Planning. This paper focuses on four developing areas of seafloor mining activities presently being undertaken or planned in the New Zealand region: hydrocarbons (oil and gas), minerals, ironsands and phosphorite nodules. A number of issues with the implementation of environmental management systems are identified including the difficulty of assessing new marine activities or technologies and the need for standardised reporting metrics. Finally, the development of ecosystem-based management and marine spatial planning is discussed which will be required to enhance environmental mining management frameworks in New Zealand.

1. Introduction

The renewed strong global interest in extraction of offshore marine mineral resources has affected New Zealand as a country which has sovereign rights to the world's fourth largest Exclusive Economic Zone (EEZ) [1]. Internationally, most commercial marine mining ventures to date have focused on aggregates, diamonds, tin, magnesium, salt, sulphur, gold, and heavy minerals generally confined to shallow depths near shore [2]. However, the industry is evolving and mining in deeper waters is now feasible with phosphate, massive sulphide deposits, polymetallic nodules and cobalt-rich crusts regarded as potential future prospects. New Zealand's EEZ contains large untapped mineral, oil, and gas resources that have considerable economic potential (Fig. 1). Seafloor mineral deposits have been estimated to be worth up to \$500 billion NZD [3] while the value of oil exports in the year to June 2014 was \$1.61 billion NZD with estimated exports from methanol of \$1 billion NZD [4]. New Zealand waters also support a globally unique and diverse biota [5], that contributes important ecosystem goods and services including significant fisheries resources [6–8] that need to be protected.

New Zealand is recognised internationally for its environmental

management and innovative regulatory frameworks [9], as demonstrated for instance by the implementation of the first no-take marine reserve in 1975 [10] and the introduction of a quota management system for fisheries in the 1980's [11,12]. A major element of management in New Zealand includes the recognition in policies and regulations of the Māori (indigenous) connection with the oceans, and Māori have specific rights as parties of the Treaty of Waitangi [13], the foundation document of modern New Zealand. Overall, there is a strong commitment to wise stewardship of natural resources including close cultural connections to the ocean [9].

The Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act) and the Crown Minerals Act 1991 provide the legislative and regulatory framework for environmentally sustainable exploration and exploitation of offshore mineral resources. The EEZ Act is the principal legislation concerned with how to manage the effects of offshore petroleum and minerals activities, which the public perceive as high risk [14]. Because the EEZ Act is relatively recent, there is limited experience with impact assessment in this environment, and little case law to help interpretation of the Act. Internationally however there is a much longer history of offshore petroleum and mining activities and therefore a larger body of literature and guidance

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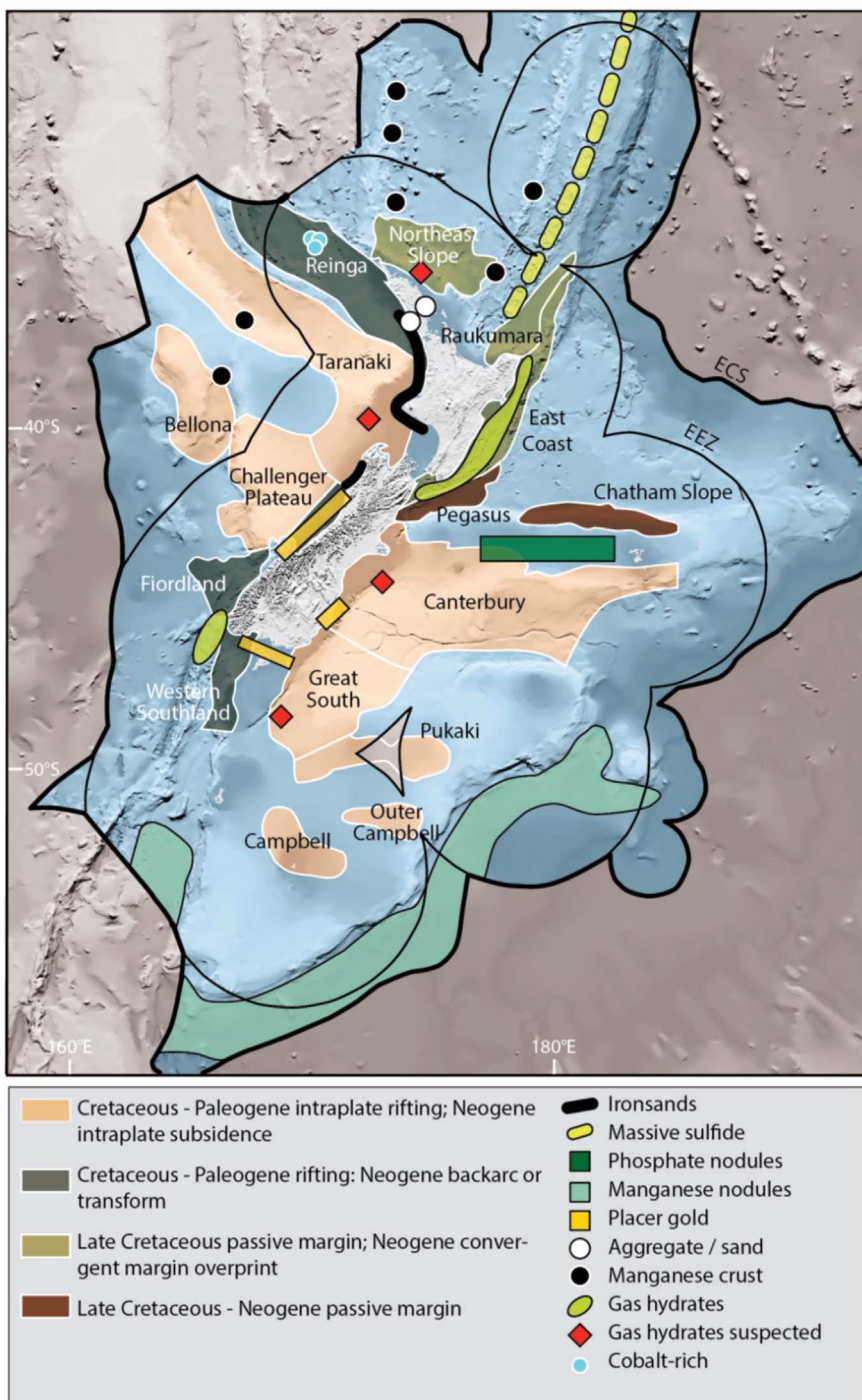


Fig. 1. Offshore hydrocarbon basins and mineral resources within New Zealand Exclusive Economic Zone (EEZ) and Extended Continental Shelf (ECS). Modified from [132].

for best practice approaches and methods for effects management.

The motivation for this review paper resulted from the lack of standardised environmental management principles for new emerging sectors. Further, a lack of best practice scientific guidelines increases the risk that environmental management practices may be insufficient to protect the marine environment and can also increase the likelihood of applications being rejected. The need for such guidance was expressed to our research team by regulators, industry and stakeholders alike. This review therefore focuses on the development of generic components of an environmental assessment framework that could be used for offshore mining applications in the future. Our review also considers lessons learned from the first marine consent applications that were made under the new EEZ Act in terms of science and policy gaps. The development of such a framework is also relevant for emerging

sectors globally where, similar to New Zealand, some of the first applications are occurring in other jurisdictions.

There are many approaches, methods and tools available to help understand potential impacts of activities (see [Supplementary material](#)). The three main tools that are generally used to determine the impacts of an activity focus on risk, impact assessment and management plans. Fig. 2 illustrates an “Environmental Mining Management System” (EMMS) framework that makes explicit the links between these three key tools: Environmental Risk Assessment (ERA) and Environmental Impact Assessment (EIA) are evaluated first which then guide the subsequent development of Environmental Management Plans (EMP). This EMMS framework helps structure our review of best practice undertaken or developed in New Zealand and other countries with reference also to guidance produced by the International Seabed

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