

Study of the CLB Mining System for Nodule & Crust Recovery

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ABSTRACT

The Continuous Line Bucket (CLB) is a mechanical system using an endless loop of rope suspended from a surface platform to reach the seabed and to which dredge buckets are attached at regular intervals.

The Turning CLB is a recent important innovation; by steering the vessel in a circular track, trailing the empty buckets over the stern and bringing up the loaded buckets amidships from within the arc of the ship's track, a good separation of lines has been achieved.

Improvements to the CLB components which have been tested recently include: horizontal traction wheels and ball rollers used in combination to decrease the number of traction wheels by half; new bucket guides and dumping device to automate discharge of the loaded buckets without removing them from the line; and small model test for bucket guides was done. double braided polyester/nylon rope adopted to increase the life of the rope; and various bucket configurations including a piano wire mesh bucket designed by the French Group IFREMER. Filling efficiencies of over 60% were recorded for the buckets.

The CLB system was evaluated for nodule deposits in 5,000 m water depth, for three sizes of ship (15,000 t, 30,000 t and 60,000 t), and three production rates (500t/d, 1,000t/d and 2,000t/d).

Using buckets of 0.75 m³ capacity with line intervals of 50 m, 25 m and 12.5 m, the forces required for the ascending line were estimated to be 46t for 500 t/d, 92.4 t for 1,000 t/d, and 184.8 t for 2,000 t/d.

Traction power required at 0.8 m/s line speed was estimated to be 500 KW for 500 t/d, 1,000 KW for 1,000 t/d, 2,000 KW for 2,000 t/d.

Rope sizes selected for the evaluation were 110 mm for 500 t/d, 150 mm for 1,000 t/d and 210 mm for 2,000 t/d.

Two 8 ton ball rollers and 6 traction wheels for the traction device were estimated to cost about 6 million dollars for the case of 1,000 t/d.

Rope and buckets were costed as consumables. With a rope life of 1-1.5 years, unit production cost was estimated at \$109/t for 500 t/d, \$76.7/t for 1,000 t/d, and \$ 54.1/t for 2,000 t/d in 1994 study.

The CLB was evaluated for crust mining on the 5th Takuyou Sea Mount (1,400 m) by the Crust Study Committee of Japan Resources Association. Additional evaluations have been made in the Republic of the Marshall Islands.

The CLB is a potential crust mining method where fragmented crust deposits are found.

Key words: Combination of ball roller and traction wheel; polyester/nylon rope; piano wire mesh bucket.

INTRODUCTION

Rich deposits of metalliferous nodules have been found on the deep seabeds at depth of 5,000 meters in the Pacific in the Clarion-Clipperton fracture zone and Exclusive Economic Zone of the Cook Islands, and in the mid-Indian Ocean.

Rich deposit of metalliferous crusts have been found on seamounts near Minami Torishima Island, Johnston Island, and in republic of the Marshall Islands.

Consideration is being given to the options available for recovery of these deposits.