

NEW INSIGHTS ON THE KOS-NISYROS VOLCANIC FIELD FROM THE MORPHOTECTONIC ANALYSIS OF THE SWATH BATHYMETRIC MAP

Nomikou P. ¹*, Papanikolaou D. ¹, Alexandri S. ², Ballas D. ²

¹ Dept. of Geology, University of Athens, Greece, ² Hellenic Centre for Marine Research, Athens, Greece - * evi@ncmr.gr

Abstract

The recent volcanic activity at the eastern edge of the Aegean volcanic arc is limited within a neotectonic graben structure which is developed in an E-W general direction, between the alpine basement of Kos Island to the north and the alpine basement of Tilos Island to the south. In between the major boundary faults of the neotectonic graben there is an extended volcanic area comprising several individual volcanic centers. The detailed bathymetric map, constructed by recently acquired high resolution multibeam data permitted the distinction of the main morphotectonic structure of the area comprising a number of basins with average bottom depth of ~600m in between several volcanic centers separated by minor active faults.

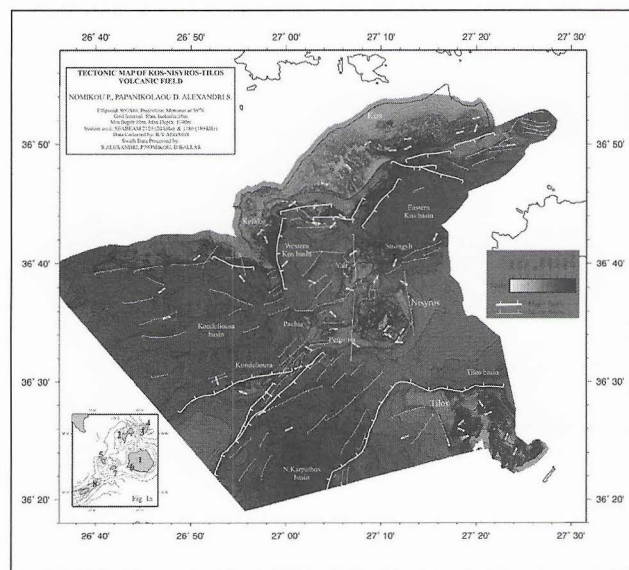
Keywords: *swath mapping, volcanic centers, Aegean Sea, tectonics*

Geodynamic setting

The eastern sector of the Aegean volcanic arc, including the islands of Kos, Nisyros and associated islets, is the result of northeastward-directed subduction of the Eastern Mediterranean lithosphere below the active Hellenic margin of the European plate. It is geodynamically very active since it comprises large volumes of volcanic products within Late Pleistocene-Holocene. Major magmatic activity began at least 160 Ka ago producing the largest eruption in the Eastern Mediterranean manifested by the "Kos ignimbrite" which covered an area of more than 3000 Km². The centre of this eruption is not known with accuracy but it is probably located in the submarine area north of Yali islet. This major caldera structure has been obscured by the younger volcanic activity and ever since several volcanic structures have been developed in the area.

Swath bathymetry

The offshore studies in the area of Nisyros-Kos islands comprise detailed multibeam bathymetric mapping carried out onboard R/V *Aegaeo* in three successive cruises during 2000, in the framework of the EC project Geowarn (IST 1999 123210). The SEABEAM 1180 (180 kHz) system was used, for depths <500m and the SEABEAM 2120 (20 kHz) system, for depths >500m. Operating the systems for totally 12 days with an average speed of 5 and 10 knots respectively, 3,500 Km² were covered from very shallow depths to great depths of 2200m. After elaborating data processing, the swath bathymetric map of Kos-Nisyros volcanic field has been created with 50m grid interval using 10m isobaths at scale 1/100,000, georeferenced to a WGS-84 ellipsoid and a Mercator projection at 38°N. Merging the two bathymetric data sets and combining the swath data with land DEMs the new DTM model of the Kos-Nisyros volcanic field has been created (Fig.1).



Morphotectonic structure of Kos-Nisyros Volcanic Field

A neotectonic graben structure which is developed in an E-W general direction, between the alpine basement of Kos Island to the

north and the alpine basement of Tilos Island to the south, is formed by a subsidence of the alpine basement rocks, of the order of 2,5 Km due to the marginal fault zones of Southern Kos and Northern Tilos. Within the tectonic graben of Nisyros and surrounding islets, there is a number of faults (1), which are limited mainly in the central part of the area creating a minor internal tectonic horst structure which is better expressed in the area of Kondelioussa islet, producing a median platform, with NE-SW and ENE-WSW general trend. The western part of this horst is composed of Mesozoic limestones in Kondelioussa islet while the eastern part, both offshore and onshore, is constructed by Quaternary volcanic formations. In the area of Nisyros and Yali islands minor faults overprint the previous ENE-WSW horst structure.

Five distinctive basins can be distinguished on both sides of the median platform of Kondelioussa and its eastern prolongation to the volcanic islands of Nisyros, Yali, Pachia, Pergousa and Strongyli. North of Kondelioussa-Nisyros platform occur: a) The Kondelioussa basin, expanding up to the western Kos platform with depths of about 550m, b) the Western Kos basin, with an average depth of 520m, among Kefalos peninsula and the islets of Yali and Pachia and c) the Eastern Kos basin, with an average sea-bottom depth of 630m separated from Western Kos basin by a relatively shallow rise between Yali and Kos with a depth of approximately 400m. South of Kondelioussa-Nisyros ridge occur: d) the northern end of the large Karpethos basin, reaching more than 2000m towards the south and e) eastwards the Tilos basin between Tilos and Nisyros with depths more than 600m.

A number of volcanic centres has been described around Nisyros Island (2, 3), developed within the neotectonic graben, in shallow areas. These are (Fig 1a): 1) The Nisyros caldera with a top of the rim at +580m and a bottom at +80m 2) The Yali Volcano which exhibits a partly submerged caldera (bottom -300m, top +170m), 3) The Strongyli Volcanic Cone, which starts from -650m depth of the sea-bottom up to +120m 4) The submarine caldera northeast of Strongyli in the depth of -670m up to -590m, 5) The Pergousa Volcanic Cone (bottom -400m, top +100m), 6) The domes of Prophitis Ilias (bottom -270m, top +698m), 7) The volcanic domes of Pachia Islet (bottom -250m, top +150m), and 8) the submarine volcanic domes to the east of Kondelioussa Islet (bottom -400m, top -80m). The lack of sediments overlying the volcanic domes indicates their very young age, ranging between Upper Pleistocene and Holocene.

References

- 1 - Nomikou, P., Papanikolaou, D., 2000. Active geodynamics at Nisyros, the eastern edge of the aegean volcanic arc: emphasis on the submarine survey. Proceedings of the 3rd Int. Conf. Geology East. Mediterranean, Sept. 1998, pp. 97-103.
- 2 - Papanikolaou D., Nomikou P., 2001. Tectonic structure and volcanic centres at the eastern edge of the Aegean Volcanic Arc around Nisyros island. Bulletin of the Geological Society of Greece, Vol. XXXIV/1, pp. 289-296, Proceedings of the 9th International Congress, Athens, September 2001.
- 3 - Nomikou, P., Papanikolaou, D., Alexandri, M., 2003. Varying modes of submarine volcanism within the Kos-Nisyros volcanic field. Abstracts IUGG, July 2003, Sapporo, Japan.