SHORT CRUISE REPORT
RV METEOR cruise M52/2

Dates: February 4 – February 25 - March 7, 2002
Port calls. Istanbul – Limassol – Limassol
Chief scientist: Dr. Christian Hübscher, University Hamburg

The vessel preparations of RV METEOR cruise M52/2 started on February 1st with the installation of the marine gravimeter in the harbor of Istanbul. The installation was completed and finished with land gravimeter measurements for calibration purposes. The main scientist group embarked on the 3rd including 4 guests from Israel and 1 guest from Palestine (Tab. 1). METEOR left Istanbul the next day passing the Marmara Sea and the Dardanelles while heading towards to the Ageis with 22 scientists plus 2 members of the Deutscher Wetterdienst (DWD) on board. On February 7th the geophysical investigation of the Israel continental margin started with hydroacoustic (Parasound, Hydrosweep), gravity, magnetic, and multichannel seismic experiments.

The first objective of the geophysical part of the program was to reconstruct the Plio-Quaternary evolution of the continental margin of southern Israel by means of sequence stratigraphy, including interpretation of seismic data during the first project period, and modeling in the second one. The Post-Messinian sediment prism is considered to represent the easternmost deposition center for Nile derived sediments. This analysis should assist in understanding local as well as regional stratigraphic and tectonic features like strike-slip movement and constrain quantitative parameters such as subsidence, sedimentation rates and sea-level changes. Correlation of local sequence boundaries with global and Mediterranean events may provide age constraints to the processes mentioned above. The second objective was to create a 3D-model of the entire crust consisting of crystalline basement, pre-, syn-, and post-Messinian layers. This model, which will be based on potential field, refraction seismic and industry reflection seismic data, represents the tectonic frame and is crucial for any subsidence analysis.

Gravity and hydroacoustic data have been collected continuously during the entire survey (Fig. 1). Altogether 44 multi-channel seismic (MCS) lines and 2 refraction seismic lines have been measured. Brutstacks of the MCS lines have been produced onboard and are available for all MCS lines (Fig. 2).

The two refraction lines strike perpendicular to the margin. Along line 1 15 ocean bottom seismographs and 5 ocean bottom hydrophones have been deployed. In the hinterland of refraction line 1 colleagues from the Geophysical Survey of Israel installed seismometers for detection and used vibrators for generation of seismic signals. Except 1 OBS, which had a water leakage, all instruments recorded without any malfunction. Due to the missing OBS we had 19 instruments for refraction line 2. A broad band seismometer was installed in the landward prolongation of the line.

A striking observation in the reflection seismic data was that the landward termination of Messinian evaporites coincides with faults in the Plio-Quaternary sediments above. At the northern margin, where the termination is located beneath the slope, faults have been produced within the prism. Frequently pinnacle like structures can be observed on the seafloor in the vicinity of the faults. To summarise the occurrence of pinnacles it can be stated that they occur above faults or slumps. We assume that slumping or faulting interrupts stratigraphic seals, which prevent upward gas migration. At the seafloor carbonates may be produced when calcium is taken from the water column and carbon from methane. Off Haifa we investigated the tectonic

activity of the Carmel (Yagur) fault with 18 MCS lines. A newly discovered active fault proofs the tectonic activity of that region. The landward prolongation of this fault aims at the region south of Mount Carmel and was not known before.

Geological sampling of the sea floor has been carried out during the cruise in order to achieve sediment records for paleoclimatic and paleoceanographic studies. The major goal is to reconstruct the late Quaternary history of the eastern Mediterranean under the impact of the Nile. Major emphasis will be given to the reconstruction of Holocene climatic variability.

During the first part of the cruise geological sampling of the sea floor has been carried out along a bathymetric profile across the southern Israel continental slope next to refraction line 1. Seven stations have been covered by multicorer and gravity corer in water depths between 372 m and 1200 m. Core recovery of multicorer samples was between 20 and 40 cm. Core recovery of the gravity corer varied between 475 and 900 cm. In addition a single multicorer has been taken from the outer Palmachim area in order to sample a potential gas content of the sediment. A Seabird CTD has been employed together with the multicorer on several stations to identify water mass characteristics. In addition sampling of the water column has been carried out with Niskin bottles on a 1131 m station in 5 depths for the analysis of water chemistry. This geological sampling profile is considered to represent the easternmost distal area of deposition of Nile derived sediments. First core descriptions and preliminary stratigraphy suggest quite high sedimentation rates. The gravity cores contain the sedimentological record back to the mid- or even early Holocene.

On February 25th METEOR called Limassol harbor in Cyprus. The 5 guests from Israel and Palestine and 3 German scientists from the geophysics working group disembarked while 1 Egypt scientist and 1 observer from the Egypt Navy arrived as well as 2 technicians for the geology working group. Next day METEOR left Limassol steaming southwards to the Nile cone. 3 reflection seismic lines were measured right after entering the working area to get a first idea regarding the relation between the seafloor morphology and tectonics of the Messinian evaporites. During the 9 following working days of the 2nd leg of M52/2 the geophysical working group supported mainly the geology group in order to find appropriate core and sample sites. It is especially very important to image the relation of the sample site to the geometry of channel levee systems.

During the second part of the cruise geological sampling has been carried out in three different areas representing three sedimentologial and tectonically different provinces of the Nile fan. All geophysical surveys and geological sampling were performed out of the 50 nm zone off Egypt in water depths between 800 and 2600 m. Prior to geological sampling intensive bathymetric and hydroacoustic surveys with Hydrosweep and Parasound were performed to identify most suitable sampling sites. Multicorer and gravity corer were used to collected both undisturbed sediment surfaces and longer sediment cores. The multicorer recovered cores of about 30 cm while gravity cores typically ranged between 7 and 8 m. A CTD was employed together with the multicorer on 17 stations to identify water mass characteristics.

The profile in the eastern province is located on a gently deepening slope in water depths between 800 and 1400 m. The Parasound survey revealed wide areas of regularly stratified sediments. This profile was sampled by seven stations. The sediment cores of the deeper stations revealed the typical sequence of the eastern Mediterranean basin including sapropel formation. Continuous sediment records back to sapropel number 9 (S9) were identified. On three stations a rosette sampler

with 10 l Niskin bottles was used to sample the water column for geochemical analysis which will help to identify the impact of Nile derived waters on eastern Mediterranean. The sediment cores from this profile on the eastern Nile fan will be correlated to the sedimentological records across the continental slope of Israel further east. They will help to reconstruct a high resolution record of the eastern part of the Nile fan for the late Quaternary.

In the central area sediment sampling for paleoclimatic research turned out to be more difficult. Wide areas of the sea floor are characterised by rough sediment surfaces and acoustic transparent zones below. Sediment slumping occurs throughout the studied area. Two attempts to recover sediment cores from the central area in water depths of about 1500 and 1800 m revealed chemically precipitated carbonate crusts. Two further attempts on the deeper slope in 2400 and 2575 m were more successful although the sediments seem to be affected by distal turbidites from the Nile fan.

The western province of the Nile fan is characterised by a number of meandering submarine channels. Sediment transport seems to be quite active in this area. Intensive geophysical survey was needed to identify locations for geological sampling. Sediment cores were retrieved on six different stations in water depths between 1600 and 2200 m. It was also tried to sample levee deposits in detail in order to identify times of active downslope sediment transport which may be linked to sea level changes. The sediment cores from the western Nile province do not exhibit the classical sapropel formation except for sapropel number 1 (S1). Instead the late glacial period seems to be represented by high sedimentation rates and is characterised by partly finely laminated sequences. Oxygen depletion may have prevailed in the studied depth interval.

The final seismic profile grid covers the transition from the southern Eratosthenes Seamount to the Nile Cone. Messinian evaporites and the Nile derived Plio-Quaternary cover sequences stop abruptly at the southern flank of the seamount at the so-called Nile Scarp. A magnetic and gravity anomaly, indicating basement structures and the presence of low-density salt respectively mark the northern Nile Cone. All together 5 MCS lines cross the Nile Scarp to investigate tectonic activity of this region. A last sediment core was recovered during the cruise on the northern slope of the steep Nile escarpment south of Eratosthenes Seamount. A 5.9 m long gravity core revealed a condensed stratigraphic sequence characterised by hemipelagic carbonate mud.

The cruise ended in the morning of March 7th 2002 in Limassol harbour, Cyprus.

Table 1 M52/2 scientific party.

University Hamburg, Institute for Geophysics	IfG	11 persons
University Bremen, Geoscience Department	GeoB	7 persons
Alfred-Wegener-Institute, Bremerhaven	AWI	1 person
University Hamburg, Institute for Geology	IfGeol.	1 person
Umwelt- und Meerestechnik Kiel GmbH	KUM	1 person
Geophysical Survey of Israel, Jerusalem	GSI	1 person
Dead Sea Research Center, Tel Aviv	DSRC	1 person
Dept. of Earth and Planetary Science, Univ. Tel Aviv	DEPS	2 persons
An-Najah National University, Palestine Nablus	ANNU	1 person
Egyptian Navy	AN	1 person
National Inst. of Oceanography and Fisheries, Cairo	NIOF	1 person
		28 scientists
		+ 2 persons DWD

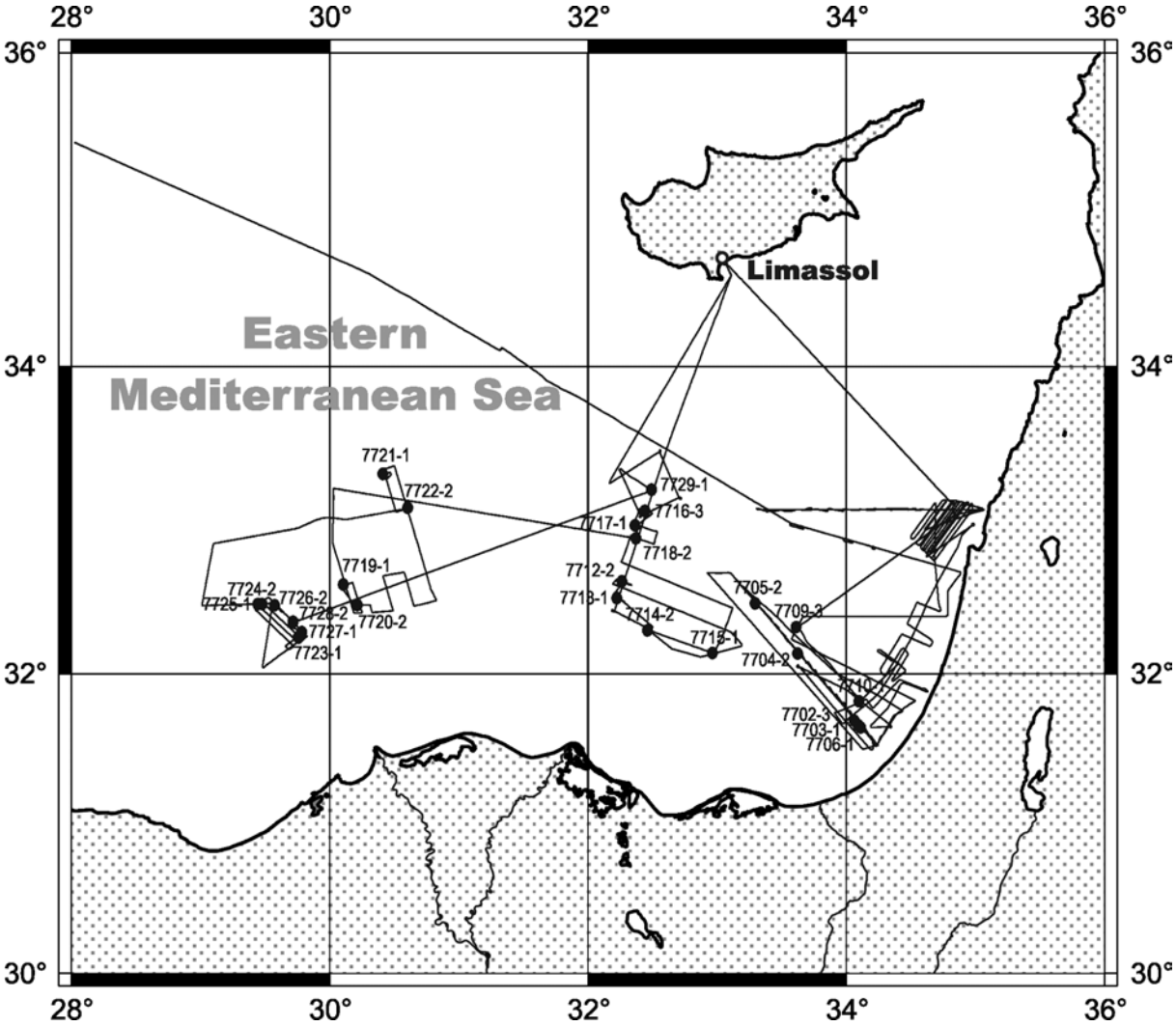

Fig. 1 Track line of RV METEOR cruise during M52/2 and geological sampling stations.

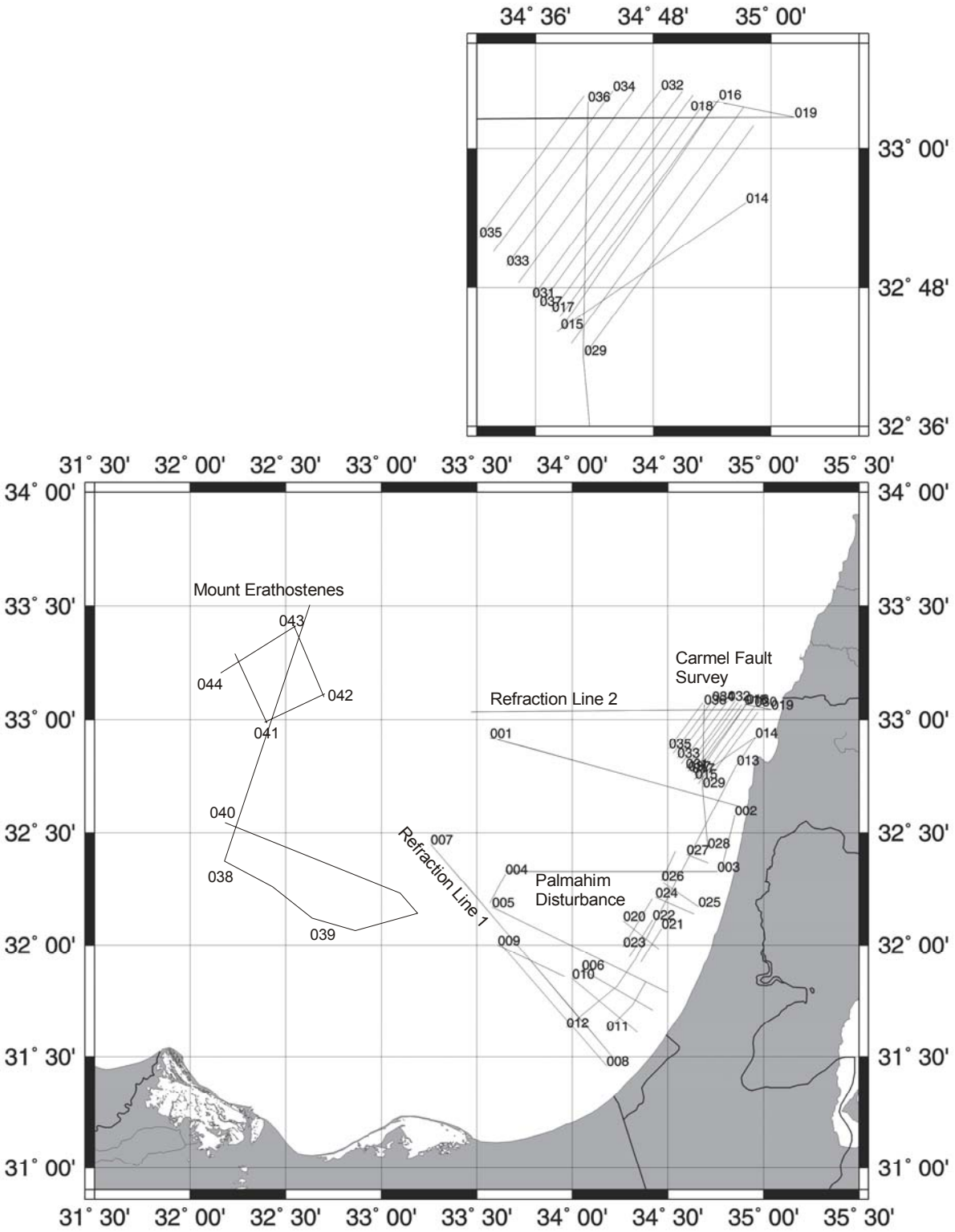

Fig. 2 Seismic lines during M52/2.