

# SEEPAGE ACTIVITY OF THE NAPOLI MUD VOLCANO: EVIDENCE FROM OBSERVATIONS MADE DURING THE MEDINAUT (1998) AND NAUTINIL (2003) DIVE EXPEDITIONS

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## Abstract

Dive observations made during the MEDINAUT (1998) and NAUTINIL (2003) expeditions demonstrate long-lasting seepage activity at the surface of the Napoli mud volcano in the eastern Mediterranean basin. Numerous spots of dark reduced sediment were identified as active seeps. Brine lakes, authigenic carbonate crusts, chemosynthetic fauna, bacterial mats and filaments are associated with seeps. Seepage activity varies with time over the summit.

*Keywords:* Napoli mud volcano, Fluid seeps, Mud volcanoes, Submersible dives, Central Mediterranean Ridge.

Unlike many other mud volcanoes that have been mapped on the summit of the Mediterranean ridge, the Napoli mud volcano, one of several large mud volcanoes that form the Olimpi mud volcano field to the south of Crete, is characterized by an overall weak backscatter (Fig. 1). One explanation for the low backscatter is a different type of extruded mud, as attested by ODP Leg 160 cores, which recovered mud containing only millimetric clasts (1). Over most of the summit of the mud volcano, a relatively chaotic acoustic pattern is observed on the side scan sonar records, which probably results from the relatively unstructured mud flows. The fluid nature of the sediment was also anticipated as one reason for the low backscatter.

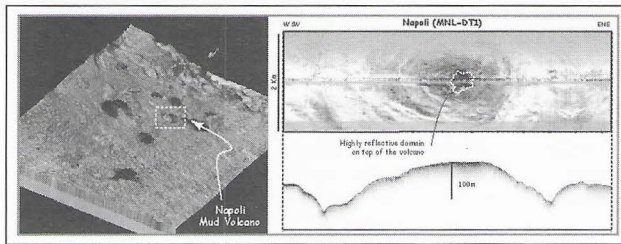


Fig. 1. (a) 3D-view of the Olimpi mud volcanoes field South of Crete. (b) Ore-Tech deep-tow side scan sonar profile recorded across Napoli Mud Volcano during the MEDINETH cruise

The MEDINAUT dive expedition carried out in 1998 revealed a peculiar characteristic of the Napoli mud volcano surface which was the occurrence of several brine lakes (2). Based on the observations of four dives, a first detailed geological map of the volcano summit was completed (Fig. 2). Shallow brine lakes, up to a few tens of meters long and only a few tens of centimeters deep were found.

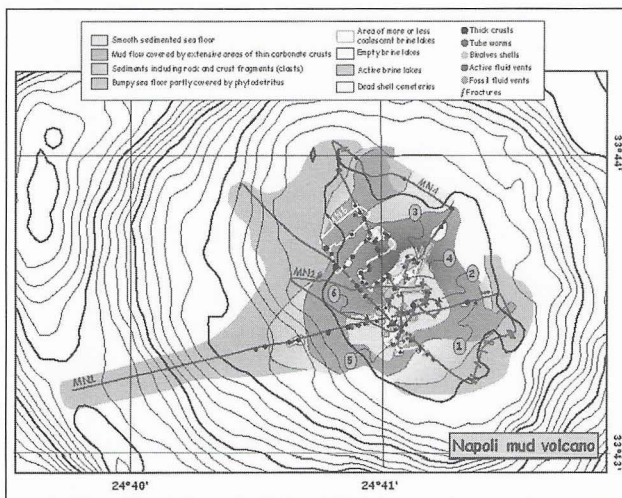


Fig. 2. Geological interpretation of the Napoli mud volcano, deduced from seafloor observations and sampling from 4 dives performed during the MEDINAUT cruise (3).

The NAUTINIL dive expedition in 2003 yielded additional seafloor observations on the summit of the Napoli mud volcano. Three new dives were carried out. Observations covered areas that had not been explored at all during MEDINAUT, but also covered areas that had been visited for a first time during MEDINAUT allowing for a comparison of seepage activity to be made after a 5 year interval.

The new observations showed that fluid seepage through the seafloor of the Napoli mud volcano was still active and that the seepage activity had remained focussed in the central part of the volcano. Numerous spots of dark reduced sediment were identified as active seeps. Whitish bacterial mats and filaments were commonly observed in association with the numerous seeps, as well as thin carbonate crusts. Chemosynthetic fauna indicators of past or recent seeps include tube worms (vestimentiferans) mainly at the edge of crust, small living bivalves (mytilidae) fixed on crust and large fields of bivalve shells (Lucinidae, Thyasiridae). Occasionally, isolated tubeworms and sponges were observed.

Our preliminary results suggest that the overall area of brine accumulation moved significantly to the northeast over the five years elapsed since MEDINAUT.

## References

- (1) - Robertson, A.H.F., Emeis, K.-C., Richter, C., and Camerlenghi, A. (eds.), 1998. *Proc. ODP, Sci. Results*, 160: College Station, TX (Ocean Drilling Program).
- (2) - MEDINAUT/MEDINETH Scientific Shipboard Parties, 2000. Linking Mediterranean Brine Pools and Mud Volcanism. *Eos Trans. Am. Geophys. Union*, 625-632.
- (3) - Huguen, C. 2001. Déformation récente à actuelle et argilo-cinèse associée au sein de la Ride Méditerranéenne (Méditerranée Orientale). *Thèse de Doctorat, Université Paris VI*, 260 p.