Gas charged sediments in the Aegean and Ionian Seas

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The Aegean and Ionian seas are parts of the Hellenic Arc-Trench system which is located within one of the world's most seismically active zones (MC KENZIE, 1972) and has experienced extreme tectonism through Tertiary and Quaternary times. Normal planar and listric faults which have been active since Pliocene are responsible for the formation of shallow and deep basins (Corinth and Patras gulfs, Trichonis lake, Amvrakikos gulf, Sporades basin) with high rates of uplift and subsidence and resulting high rates of erosion and deposition.

During the last ten years seismic surveys in various environments in the Aegean and Ionian seas revealed anomalous acoustic characters (acoustic turbid zones, gas pockets, gas plumes, enhanced reflectors, columnar disturbances, wipe outs) and meso to micro morphological features (pockmarks, domes mud volcanoes, elongated depressions) which were attributed to the presence of gas in sediment interstices (FERENTINOS, 1991). They usually occur in water depths less than 250 m. The gas charged sediments are found in (i) Pleistocene and present-day deltaic environments (ii) Pleistocene and present-day fjord-like environments (iii) lakes (iv) open sea environments.

Pleistocene and present-day deltaic deposits (foresets and bottomsets) in Amvrakikos gulf, Patras gulf and NW Aegean shelf are gas charged as is suggested by the acoustic turbidity, the enhanced reflectors, the gas plumes and mid-water reflections in 3,5 KHz profiles. Slides affecting these deposits and underlain gases suggest a cause-and-effect relationship. No pockmarks are found in these environments.

The Quaternary sedimentary cover of the Amvrakikos and Patras gulfs which represent present-day and Pleistocene fjord-like environments, respectively contains gas which is very often in the form of gas pockets and gas plumes and produce intrasedimentary and seabed small relief doming. Gas plumes migrating along active fault planes or seeping through the seabed to the water column were observed on the seismic records. Seabed displacements due to faulting are sometimes associated with depressions which follow the trace of the faults for some distance. According to HOVLAND (1984) we assumed that they are elongated depressions caused by the violent escape of gas via fault planes. In Amvrakikos gulf buried pockmarks (paleopockmarks) were identified in 3,5 KHz profiles.

Open sea environments where gas has been detected in the sediments are the NW shelf of the Aegean sea and the NE shelf of the Ionian sea (Corfu island). In the NW Aegean shelf the gas is found in Plio-Quaternary grabens and near fault planes. In the NW Ionian shelf the gas is associated with salt domes.

Gas has also been found in Trichonis take as it is indicated by the acoustic turbidity which appears in the sediments all over the lake.

Since big rivers and streams discharge into the aforementioned environments the gas is expected to be of biogenic origin. Only in the NW Ionian shelf and in the NW Aegean shelf where gas is found in association with salt domes and appears to migrate from deep horizons respectively, it is believed to be of thermogenic origin.

Grain size analysis of samples taken from all these environments reveals that although the seafloor is favourable for formation of pockmarks, their occurence in seismic records was very scarce. This may be due to the high seismicity which characterise these regions. The internal pressures are expanded by the cyclic loading of the seismic waves destabilizing the granular framework and thus cause the gas to release.

A rather unique acoustic character which has not been previously described in the literature was recognised in seismic profiles in Corfu shelf, Trichonis lake and Amvrakikos and Patras gulfs. Coarse-grained beds in parallel lying sedimentary sequences, giving rise to strong echo returns, sometimes seem to be laterally interrupted and producing intermittent reflectors with a permanent rhomboid shape for some distance. Because this acoustic character is found in relation with gas charged sediments it may be possible that upward migration of small amounts of gases disrupt the texture of the sediments and contemporary acoustic phenomena contribute for this acoustic response.

Vertically migrated gases around diapirs or faults may found porous horizons, and be expulsed producing coherent reflections of increased intensity or acoustic turbidity over short distances around these structures. Thus, is concluded that not only vertical seepage but also lateral migration of gases in permeable beds can create enhanced reflectors in seismic records.

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