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Deep-Ocean Mining Technology III: Developments

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ABSTRACT

The review is an update from the review presented at the OMS-2005 (Chung, 2005). It includes discussions on the technical issues that have been already identified in the literature for manganese nodule production system design and on initial stages of crust mining concepts. It appears no new additional issues have yet been identified and solved. Recent discovery of the buried nodules would necessitate a new miner/collector concept. Under the present step-by-step water-depth approach the realization of a cost-effective commercial deep-ocean mining system will take much longer than is claimed or targeted. The present incremental (step-by-step) approaches for not much deeper than 100 m in equipment design and testing in the coastal water for past 10 to 15 years may be worth re-assessing against a direct approach for 5,000-m depth technology and system development.

KEY WORDS: Deep-Ocean, mining, manganese nodules, crusts, Hughes Glomar Explorer, full-scale tests, sea-floor vehicle, pipe, riser, integrated system.
* The statements in this paper is the author's, not ISOPE .

INTRODUCTION

The recent state of technological developments in the countries that have joined deep-ocean mining since the '90s is reviewed in terms of readiness for the development of a commercial mining technology. The recent developments are funded primarily by their respective governments at small budget scales. This review uses as baseline the previous large-scale international R&D work performed in the 70's on 5,000-m, deep-ocean mining technology and systems.

Previous Developments

The design of the *Hughes Glomar Explorer* (Fig. 1) was one of the greatest technological innovations in ship and deep-ocean technology of the century. The *Explorer*, with its deep-ocean mining system, had a huge rectangular door, the so-called moon pool: 270 ft (82 m) long, 70 ft (21 m) wide in the bottom of the ship hull, this could be opened and closed in mid-ocean. A large, remotely controlled, self-propelled ocean-floor miner with a 5,000-m-long steel pipe system—OD 15-in (38-cm); ID 7.5-in (19-cm)—deployed and retrieved through the moon pool's open door

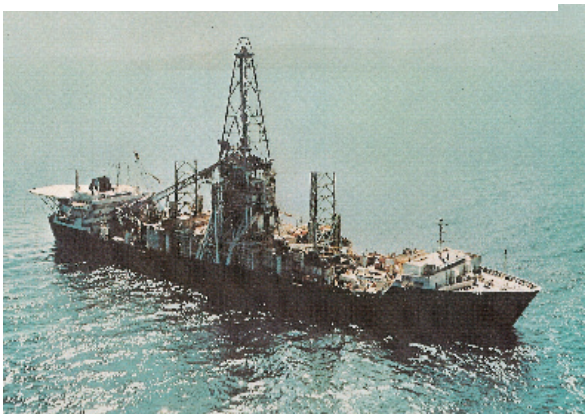

Fig. 1 Hughes Glomar Explorer

for operation on the nearly 6,000-m-deep ocean floor (Fig. 2). Its pipe handling and deployment of the 5,000-m-long pipe were automated.
Even now, no new systems have been developed that can match the capability of the *Explorer*'s heavy lift system, heave compensator and large, remotely-controlled, self-propelled miner (ocean-floor vehicle),

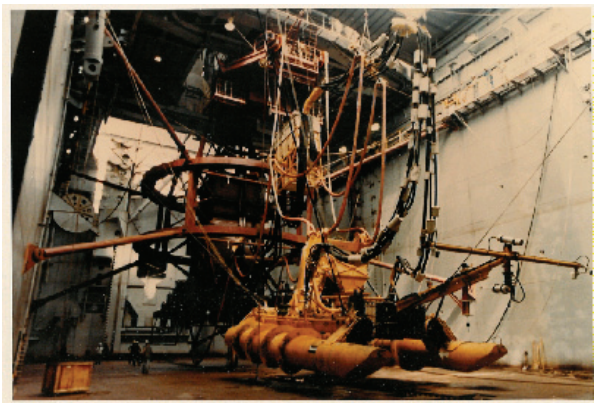

Fig. 2 OMCO's RCM inside *Hughes Glomar Explorer* during at-sea test in Pacific Ocean, 1976: Flexible hose and buffer above Archimedean-screw miner