GEOPOLITICS OF ENERGY IN THE KASTELORIZO - CYPRUS – MIDDLE EAST COMPLEX: BASED ON THE EXISTING GEOPHYSICAL AND GEOLOGICAL INDICATIONS OF HYDROCARBON DEPOSITS.

Professor Ioannis Th. Mazis
Professor of Economic Geography, National and Kapodistrian University of Athens, Dept of Turkish and Modern Asian Studies
Email: mazis@her.forthnet.gr
and
Dr. Georgios – Alexandros Sgouros
National and Kapodistrian University of Athens, Laboratory of Marine Geo-environment & Sedimentology, Dept. of Geology and Geo environment.
Email: gesgour@geol.uoa.gr

Abstract:

The geophysical and geological submarine features (pockmarks, gas chimneys, salt domes, etc).,identified by multi-beam echosounders and sidescan sonars ,seismic surveys in the region South, South-west and South-east of Cyprus, as well as the corresponding international interest of investors, especially in the marine region of the Levantine Basin, lead to the conclusion that, from a geopolitical standpoint, Greece must be urged to accelerate the consolidation of its sovereign rights and understand anew and in practical terms, that "Cyprus is not far away, not at all actually". With respect to Kastelorizo and the submarine area of its EEZ, we note that detailed geophysical and bathymetric surveys have confirmed the fact that the region of the submarine Anaximander Mountains presents active mud volcanoes that are linked to the presence of gas hydrates. Samples of gas hydrates were collected by means of indicative samplings in mud volcanoes thoroughly mapped in sub-seabed layers that do not exceed 1.5 m. These "ice-crystal" like features will probably have a significant socioeconomic impact in the near feature as an energy resource. New mud volcanoes were also discovered ("Athens" and "Thessaloniki"). Gas hydrates were found in samplings conducted in the "Thessaloniki" M.V. According to preliminary assessments, the total capacity of the mud volcanoes of the Anaximander mountains complex is estimated between 2.56 - 6.40 c. km.

Keywords: Geopolitics of Energy, Cyprus, Israel, Levantine, multi-beam echosounders, side scan sonars, pockmarks, gas chimneys, salt domes, Exclusive Economic Zone/EEZ.

1. Indications of fluid seeps in deep water environments

Indications of fluid hydrocarbon seabed seeps detected in offshore areas have increased considerably with the evolvement of acoustic imagery/sub bottom profile (survey) systems and geo-morphological imagery technologies from the 1970's until today (Hovland et al., 1998, Milkov, 2000, Kopf, 2002). These phenomena, usually referred to as "cold vents" and "cold mud volcanism", have been observed in various regions of different physiography, varying from accretionary wedges in active margins up to salt-bearing passive margin segments, shelves, and deep-sea fans. Submarine mud domes and cold seeps were observed for the first time, at the convergence boundaries of the lithospheric plates (Deville et al, 2003, Griboulard et al., 1998, Griboulard et al., 1991) or for example at the Mediterranean Ridge accretionary wedge (Cita et al, 1981, Cita et al, 1989, Limonov et al, 1994). The cold seep emissions are substantially differentiated, whether they spurt from the seabed and are diffused into the marine environment, or they are gathered through seeps and vents, and probably altered considerably in time. In regions with compressive settings, the thrust planes were considered until recently as fundamental factors of seep emissions to the seabed (Camerlenghi et al, 1995). The case of Eastern Makran (Pakistan) is reported as an example in literature, where according to recent data most mud domes are located above transcurrent faults which are also consequences of accretionary wedges fast growth (Rabaute et al, 2005). The passive continental margins are also identified as regions of a possible appearance of important fluid seeps. Mud volcanoes and the seeps linked to them have been observed in regions with important sedimentation (e.g. Mississippi, the Delta of Niger and Nile) (Hovland et al., 1996, Milkov, 2000, Milkov et al., 2000), where fluid seeps and gas emissions on the seabed are most probably due to tectonic factors. Special structures, such as deep channels, most probably release large quantities of fluid quite early as far as the historical development of their burial is concerned (Gay, 2002). All these regions present a high fluid production of biogenous or thermogenous origin (or even both simultaneously).

1.a. The geographical distribution and geophysical indications of seeps in the Eastern Mediterranean

The indications originate mainly from data gathered by multibeam echosounders, which produce high resolution mapping of the seabed morphology and by seismic surveys that have taken place in the Eastern Mediterranean region in recent years.

Modern technology has proved to be a great help in the attempt to locate hydrocarbon seeps as it is based mainly on the alteration of physical attributes of the seabed's surface sediment structures and on the alteration of its local morphology, creating, for example, mud domes and volcanoes or -instead of the previously mentioned elevations- abrupt depressions (e.g. caldera formations). All these formations are henceforth easily recognisable on the seabed due to the high definition attributes of echosounding systems, as well as to the recordings of back scattering signals from sidescan sonars (Behrens, 1998, Bryant et al., 1990, Neurauter et al., 1994).

The presence of hydrocarbons also leaves a characteristic "signature" in the acoustic imagery recordings of the back scattering signal from seismic soundings (Sager et al., 2003, Anderson et al, 1990, Blondel, 1997, Bryant et al., 1990). A general characteristic is that any emission of fluid seep, and the authigenic carbonate crust linked to cold seeps, generally scatters the acoustic energy in a circular or elliptic manner (Sager et al, 1999). From core analyses it recently became evident that the strengthening returns from the seabed are also owed to seep matter (oil and natural gas) located on surface or subsurface sediments, increasing the seabed's acoustic reflection and that of the surface sedimentary cover. On the contrary, regions with low back scattering signal strength, indicate non degraded regions with semi-pelagic sediment. In certain regions, the low back scattering signal, is linked to brine pools on the seabed (Huguen, 2001, Woodside et al., 1996). Many authors link the high reflectivity with mud volcano activity, as in the case of the Mediterranean Ridge (Sager et al, 1996, Woodside et al., 1996). On seismic reflections, standard hydrocarbon seeps are characterized by loss of the seismic signal due to high concentration of gases in the sediments. In the Nile Deep-sea Fan (NDSF), acoustic transparent sections reported in literature as gas chimneys, are relatively frequent (Barsoum et al, 2000, Mascle et al., 2002).

1. b. Reports on fluid seeps in the Eastern Mediterranean

In the Eastern Mediterranean region, there is an abundance of mud volcanoes and hydrocarbon seeps, particularly in the Mediterranean Ridge (MR) region (Figure 1) that are considered to be directly linked to active compressional and transcurrent, tectonic lineaments (Camerlenghi et al, 1995, Huguen, 2001, Woodside et al, 1994).

From geophysical and geological surveys carried out in 1998 and in 2000 on the Nile boundary, more than 150 mud cones were found and characterized, as well as an abundance of large and small spot-like craters (pockmarks and mounds), in the Nile Deep Sea Fan system. At approximately the same time period, there were also reports on the discovery of several active gas chimneys along the higher seawall of the NDSF, while in 2001 indications of cold hydrocarbon seeps appeared, which are linked to minor (of a diameter smaller than 10m) mud mounds and authigenic carbonate crusts (Coleman et al., 2001). (Fig. 1.1)

Finally, the existence of pockmarks is demonstrated – probably associated to faults – in the mountain of Eratosthenes, a large disrupted plateau-like relief that connects the NDSF system in the North-east (Dimitrov et al, 2003). (Fig. 1.2 and 1.3.).

***Fig.1**. Geodynamic description of the Eastern Mediterranean Basin. Mediterranean Ridge (MR). . (Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*

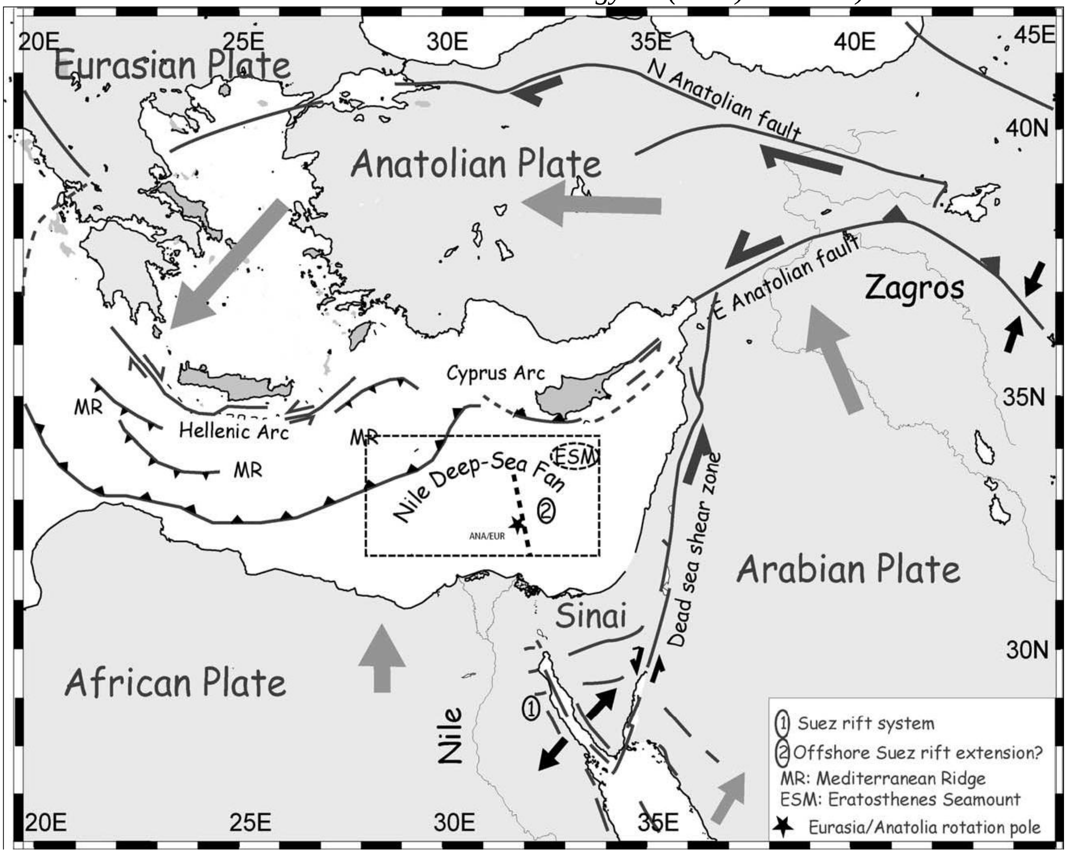


***Fig. 1.1** Schematic interpretation of hydrocarbon seeps in the Eastern Mediterranean basin. . (Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*

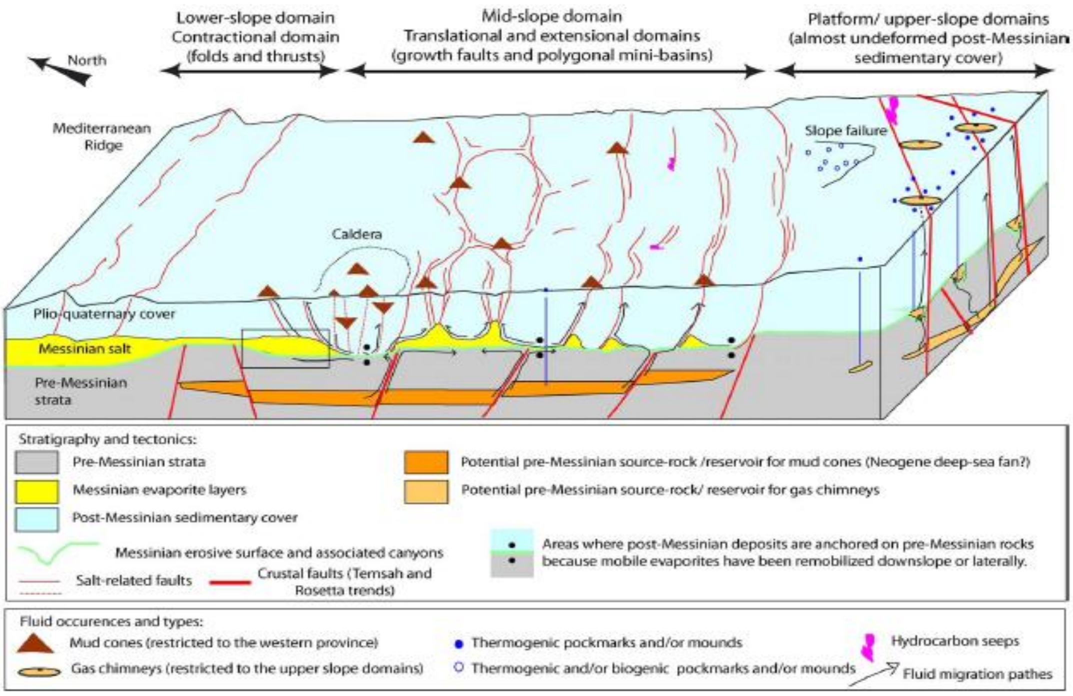


Fig. 1.2 *Multibeam backscattering image of the Eastern Mediterranean basin. The interrupted line represents is the extension of the southern limit of the Messinian Salinity Crisis. (Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*

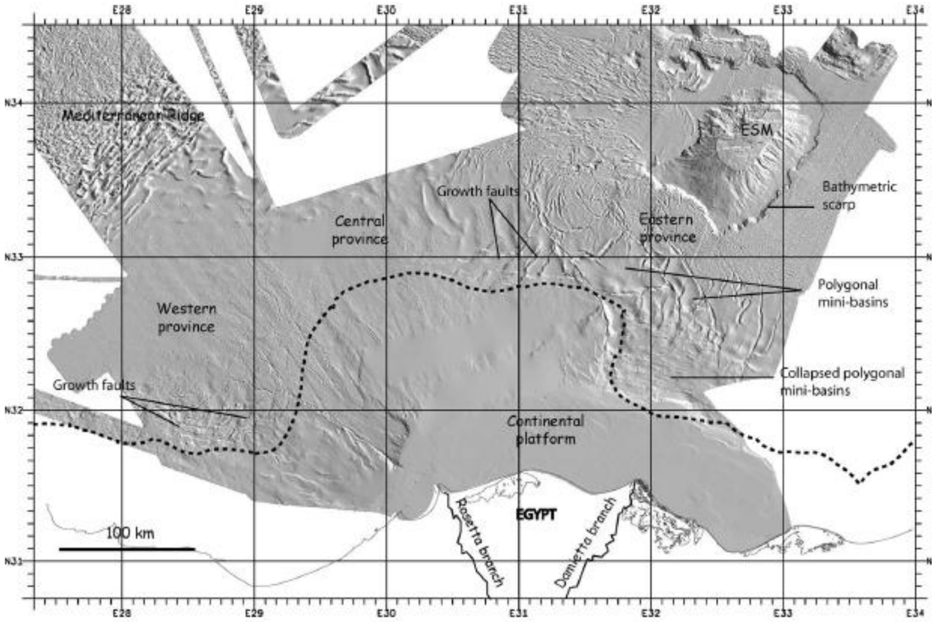
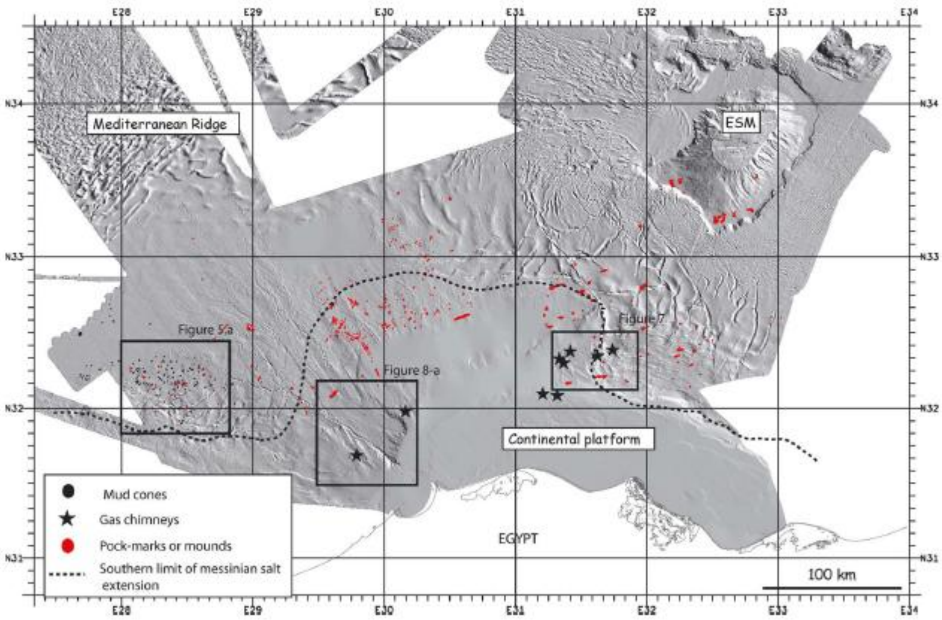


Fig. 1.3. *Geomorphological indications of hydrocarbon seeps on the seabed surface in the Eastern Mediterranean region. (Legend: ESM: Eratosthenes Mountain. (Mud Cones, Gas Chimneys, Pockmarks, Mounds),(Source: L. Loncke et al. / Marine and Petroleum Geology 21 (2004) 669–689)*



1.c. The offshore area between Cyprus – Egypt with respect to hydrocarbon potential

All the geophysical indications for the existence of hydrocarbons in the broader region of the Eastern Mediterranean and more specifically in the offshore area between Cyprus and Egypt have been well known up to 2004 (Loncke et al., 2004). The Eastern Mediterranean region and particularly that between Cyprus and Egypt has been systematically explored during the last 10 years by petroleum companies and currently stands for an oil and natural gas producing site. Up until the year 2000, natural gas (mainly) and oil reserves -corresponding to 3.8 billion barrels- have been discovered (Abdel et al., 2000 and 2001, Samuel et al, 2003). The main source is located either in the Upper

Cretaceous (black shales), in gas-rich sediments of the Miocene, or even in Pleistocene sapropyl with exceptionally high TOC (Total Organic Carbon) values. It appears that reservoirs are mainly located in land deposits of the Miocene and in channel clusters of the Pleistocene (Samuel et al, 2003). On the seabed surface, incidents of high quality hydrocarbon seeps have been discovered, mainly above large fracture zones in the Eastern section of the NDSF. The presence of hydrocarbon seeps is most probably linked to recent sapropyl degradation (Coleman et al., 2001)·

2. Petroleum and natural gas reserves in the Eastern Mediterranean

The land and offshore area of the Eastern Mediterranean Basin (Figure 1.3.) has proved to be quite promising for hydrocarbon production. As stated in numerous publications, up until December of 2006, the oil reserves were 15 bbl and 100 tcf of natural gas. The basin's tectonic development has been interpreted according to the following stages (Peck, 2008) (Figure 2):

- A period of compression-generated tectonic pit formation (Late Triassic to Early Jurassic).
- Middle Jurassic to Early Cretaceous sag period.
- A period of alpic reversal (Late Cretaceous to Early Palaeogene period).
- An internal plate settlement period (Late Palaeogene to Miocene) which is characterised by:
  - — The Suez Golf Tectonic pit (Oligo – Miocene).
  - — The Red Sea Tectonic pit.
  - — The Salinity Crisis (Messinian).
- Flood Period (Pliocene).

The hydrocarbon reserves are distributed in three broader and proven oil systems (Systems A, B and C) (Peck, 2008) (Figure 2.1.). The basin's special characteristics are the following:

Fig. 2. *Offshore Two-dimensional Seismic Measurement Program of the S/E Mediterranean (Source: TGS-NOPEC Geophysical Co).*

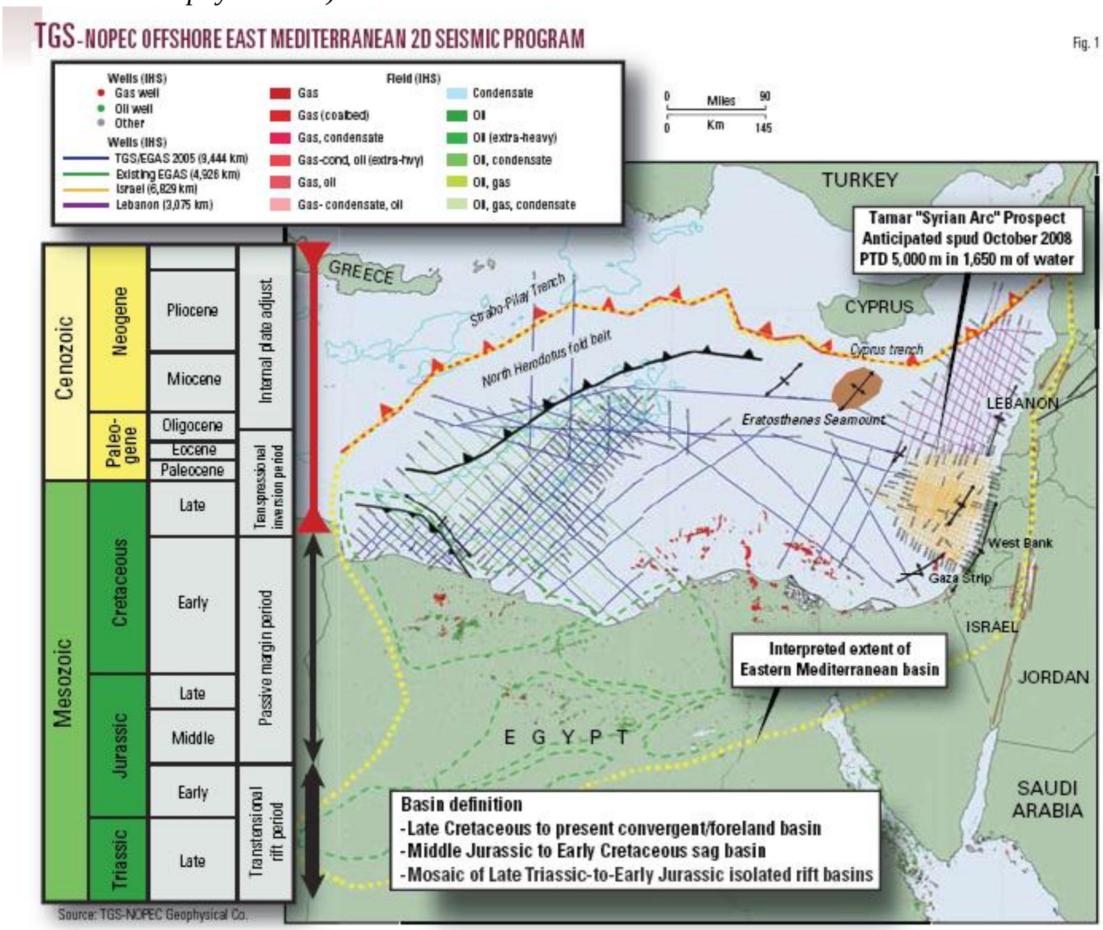
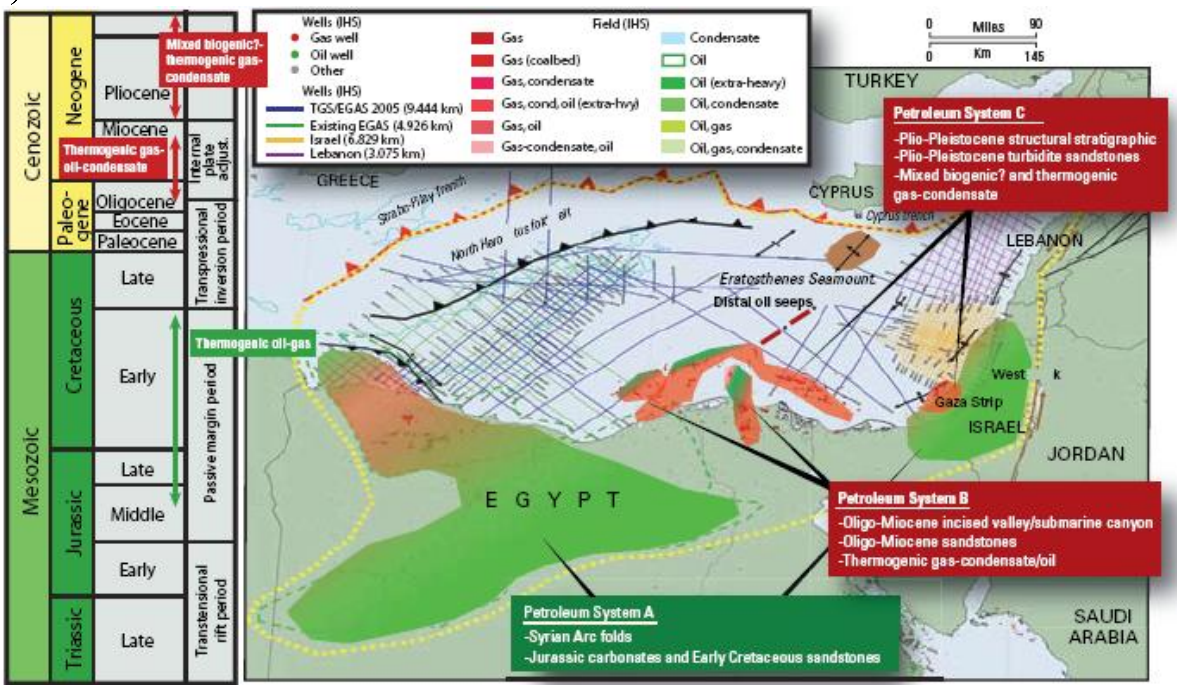


Fig. 2.1. *Petroleum Systems of the S/E Mediterranean: A, B and C (Source: TGS-NOPEC Geophysical Co).*



The offshore section of system C, parts of which are located in front of the Nile and Gaza, are mainly characterized by natural gas reserves. All Pleo-Pleistocene natural gas reserves are close to almost vertical palaeo-fractures extending throughout the length of the layer column. According to company reports, oil seeps from the seabed are linked to the previously mentioned palaeo-fractures that begin from the Mesozoic section until the corresponding Cainozoic (including the Messinian salinity and the overlaying Pleo-Pleistocene section) (Cf. Fig. 2.1.).

In spite of the abundance of Eastern Mediterranean Basin (EMB) reserves, based on the collected literature, the degree to which the deep section of the basin has been researched is unknown. Between 2001 and 2005, TGS-NOPEC Geophysical Co. acquired the data which concern the two-dimensional, 19.256 km long seismic recordings off the coasts of Lebanon, Israel and Egypt. (Figure 2.1).

The company also reprocessed the seismic recording data for a length of 4.526 km, whose rights are held by the EGAS and refer to the offshore region north of Egypt (Figure 2.1).

We must point out for reasons of seismic data reliability, that their linking to data acquired by means of offshore drillings (up to the Mesozoic period) was achieved. All the drillings are relatively close to the coastlines of Egypt and Israel.

3. Mud Volcanoes and gas hydrates in the region south of Kastelorizo

As mentioned in recent publications regarding the region of the Anaximander Mountains: “Detailed geophysical, bathymetric and sediment surveys have confirmed the fact that the region of the submarine Anaximander mountains presents active mud volcanoes that are linked to the presence of gas hydrates” (Lykoussis et al, 2009).

Samples of gas hydrates were collected by means of indicative samplings in mud volcanoes thoroughly mapped in sub-seabed layers that do not exceed 1.5 m. Their form is “ice-crystal”. New mud volcanoes were also discovered (“Athens” and “Thessaloniki”). Gas hydrates were found in samplings conducted in the “Thessaloniki” M.V.

According to preliminary assessments, the total mud volcanoes capacity of the Anaximander mountains complex ranges between 2.56 - 6.40 c. Km (Lykoussis et al, 2009).”

3.1 General description

Mud volcanoes are a sovereign geological mechanism for the escape of gases of hydrocarbons in deeply buried sediments. They are mainly located in subduction and orogenic areas where tectonic compressional tendencies are dominant (Milkov et al, 2000, Mascle et al, 1999). Mud volcanoes are linked to the presence of solid gas hydrates which constitute a possible source of an exploitable natural resource but also an environmental pollutant (Woodside et al, 1997, Woodside et al, 1998). The presence of mud volcanoes in the Eastern Mediterranean is widespread in several points of the Mediterranean Ridge (Figure 3.).

Their creation is owed to mud seeps hyperpressured by overlaying methane gas layers, which "spring up" via distorted sediments and reach the seabed surface forming the characteristic form of a "dome". The first mud volcanoes in the Eastern Mediterranean were recorded in the decade of the 1970's (Cita et al, 1981).

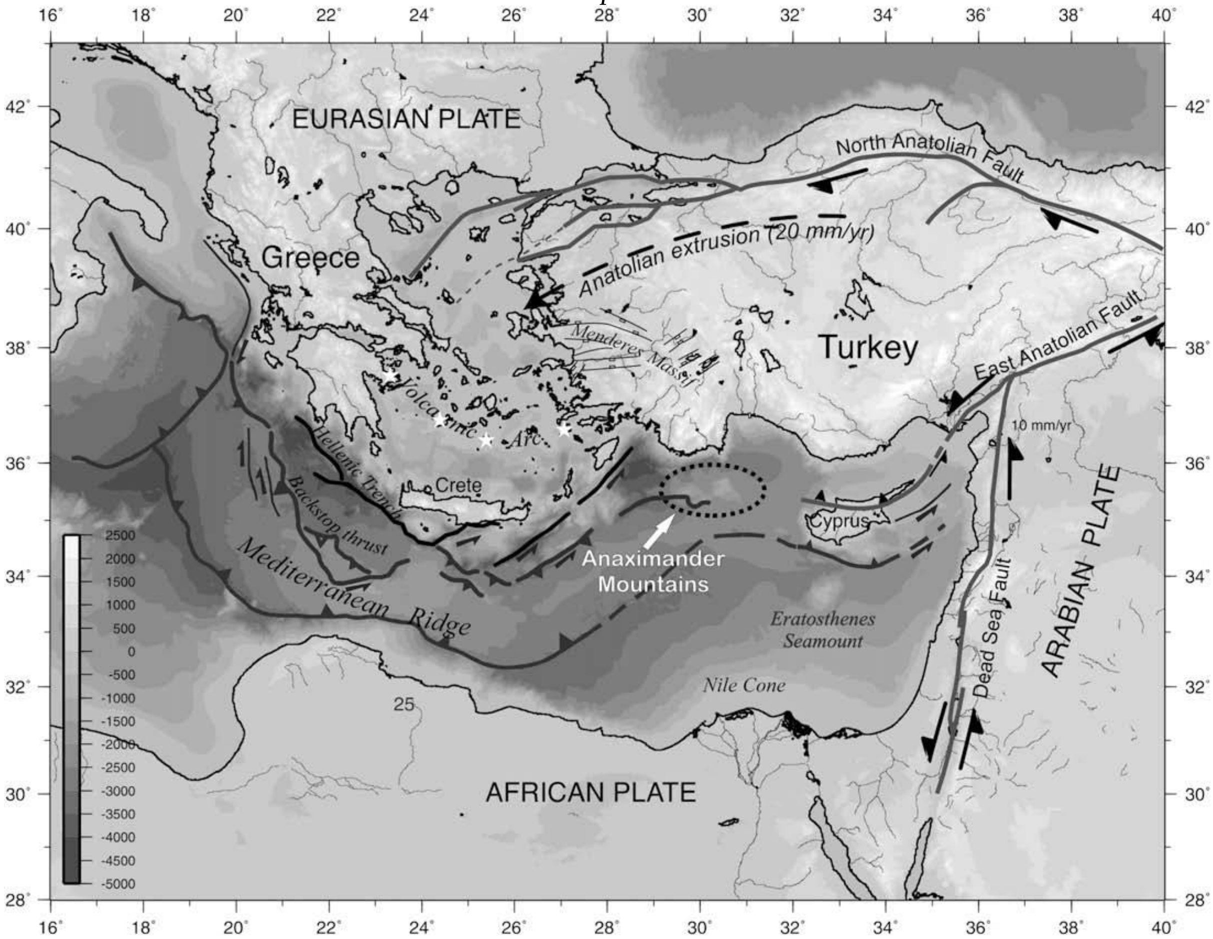
Their linking to the presence of gas hydrates boosted researching and recording them. The Anaximander mountains cluster is located in the region south of Kastelorizo (Figure 3.1) presenting a characteristic geomorphology featuring mud volcanoes and associated gas hydrates.

The region's mapping was carried out within the framework of European programs on the initiative of the INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION (Perissoratis et al., 2003), and the ANAXIMANDER program (EVK3-2001-0001233000). Following below is the description of the results from the oceanographic voyages carried out within the framework of the previously mentioned program in the years 2003 and 2004. A detailed bathymetric surveying of the seabed was conducted and seismic profiles were taken.

3.2 Area geomorphology and description

The research carried out in 2003 produced the seabed's precise morphology and the possibility to determine the sedimentary distribution from the acoustic tone's differentiations which results from analysing the backscattering signal's intensity. The bathymetric map of the region was made on a 100 metre distance grid, while in the regions of interest, the map was made on a more detailed grid of a 20 and 50 metre distance (Fig. 3.1.). The submarine mountain of Anaximenes presents a ridge-like structure with a SW – NE direction and is approximately 1300 metres long, with steep slopes. Contrarily, the mountain of Anaxagoras, which is geographically located eastwards of Anaximenes, has an almost square structure, (approximately 30 km wide and 55 km long) and a relatively irregular topographic bas-relief. Anaxagoras presents three distinguishable geomorphological units on its northern, southern and south-eastern section. The large northern structure has an arc-shaped form, with a slight upwards gradient until a depth less than 1000 m, with a characteristic plateau in smaller depths. The Kula mud volcano presents a downward sediment movement, via the erosive channels which terminate towards the north-west in a deep level sinking. The southern structure is an oblong ridge with a SW-NE direction, bibliographically referred to as "Faulted Ridge" (Zitter et al, 2006).

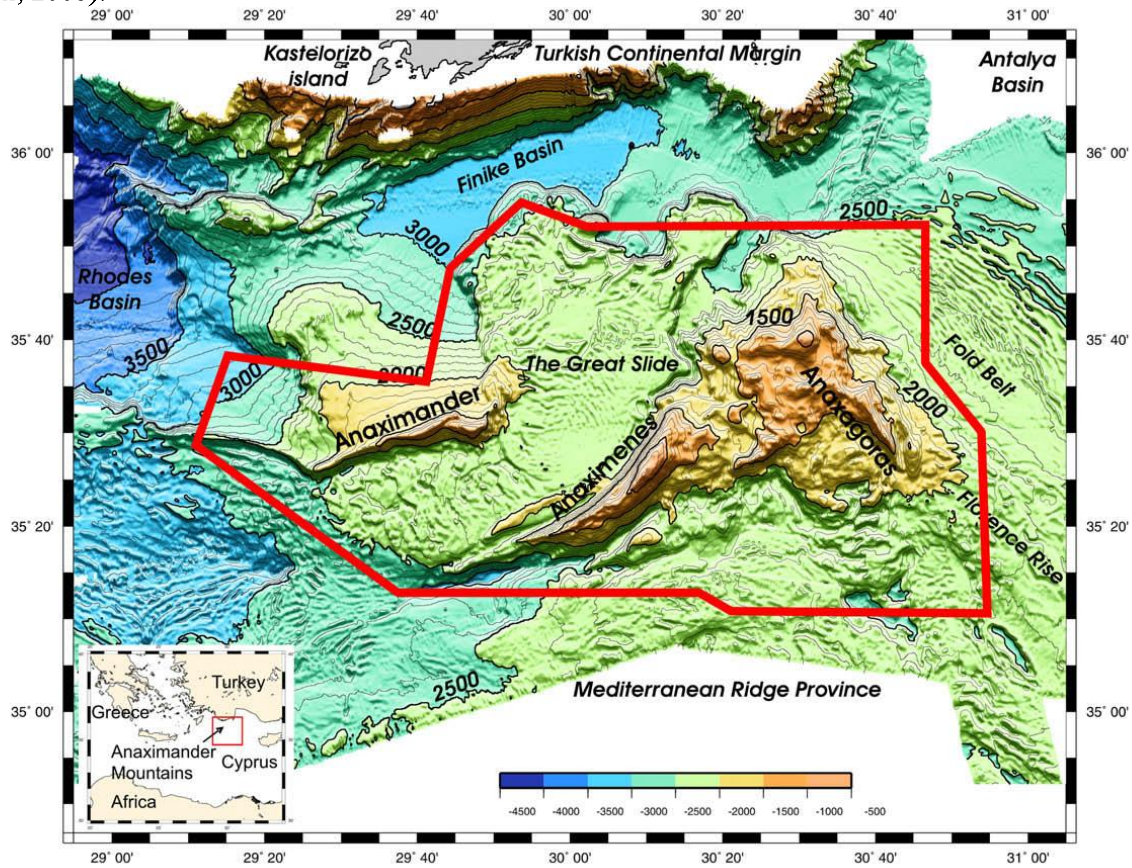
Fig.3. *General geotectonic and bathymetric map of the Eastern Mediterranean. The region of the Anaximander Mountains is marked with an interrupted line.*



Source: (Modified by MEDINAUT/ MEDINETH Shipboard Scientific Parties, 2000; Ten Veen et al., 2004 in Lykousis et al, 2009.).

North of Anaxagoras and northeast of Anaximenes, a linear sinusoidal subduction is formed (Fig. 3.1), starting at the Anaximenes front, with a width of 300 m and heading northeast, with a 10 km span that wears off between the deep basins of Antaleia and Finike Basin. A system of deep canyons, most likely created by avalanches, originates from the northwest section of Anaxagoras and develops towards the channel's east side for a 30 km distance. The closing end of the Mediterranean Rigde is apparent in the same region, in a slightly rippled area that is clearly dissociated from the complex by a deep canal south of Anaximenes, at a depth of approximately 2800 m.

Fig.3.1 *Anaximander Mountains region, S-SE of Kastelorizo (Woodside et al, 1997, 1998;* in *Lykousis et al, 2009).*



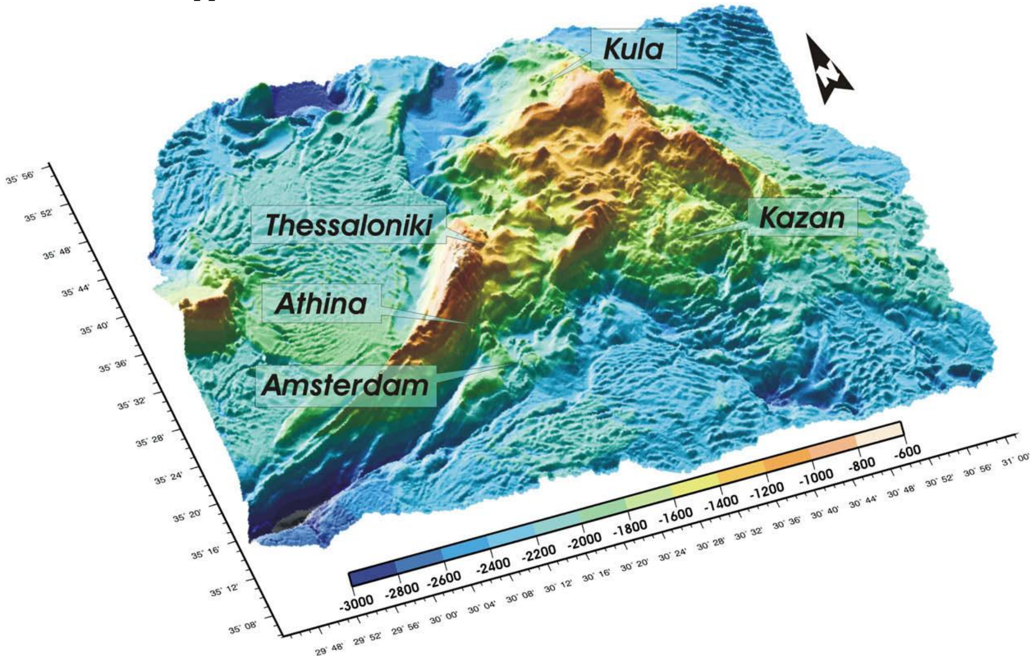
3.3 Description of mud volcanoes[1]

3.3.1. Amsterdam

It features a flat projection of 6 km^2 at the south slope of Anaximenes, at a depth of 2025 m (Fig. 3.1). The detailed bathymetric bas-relief brought up two concentric craters, linked to the characteristic slope and the 400 m deep sub-sea canyon, at the southern part exceeding the depth of 2250 m. In the crater area, 27 mud samplings were taken by means of coring. No presence of pelagic sediments was noted, which indicates the active state of the mud volcano. The set of samplings also demonstrates that gas hydrates are located in the centre and the southern slope of the Amsterdam SM (fig. 3.2.-3.3). Gas hydrates were located at a depth of 0.3-1.5 m, under the seabed surface. Particularly in the case of this specific mud volcano, it must be reported that the seismic profiles revealed a layer, located 40 m under the seabed surface, directly related to highest limit of gas hydrates. The lowest limit of gas hydrates' stability zone is most likely located at approximately 200 m (Woodside et al., 2003). Based on the topographic bas-relief and sampling, the gas hydrates territorial expansion is estimated at 26-28 km^2.

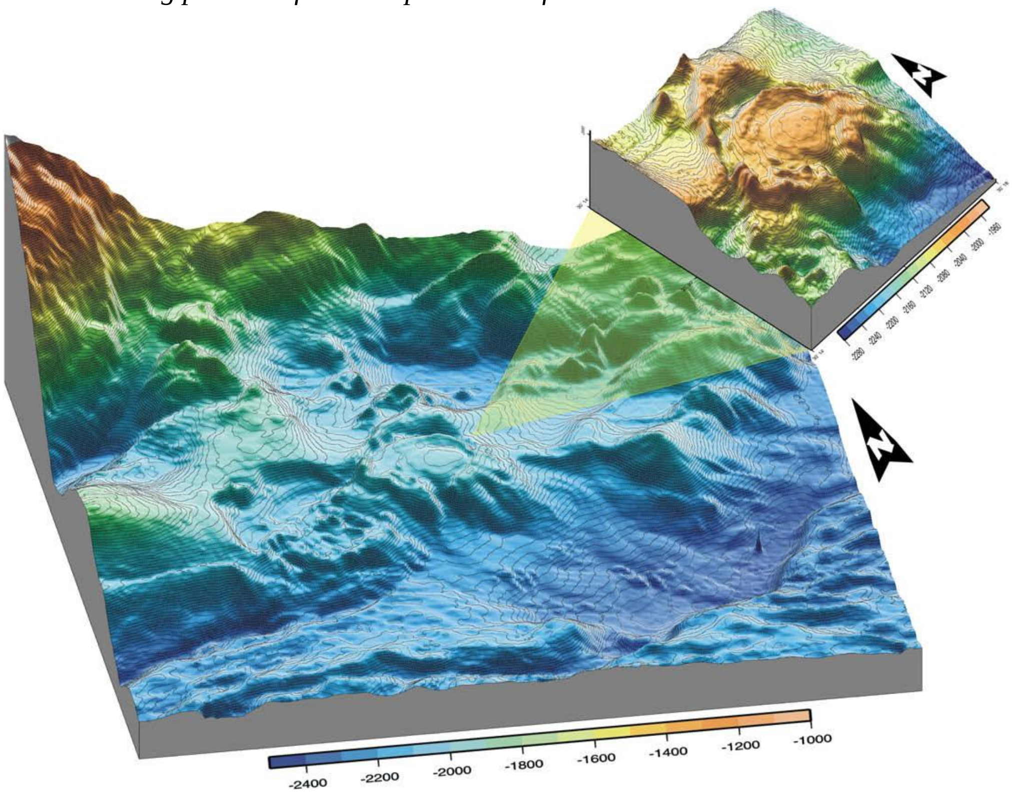
[1] Paragraph 3 describes the physiography of the region and the findings in order to serve the geopolitical view of the authors for the political conclusion that follows. A thorough and more detailed description for the region is found in Lykoyssis et al, 2009.

Fig. 3.2 *Mud volcanoes mapped at the Anaximander mountain*



Source: Lykousis et al, 2009

Fig. 3.3 *Generic and more detailed 3-D bathymetry map. Amsterdam mud volcano. The map clearly illustrates the avalanching process of mud seeps directed from N-NW to S-SE.*



Source: Lykousis et al, 2009

Fig.3.4 *Micro-topographic depiction with shadding of the Amsterdam mud volcano. Sampling locations and points of discovered gas hydrates are identified. 5 cm isobaths.*

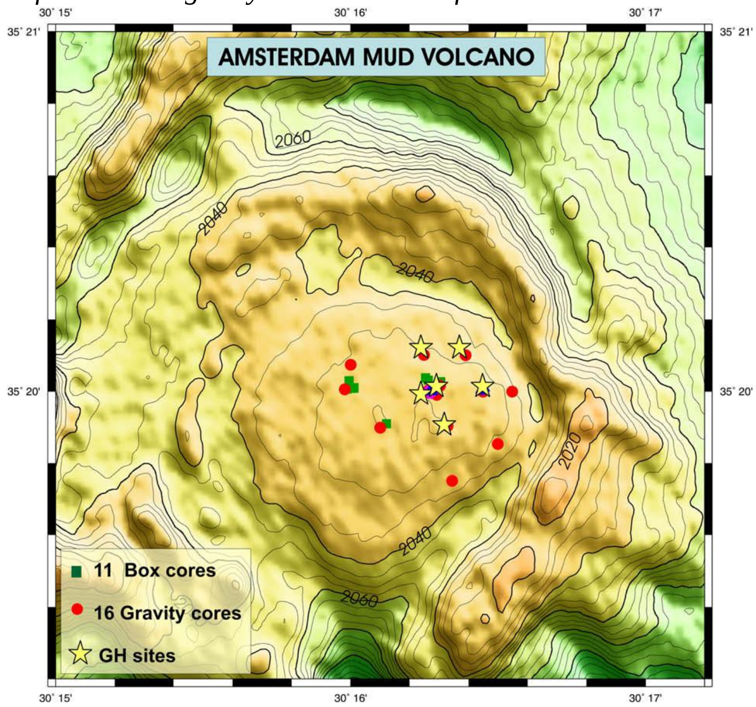


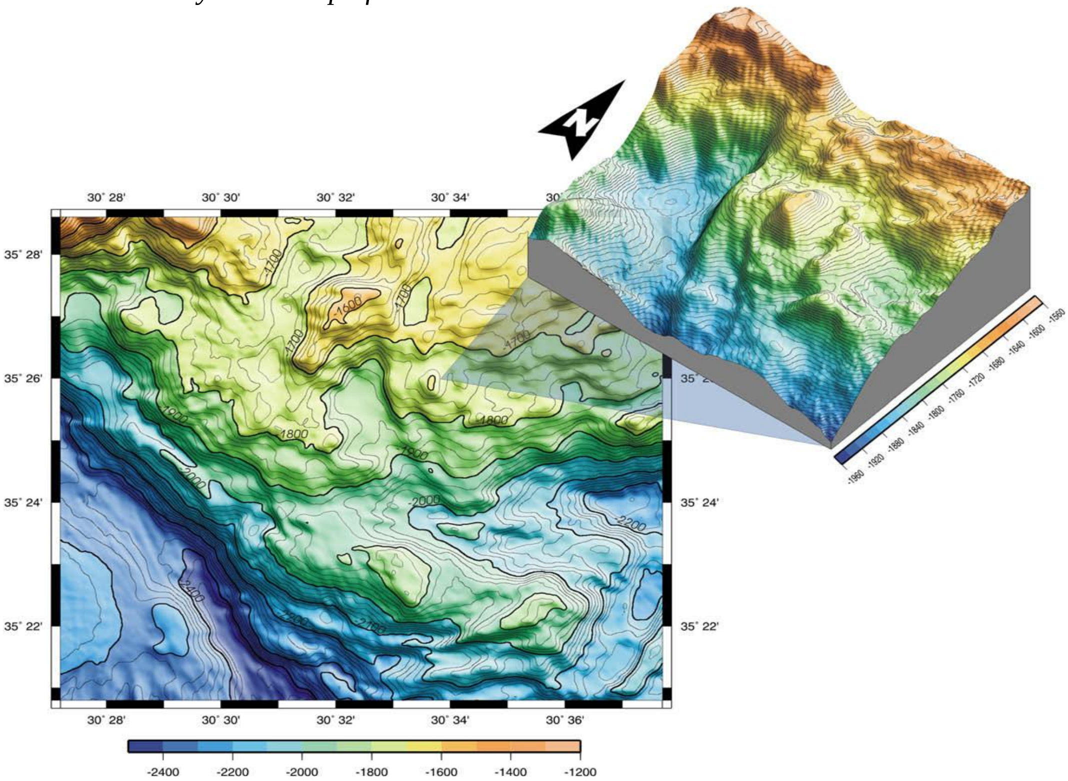
Fig.3.5 *Gas hydrates (8, 5 and 4 cm)(centre) from the Amsterdam mud volcano. Consecutive measurements after retrieving the core receivers produced min. temperatures of 3-4^{o}C.*

Source: Lykousis et al, 2009

3.3.2. Kazan

The Kazan mud volcano is approximately 50 m tall, located at the edge of a relatively level flattened area, at a depth of 1750 m (Fig. 3.8). It stands at the southern rib of Anaxagoras SM and eastwards of a major fault zone NW-SE separating Anaximenes from Anaxagoras. It presents an oval dome-like shape, aligned to the North-West axis. Its detailed bathymetric depiction clearly demonstrates the avalanching subduction at its sub-circular structure. The back scattering signal's intensity, as recorded by the multi-beam echosounder, varies significantly in the surrounding area. No smooth mud seeps are apparent on neighbouring slopes. High intensity values are related to the active flow of the mud volcano. The northern limit has two cuspate structures facing north, related to mud seeps towards the north. Mud hydrates were found for the first time after the original site survey/mapping. A total of 6 samples have been taken from four different points of the volcano. Gas hydrates were found at 0.3 m below the seabed surface (Fig. 3.9)

Fig 3.6 *Local 3-d bathymetric map of Kazan mud volcano*



Source: Lykousis et al, 2009

Fig. 3.7 *Micro-topographic depiction with shaded Amsterdam mud volcano. Sampling locations and points of discovered gas hydrates are identified. 5 cm isobaths.*

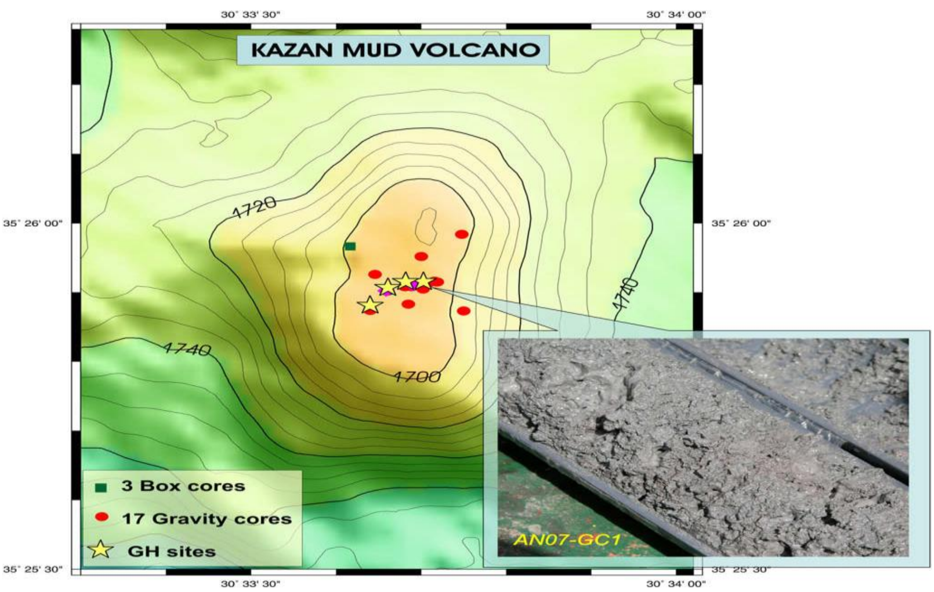
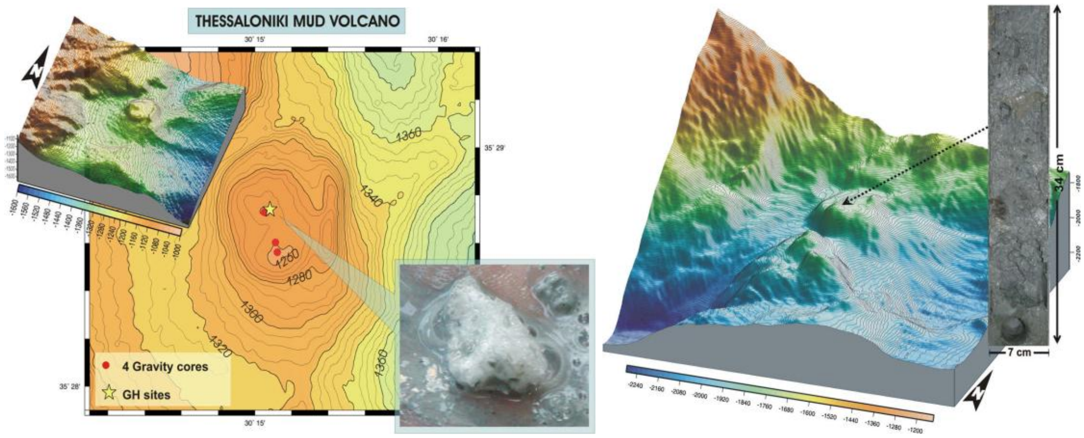


Fig.3.8 *Local 3-d bathmetric map of Athina (left) and Thessaloniki (right) mud volcano*



Source: Lykousis et al, 2009

4. History of actions and statements by interested state actors

A history of actions and statements between Turkey and Cyprus (Skordas. 2007), is presented below as it took place following determination of Cyprus Economic Exploitation Zone and subsequent concession of exploitation rights, coupled with some additional comments by the author.

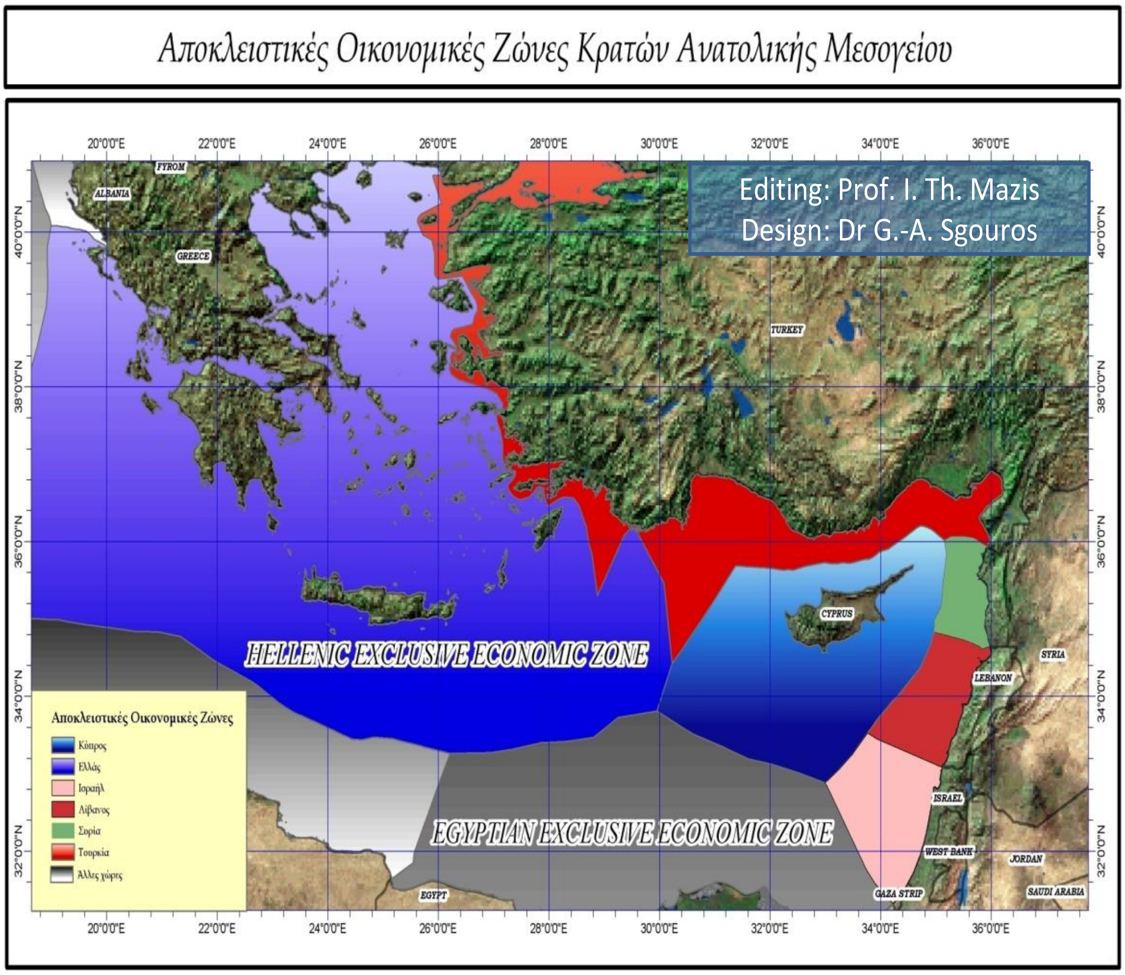
"*1. On February 17, 2003, Cyprus and Egypt signed the Agreement on the Delimitation of the Exclusive Economic Zone (EEZ). According to Article 1, paragraph 1, "the delimitation of the EEZ between the two Parties is effected by the median line of which every point is equidistant from the nearest point on the baseline of the two Parties."*

"2. A similar Agreement was signed on January 17, 2007 between Cyprus and Lebanon. In 2004, Cyprus enacted legislation for the proclamation of the EEZ extending not beyond 200 miles from the baselines from which the breadth of the territorial sea is measured, and contiguous zone, the outer limit of which should not extend beyond the 24 nautical miles from the same baselines.

"3. On February 15th 2007, Cyprus opened a bidding process to license offshore gas and oil exploration. In January 2009, a US-Israeli company announced an 88 bcm natural gas find off the coast of Haifa, according to a Reuters news article (Kambas, 2009). This company holds exploration rights for an adjacent block belonging to Cyprus' Economic Exploitation Zone. Adjacency (distance between 2 countries is merely 250 km)[2] and geological indications suggest that there may be a link between these neighboring areas with respect to hydrocarbon deposits in this region. All said exploration fields are situated in the South, Southeast and Southwest of the Island, excluding thus any issue of EEZ settlement with Turkey, as seen in Figure 4.1. "Despite this fact, Turkey has sharply protested the move by Cyprus with Greece and the United States [...]"

[2] It seems quite reasonable to have had an already existing settlement of EEZ between Israel and Republic of Cyprus.

***Fig. 4.1** Exclusive Economic Zones of Eastern Mediterranean countries (Based on the Flanders Marine Institute, Belgium Database and the Eurosion GIS Database)*



4. In its statement of January 30, 2007, Turkey argued as follows (Skordas, 2007) "…the TRNC (Turkish Republic of Northern Cyprus) also has rights and authority over the maritime areas around the Island of Cyprus. Moreover, Greek Cypriots do not represent the Island as a whole. Consequently, neither the legislation adopted nor the bilateral agreements concluded by the Greek Cypriot Authorities have any effect. In addition, it must also be kept in mind that Turkey has legitimate and legal rights and interests in the Eastern Mediterranean. Parts of the maritime areas that are subject of bilateral agreements intended to be concluded by the Greek Cypriot Authorities also concern Turkey's stated rights and interests. Turkey is determined to protect its rights and interests in the Eastern Mediterranean and will not allow any attempt to undermine them. In this context, we would like to remind those countries and companies that might consider conducting research for oil and gas exploration, based on invalid licenses Greek Cypriot Authorities may contemplate to issue for maritime areas around the Island of Cyprus, to take into account the sensitivity of the situation as well as the will of the Turkish Cypriots, the other constituent people of the Island.

"5. In a further statement of February 15, 2007, Turkey refined its position: "Accordingly, we expect the Greek Cypriot Authorities to end their calls for international tender which are not based on common understanding among the Eastern Mediterranean states, and thereby creating fait-accomplis, violating the joint rights of the two peoples on the Island on issues like oil and natural gas exploration".

"It is obvious", A. Skordas continues, "the legal arguments of Turkey are not convincing, and there does not seem to be any real legal dispute between Turkey and Cyprus with respect to the latter's EEZ delimitation agreements, apart from potentially overlapping claims on some maritime areas between Turkey and Cyprus. Instead, Turkey attempts to exercise pressure on foreign companies

and neighbouring states to indirectly undermine the effective exploration and exploitation of the resources of the EEZ."

"6. Through identical letters addressed to the United Nations (UN) Secretary General and to the President of the Security Council dated January 31, 2007 (A/61/726-S/2007/52/2 February 2007), Cyprus responded by invoking its sovereign rights: "Turkey has no right whatsoever to challenge the delimitation of the EEZ or the continental shelf between the Republic of Cyprus and its neighbouring States, in accordance with relevant provisions of international law and in areas that are neither opposite nor adjacent to Turkish coasts (...). The Government of Cyprus has no doubts about the sovereignty of the Republic of Cyprus over the maritime areas surrounding the island and the natural resources therein and rejects any claim by the Government of the Republic of Turkey to the contrary".

The United States took a cautious approach, and avoided taking sides. On February 5, 2007, the spokesman of the State Department gave the following answer:

"U.S. policy has not changed. Any dispute here is between the Republic of Cyprus [...] and Turkey. The United States is not a party to these agreements. The State Department has no recommendations as to whether American companies should participate in the bidding process. The controversy, however, points to the need for all parties to focus on re-starting the UN's good offices mission to forge a comprehensive Cyprus settlement that reunifies the island into a bi-zonal, bi-communal federation. The next step should be to implement the agreement brokered by the Under Secretary-General Gambari, July 8, 2006. A final settlement will enable all Cypriots to benefit from the island's resources".

2. Delimitation of EZZs

"Stability and viability of the EEZ delimitation agreements lies on the existing agreements between Cyprus, Egypt and Lebanon. There is no doubt that the two agreements have been concluded under international law; they become binding upon the parties by the completion of the ratification process. [...] None of them infringes upon Turkey's sovereign rights, according to the presented technical analysis.

An important issue that may amend existing agreements is the -future- way to solve the Cyprus issue[3].

If a future state of affairs in Cyprus takes shape in any form of state succession, it might be asked, whether the successor entity could claim a fundamental revision of the treaties. [...] <u>The delimitation agreements concluded by Cyprus followed the median line, which corresponds to the principle of equidistance, as recognized by the law of the sea</u>. This is an additional reason that practically precludes any future controversies on the agreed line" [emphasis added].

Therefore, further delaying of Greece to delimit its EEZ with Cyprus is deemed by Turkey as a token of laxity on behalf of Greece, whose government has already "tacitly" agreed on some sort of new state formation that will not be covered by a Greece-Cyprus delimitation based on current data.

"*The Cyprus-Egypt agreement provides for review of the existing lies in two cases*[4]*: a) if more accurate data are available, thus giving the legal right to any part to ask for redetermination of the*

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[3] To facilitate the reader, Article 83 on continental shelf is quoted:

1. The delimitation of the continental shelf between States with opposite or adjacent coasts shall be effected by agreement on the basis of international law, as referred to in Article 38 of the Statute of the International Court of Justice, in order to achieve an equitable solution.

2. If no agreement can be reached within a reasonable period of time, the States concerned shall resort to the procedures provided for in Part XV.

3. Pending agreement as provided for in paragraph 1, the States concerned, in a spirit of understanding and cooperation, shall make every effort to enter into provisional arrangements of a practical nature and, during this transitional period, not to jeopardize or hamper the reaching of the final agreement. Such arrangements shall be without prejudice to the final delimitation.

4. Where there is an agreement in force between the States concerned, questions relating to the delimitation of the continental shelf shall be determined in accordance with the provisions of that agreement.

Article 74 is identical, differentiated however by the replacement of the term "Continental shelf" with the tem EEZ. When States are adjacent or facing each other, with a distance less than 400 miles, then we have overlapping of sea limits. A useful reference covering major part of delimitation agreements until 1992 can be found in International Maritime Boundaries (Charney and Alexander, 1993), in two volumes, updated in 1996 for the third volume, edition 1998.

[4] <u>http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/regionslist.htm</u>

median line and b) the geographical coordinates […] could be reviewed / extended as necessary in light of future delimitation of EEZ with other concerned neighboring states[5] […]".

This means that should existing lines infringe upon third countries' continental shelf, the counterparts are obliged to proceed with relevant amendments.

We must also add that currently, there are natural gas deposits in the Levantine sea basin and particularly in Israel's EEZ, that US-Israeli company Noble Energy has been contracted to drill. These are the following: i) Tamar: 90 km off Haifa and at a depth of ~1680. Estimated reserves: 142 bcm. ii) Dalit: 13 km east of Tamar deposit. Estimated reserves: 14 bcm. Moreover, it has to be mentioned that hydrocarbon indications, such as pockmarks, gas chimneys etc, highlight the importance of the Levantine basin region with respect to other deposits as well.

So, it is obvious that Israeli oil interests are being covered by the EEZ delimitation between Israel and Cyprus as effected already by the late Tassos Papadopoulos' government. The alignment of Israeli and Cypriot interests in the field of sub-sea hydrocarbons may act as a solid foundation for additional points of concurrence of political-economical interests, and partnerships on security. This is made even clearer in light of two facts:

i) the significant deterioration of the Turkish-Israeli relationships and

ii) the close ties being developed between Turkey and Syria-Lebanon, via the occupied Cyprus territories, which act as transfer belts of Turkey's neo-osmanic-type power on Arabic-Muslim actors, hostile to Israel, located in the inflammable Levantine basin region.

The latter becomes increasingly apparent by the coastal connection already established between occupied Cyprus areas and Tripoli of Lebanon, calling at Lattakia of Syria, inaugurated on August 25th 2009[6].

In any case, the overall state of affairs provides the necessary and sufficient condition that may drive Greece into delimiting its own EEZ with Cyprus, thus ensuring westwards the existing favorable -and legally sound- balance in the Levantine Basin. That would be an act of utter diligence and optimum timing, although we consider it practically improbable.

References

1. Abdel Aal, A., El Barkooky, A., Gerrits, M., Meyer, H., Schwander, M., & Zaki, H. A. (2000). Tectonic evolution of the Eastern Mediterranean basin and its significance for hydrocarbon prospectivity in the ultradeepwater of the Nile delta, *The Leading Edge*, 1086–1102.
2. Abdel Aal, A., El Barkooky, A., Gerrits, M., Meyer, H., Schwander, M., & Zaki, H. A. (2001). Tectonic evolution of the Eastern Mediterranean basin and its significance for hydrocarbon prospectivity in the ultradeepwater of the Nile delta, *GeoArabia*, 6(3), 363–384.
3. Anderson, A. L., & Bryant, W. R. (1990). Gassy sediment occurrence and properties: Northern Gulf of Mexico, *Geo-Marine Letters*, 10, 209–220.
4. Barsoum, K., Della Martera, M., & Menardi Noguera, A. (2000). Gas chimneys in the Nile delta slope and gas fields occurrence. EAGE Conference on Geology and Petroleum Geology, St Julians, Malta.
5. Behrens, E. W. (1988). Geology of a continental slope oil seep, northernn Gulf of Mexico, *AAPG Bulletin*, 72, 105–114.
6. Blondel, P., & Murton, B. J. (1997). *Handbook of seafloor sonar imagery*, New York: Wiley, p.314
7. Bryant, W. R., Bryant, J. R., Feeley, M. H., & Simmons, G. R. (1990). Physiographic and bathymetric characteristics of the continental slope, northwest Gulf of Mexico, *Geo-Marine Letters*, 10, 182–199.

http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/DEPOSIT/cyp_mzn47_2004.pdf

5 The exact phrasing of the agreement in English is given in order to avoid subjective translation into Greek by the author.

6 "On Thursdays, a passenger carrier will bring 200 people with their vehicles from Tripoli, Lebanon, calling at Lattakia, Syria, to the port of [occupied] Famagusta. The return trip will be conducted on Mondays with a duration of 6 hours. [see "Ancara implements connection agreements with Lebanon, Syria, Iran and Pakistan", *Amintiki Epithehorisi (Defence Review)*, no. 81, September 2009, pg. 10-11.

8. Camerlenghi, A., Cita, M. B., Della Vedova, B., Fusi, N., Mirabile, N., & Pellis, G. (1995). Geophysical evidence of mud diapirism on the Mediterranean Ridge accretionary complex. Marine Geophysical Researches, 17, 115–141.
9. Cita, M. B., Camerlenghi, A., Erba, E., McCoy, F. W., Castadrori, D., Cazzani, A., Guasti, G., Gambastiani, M., Lucchi, R., Nolli, V., Pezzi, G., Redaelli, M., Rizzi, E., Torricelli, S., & Violanti, D. (1989). Discovery of mud diapirism in the Mediterranean Ridge, a preliminary report. Bollettino della Societa' Geologica Italiana, 108, 537–543. also in:
10. Cita, M. B., Ryan, W. B. F., & Paggi, L. (1981). Prometheus mud breccia. An example of shale diapirism in the Western Mediterranean Ridge. Annales Géologiques des Pays Helléniques, 30, 543–569.
11. Coleman, D. F., & Ballard, R. D. (2001). A highly concentrated region of cold hydrocarbon seeps in the south-eastern Mediterranean sea. Geo-Marine Letters, 21, 162–167.
12. Deville, E., Battani, A., Griboulard, R., Guerlais, S., Lallemant, S., Mascle, A., Muller, C., & Prinzhofer, A. (2003). Processes of mud volcanism in the Barbados-Trinidad compressional system (SE Caribbean): New structural and geochemical data. EGS Geophysical Research Abstracts, Nice (France), 14128.
13. Dimitrov, L. I., & Woodside, J. (2003). Deep-sea pockmark environments in the Eastern Mediterranean. Marine Geology, 195(1–4), 263–276.
14. Gay, A (2002). Les marqueurs géologiques de la migration et de l'expulsion des fluides sédimentaires sur le plancher des marges passives matures. Exemples dans le bassin du Congo. Thèse de doctorat, Université des Sciences et Technologies de Lille, Lille 1, 426 p.
15. Griboulard, R., Bobier, C., Faugeres, J. C., Huyghe, P., Gonthier, E., Odonne, F., & Welsh, R. (1998). Recent tectonic activity in the South Barbados prism Deep-towed side-scan sonar imagery. Tectonophysics, 284(1/2), 79–99.
16. Griboulard, R., Bobier, C., Faugeres, J. C., & Vernette, G. (1991). Clay diapiric structures within the strike-slip margin of the Southern leg of the Barbados prism. Tectonophysics, 192(3/4), 383–387.
17. Guerlais, S. H., Ellouz, N., Deville, E., Lallemant, S., Coletta, B., & Muller, C. (2001). Shale diapirism and mud volcanism processes in transform fault systems associated with accretionary prisms. Examples from east Makran (Pakistan) and south-east Caribbean. In Subsurface Sediment Mobilisation Conference, Gent (Belgium), p. 51.
18. Hovland, M., and Judd, A. G. (1988). Seabed pockmarks and seepages: Impact on geology, biology and the marine environment. London: Graham and Trotman, 293 p.
19. Hovland, M., Gallagher, J. W., Clennell, M. B., & Lekvam, K. (1997). Gas hydrate and free volumes in marine sediments: Example from Niger delta front. Marine and Petroleum Geology, 14(3), 245–255
20. Huguen, C. (2001). *Déformation récente a actuelle et argilo-cinèse associée au sein de la Ride Méditerranéenne (Méditerranée orientale)*, Thèse de doctorat, spécialité: Géologie Marine [Thesis, Université P. et M. Curie (Paris 6)].
21. Kambas, Michele, (2009). "Israeli Gas Find Raises Hopes in Cyprus", (Reuters) *AFX News Limited*, Thursday, Jan 22.
22. Kopf, A. (2002). Significance of mud volcanism. Reviews of Geophysics, 40(2), 1–52.
23. Loncke, L., Mascle, J., Fanil Scientific Parties (2004). Mud volcanoes, gas chimneys, pockmarks and mounds in the Nile deep-sea fan (Eastern Mediterranean): geophysical evidences, Marine *and Petroleum Geology*, 21, 669–689.
24. Limonov, A. F., Woodside, J. M., & Ivanov, M. K (1994). Mud volcanism in the Mediterranean and Black Seas and shallow structures of the Eratosthenes Seamount, Initial results of the geological and geophysical investigations during the Third UNESCO-ESF 'Training- Through-Research' Cruise of RV Gelendezhik (June–July 1993). 64, UNESCO Reports in Marine Science.
25. Lykousis, V., Alexandri, S., Woodside, J., Nomikou, P., Perissoratis, C., Sakellariou, D., de Lange, G., Dahlmann, A., Casas, D., Rousakis, G., Ballas, D., Ioakim, C., (2004). New evidence of extensive active mud volcanism in the Anaximander Mountains (Eastern Mediterranean): the ''ATHINA'' mud volcano. Environmental Geology 46, 1030–1037.

26. Mascle, J., Loncke, L., Sardou, O., Boucher, P., Felt, V., and Prismed II and Fanil scientific parties, (2002). Evidences of fluid escape structures and mud volcanoes on the Nile Deep-Sea Fan. AAPG Meeting, p. pA56.
27. Mascle, J., Huguen, C., Benhelil, J., Chamot-Rooke, N., Chaumillon, E., Foucher, J.-P., Griboulard, R., Kopf, A., Lamarche, G., Volkonskaia, A., Woodside, J., Zitter, T., (1999). Images may show start of European–African plate collision. EOS, Transactions American Geophysical Union 80, 37.
28. Milkov, A. V., & Sassen, R. (2000). Thickness of the gas hydrate stability zone, Gulf of Mexico continental slope. Marine and Petroleum Geology, 17, 981–991.
29. Milkov, A. V. (2000). Worldwide distribution of submarine mud volcanoes and associated gas hydrates. Marine Geology, 167, 29–42.
30. Neurauter, T. W., &Roberts, H. H. (1994). Three generations of mud volcanoes on the Louisiana continental slope, Geo-Marine Letters, 14, 120–125
31. Peck, J., 2008. "Giant oil prospects lie in distal portion of offshore East Mediterranean basin", *Oil & Gas Journal*, Oct 2008
32. Perissoratis, C., Amann, H., Meyn, V., De Lange, G., Kalogerakis, N., Lykoussis, V., Wooside, J., Ercilla, G., (2003). Exploring the extreme environment of the gas hydrates and the associated biosphere in the Eastern Mediterranean: the ANAXIMANDER Project. OMARC Conference, Paris, September 15–17, 2003, Conference Abstracts, 89 pp.
33. Rabaute, A., Chamot-Rooke, N., & DOTMED team, (2003). Tectonics and mud volcanism at the western Mediterranean Ridge - backstop contact. EGS Geophysical Research Abstracts, 120007.
34. Sager, W.W., MacDonald, I. R., and Rousheng, H. (2003). Geophysical signatures of mud mounds at hydrocarbon seeps on the Louisiana continental slope, northern Gulf of Mexico. *Marine Geology*, 198, 97–132.
35. Samuel, A., Kneller, B., Raslan, S., Sharp, A., & Parsons, C. (2003). "Prolific deep-marine slope channels of the Nile delta, Egypt", *AAPG Bulletin*, 87, 541–560.
36. Skordas, Achilles, 2007. "Oil Exploitation in the Eastern Mediterranean: Cyprus, Turkey and International Law", Woodrow Wilson International Centre for Scholars, http://www.wilsoncenter.org/index.cfm?fuseaction=events.event_summary&event_id=225758
37. Woodside, J. M., & Volgin, A. V. (1996). Brine pools associated with Mediterranean Ridge mud diapirs: An interpretation of echo-free patches in deep tow sidescan sonar data. Marine Geology, 132, 55–61.
38. Woodside, J.M., Ivanov, M.K., Limonov, A.F., (1997). Neotectonics and fluid flow through the seafloor sediments in the Eastern Mediterranean and Black Seas. Part I: eastern Mediterranean Sea. In: IOC Technical Series, vol. 48, pp. 1–128.
39. Woodside, J.M., Ivanov, M.K., Limonov, A.F., (1998). Shipboard Scientists of the Anaxiprobe Expeditions. Shallow gas and gas hydrates in the Anaximander Mountains region Eastern Mediterranean Sea. Henriet, J.P., Mienert, J. (Eds.), Gas Hydrates: Relevance to World Margin Stability and Climate Change. Geological Society of London, Special Publication, vol. 137, pp. 177–193.
40. Woodside, J.M., Modin, D.I., Ivanov, M.K., (2003). An enigmatic strong reflector on subbottom profile records from the Black Sea - the top of swallow gas hydrate deposits. Geo-Marine Letters 23 (3/4), 269-277.
41. Zitter, T.A.C., Huguen, C., ten Veen, J., Woodside, J.M., (2006). Tectonic control on mud volcanoes and fluid seeps in the Anaximander Mountains, eastern Mediterranean Sea. In: Dilek, Y., Pavlides, S. (Eds.), Postcollisional Tectonics and Magmatism in the Mediterranean Region and ASIA. Geological Society of America Special Paper, vol. 409, pp. 615–631, doi:10.1130/2006.2409 (28).
42. http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/regionslist.htm
43. http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/PDFFILES/DEPOSIT/cyp_mzn47_2004.pdf