

DEEP-SEA MANGANESE DEPOSITS FROM THE SOUTH TYRRHENIAN AREA

By

G. BOCCHI⁺, G. GABBIANELLI⁺⁺, F. LUCCHINI⁺, P. L. ROSSI⁺, R. SELLI⁺

During the last ten years numerous iron-manganese samples have been collected in the Tyrrhenian Sea. Two kinds of mineralizations are present:

- a. - iron-manganese crust some mm or cm thick very widespread on every hard substratum (rocks, shells, etc.), where the terrigenous sedimentation is lacking or very slow;
- b. - iron-manganese concretions in strata from few cm to up 1.5 m thick, brown or black in color, exclusively placed on the submarine volcanoes especially of Eolian ring (Eolo, Enarete, Lametini, Palinuro Smt.

From the economic point of view the first kind of deposits is devoid of interest; on the other hand the second one can represent an exploitable source of manganese, where the metal-content is high enough. This situation happens on the Palinuro and Lametini Seamounts.

The Palinuro Seamount is a big elliptical perityrrhenian calcalkaline volcano placed on a system of E-W transcurrent faults. The mineralized area extends at least on 12.5 sq. km between 70-700 m in depth. The mineral is represented by botryoidal concretions roughly concentric laminated from 1-2 mm up to 10 cm in diameter and with an average Mn-content of 39% (wt). The concretions are distributed in strata of few cm up to 50 cm thick; the gangue is absent or represented by clay or fine to medium sand.

The Lametini seamounts are two calcalkaline conical volcanoes placed on NE-SW fault. The mineralized area till now ascertained extends on 1 sq. km between 850 and 1200 m in depth. The mineral is represented by a stra-

⁺ *Ist. di Mineralogia e Petrografia - Università
P.zza di Porta S. Donato, 1 - Bologna*

⁺⁺ *Ist. di Geologia e Paleontologia - Università
Via Zamboni, 67 - Bologna*

tum without impurities at least 20 cm thick resting on a quaternary clay or calcilutite crossed by very numerous veins and dikes of Mn mineral. The mean Mn-content is 46% (wt).

In both deposits the Fe/Mn ratio is very low, and the main crystalline phase is todorokite with minor 7 Å manganite, halite and carbonates. Careful SEM investigation on different fragments revealed frequent laminations. The laminae grow through cylinders, perpendicular to the same laminae, showing a radial structure only on their outer portions. Such accretionary structures suggest that todorokite crystallization is post-depositional.

The characteristics of sites (tops of volcanic seamounts) and the major and trace elements suggest that the latter kind of mineralizations were deposited from hydrothermal springs. The extreme fractionation of Mn from Fe may be explained by a process involving a sub-bottom circulation leading to iron sulphide formation, due to reducing conditions in deeper areas, and to Mn depositions higher in oxidation areas, probably due to contact with sea water oxygen. On the other hand the first kind of deposits, that is the iron-manganese crust, have been originated by direct precipitation (of Mn) from marine water. The very far origin of Fe and Mn are terrestrial and/or volcanic sources.