Exploration and Evaluation of the Eastern Mediterranean Gas Hydrates and the the Associated Deep Biosphere - (ANAXIMANDER)

Perissoratis, C.[1], Ioakim, Chr.[1], Zacharaki, P.[1], Lykousis, V.[2], Sakellariou, D.[2], Kormas, K.[2], Woodside, J.[3], Amann, H.[4], Maggiulli, M.[4], Daehlmann, A.[5], De Lange, G.[5], Casas, D.[6], Gemma, E.[6], Meyn, V.[7], Varotsis, N.[8], Marinakis, D.[8]

[1] Institute of Geology and Mineral Exploration, Greece; [2] National Center for Marine Research, Greece; [3] Free University of Amsterdam, The Netherlands; [4] Technische Universitaet Berlin, Germany; [5] Utrecht University, The Netherlands; [6] Instituto de Ciencies del Mar, Spain; [7] Technische Universitaet Clausthal, Germany; [8] Technical University of Crete, Greece.

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Objectives

The project ANAXIMANDER[1] has its target the Exploration and Evaluation of the Gas Hydrates (GH) and the associated deep biosphere in the Anaximander sea-mountains in the Eastern Mediterranean (av. water depth 2000m, bottom water temp. 12-14°C). In this site the presence of GH has been confirmed during earlier research programs, their occurrence is near the sea bottom, and a characteristic methanophil and methanotrophic rich biota is present.

In the project appropriate and innovative coring and sampling instruments will be used in order to obtain undisturbed cores, to carry out subsampling with minimum distortion of the sediments containing GH, and to keep unaffected the associated biocommunities.

Results

During the first field work (May 2003) by the R/V AEGAEO, a detailed bathymetry of the area was obtained. Specific attention was given to three known MVs (Amsterdam, Kazan, and Kula) where high-resolution seismic (10 cu.in air gun) and bathymetric data (dense grid, low speed multibeam coverage) were obtained and selected box and gravity cores were retrieved. In addition CTD water samples were analyzed for CH_4 and other gases in order to identify active emissions.

The major results of the project up to now have been the following[2,3]:

The coring sites for the first and the second field work where defined.

The GH hosting sediments are mud flows interbedded with hemipelagic mud, with high content of clay and silt . The sand content is about 14% in the mud flows and less then 3% in the hemipelagic mud.

Micropaleontological analyses indicated a Late Cetaceous to Early-Middle Miocene age for the rock clasts present in the mud flows.

GH were sampled for the first time at Kazan MV, a third site in the Mediterranean with GH besides the known sites at Amsterdam and Kula MVs. They displayed "rice" – like appearance and a texture resembling compacted snow.

GH in layered form were sampled from Amsterdam MV at a subbottom depth of around 1m.

The last two successive mud flows identified in cores retrieved from Kula MV were estimated to have an episodicity of about 5-20 ka, based on the chronology of the sapropel and of the Y_2 tephra layer present (Cape Riva eruption).

A bottom simulating reflector (BSR) was inferred to occur at about 50-80 m below the seabed, throughout a mud flow south of Amsterdam MV.

New MVs were identified, one of which was sampled and documented as active and named "Athina".

All cores bearing GH are characterized by temperatures much lower than the ambient water temperature. The largest anomaly (16.5° C) was found in a gravity core at Amsterdam MV.

The CH_4 total concentrations in sea floor sediments are up to 800 and 1400 μmol/1 wet sediment for Amsterdam and Kazan MVs. The GH bearing gravity cores shows concentrations, of up to 3300 μmol/1 wet sediment at the core top (<60cm) decreasing towards the bottom (130 cm). CH_4 and hydrogen sulfide concentrations of selected samples revealed that the depth of anoxic methane oxidation lies at about 10 to 15 cm below seafloor.

Low salinities found decreased to 25% and 10% at Amsterdam and Kazan MV. At Amsterdam MV, CH_4 concentrations in the seawater close to the seafloor are enhanced with respect to the average seawater values by a factor of 3 to 4. A small additional plume lies at about 100-150 m above sea bottom.

The GH dissociation temperatures may vary from 14^0 C to 24^0 C. Depth-dependent GH and liberated gas composition profiles may occur in the study area.

The maximum cell concentration (95%) has the same order of magnitude in all samples while both Bacteria and Archaea Domains were present in most of the sediment layers. Presence of methanogens, was noted in three sediment layers in a core from Kazan MV.

On the basis of the geological and geotechnical data collected, a Multi Autoclave Corer with four tubes of 0,7 m length, and an Autoclave Piston Corer with a 2,7 m long core barrel are currently being modified[4] to be used for the second field work (fall 2004) in order to obtain pristine cores.

Potential exploitation by end users

The GH when decomposed can play an important role in the marine environment due to the methane that will be released, while at the same time it is a potential energy source. The results of the first year activities of the project strongly imply that the active mud volcanism and the presence of GH in the E. Mediterranean is much more extensive than previously thought. This has provoked the interest of both the decision makers and the greater public during the various presentations of the preliminary results of the Anaximander project. For this purpose the team has provided, in simplified form, these results to the responsible public agents, to decision makers and to daily newspapers where relative articles appeared.

Contact point for project: prs@igme .gr

References

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