Aigner 1999). Damit lassen sich sedimentäre und stratigraphische Muster in hydrostratigraphische Einheiten übertragen.
Nach dem Konzept der "Dynamischen Stratigraphie" (Aigner et. al. 1998) wurden die Abfolgen in verschiedenen Maßstäben untersucht und quantifiziert:

(1) Mesomaßstab: Abgrenzung der Lithofaziestypen nach sedimentologischen Kriterien. Die Lithofaziestypen lassen sich in petrophysikalische Faziesgruppen zusammenfassen, die ähnliche Eigenschaften bezüglich Porosität, Permeabilität und Gamma-Ray Signatur aufweisen. Die Lithofaziestypen entsprechen also nicht gleichzeitig petrophysikalischen "rock-types".
(2) Makromaßstab: Im Aufschluß wurden 9 verschiedene Architekturelemente klassifiziert und kartiert, sowie deren Geometrien (w/t-Raten), deren sedimentären Aufbau (Fazies-Architektur) und deren Poroperm und Gamma-Ray-Eigenschaften quantifiziert. Zur dreidimensionalen Vermessung der Architekturelemente im Raum wurde ein Theodolit eingesetzt. Mit Hilfe des Georadars ließen sich Architekturelemente im Untergrund über die Aufschlußgrenzen hinweg verfolgen. Es zeigten sich stratigraphische und paläogeographische Trends bezüglich ihrem sedimentären Aufbau, ihrer petrophysikalischen Eigenschaften und ihrer Dimensionen/Geometrien. Diese sedimentären Muster lassen sich in hydrostratigraphische Muster übertragen. Zukünftige Fluid-Flow-Simulationen können auf diese Poroperm-Datenbank zurückgreifen. Eine große Auswirkung auf die Strömungsanisotropie haben die erfassten Heterogenitäten in allen Maßstabsebenen (Leckagen, Kommunikation der Sandsteinkörper und Aquiferstockwerksbildung).
(3) Megamaßstab: Die im Aufschluß und durch Subsurface-Kartierungen festgestellten Trends und sedimentären Stapelungsmuster lassen sich überregional weiter verfolgen, wobei meso- (5-15 m mächtig), makro- (10-50 m mächtig) und megaskalige (40-150 m mächtig) Größenordnungen von sedimentären Zyklen unterschieden werden können. Die zyklische Ablagerungsdynamik wird mit Hilfe des "Base-Level"-Konzepts (Ramon & Cross in press) interpretiert.

Isotopendaten, Merkmale von Paläoböden, die Tonmineralogie und Palynomorphe weisen neben sedimentologischen Daten auf Klimaschwankungen hin als einen potentiellen Steuerungsfaktor dieser sedimentären Zyklen. Aus dem Stacking und den Geometrien der Architekturelemente wurde ein überregionales sedimentologisches und sequenzstratigraphisches Modell für aride kratonische Becken entwickelt, welches auf Klimaschwankungen und daraus resultierend Schwankungen des Playaseespiegels als dominierende Steuerungsfaktoren beruht. Durch die Synthese von Sequenzstratigraphie und Petrophysik lassen sich nun für künftige Fluid-Flow-Simulationen bis zu einem gewissen Grad Vorhersagen der Reservoir- und Aquifereigenschaften machen.

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Metal enrichment in a Mn-rich layer above a „ghost" sapropel S-2, eastern Mediterranean

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A thin dark-brown layer containing unusually high Mn contents of about 4 wt.% was observed in sediment core 6SL taken during METEOR cruise M40/4 in the vicinity of the Urania Basin, eastern Mediterranean (Fig. 1). The core contains dominantly hemipelagic marls with $CaCO_3$ contents about 30-40 wt.%. These sediments were deposited under oxic bottom water conditions, whereas short term anoxic bottom water conditions led to the deposition of dark, sharply defined C_{org}-rich layers. Kidd et al. (1978) defined such layers with thickness >1cm and C_{org} contents >2 wt.% as sapropels; layers with similar thickness, but C_{org} contents between 0.5-2 wt.% were termed sapropelic. Sapropels are known to occur as discrete dark-green to black layers in the sediment column in the whole Mediterranean, and are especially present in the eastern Mediterranean. The conditions leading to sapropel formation are still disputed, but bottom water anoxia, increased surface water productivity and different hydrodynamics in the Mediterranean basin are believed to be the main factors controlling sapropel deposition (for a recent review see e.g. Emeis & Sakamoto 1998). In most cores from the eastern Mediterranean, the sapropel sequence is not complete due to sediment redeposition and/or postsedimentary alteration. The latter process includes diffusion of bottom water oxygen into the sediment column after sapropel deposition ceases. The complete oxidation (burn-down) of a sapropel layer leads to the loss of its dark colour and thus so-called "ghost" sapropels are easily overlooked in sediment sections.

Barium concentrations in core 6SL were used to identify a completely burned-down sapropel of about 3 cm thickness directly below the Mn-rich layer (Fig. 2), and stratigraphic information for core 6SL proves the rare presence of the enigmatic S-2 sapropel. This sapropel was described only once to be present in two cores from the eastern Mediterranean (Vergnaud-Grazzini et al. 1977) and was never addressed since then.

Mn-enrichments above sapropel layers are well known from many cores of the Mediterranean Sea (e.g. Murat & Got 1987, Anastasakis & Stanley 1986), and sometimes a double peak of Mn was observed (e.g. Pruysers et al. 1993). The latter authors suggested that the upper Mn peak formed by an upwards-retreating oxidation front. This view was challenged by Higgs et al. (1994), Thomson et al. (1995) and Van Santvoort et al. (1996), who postulated the lower Mn peak still being formed by early diagenetic processes, whereas the upper one was produced by precipitation of high amounts of watercolumn Mn^{2+} from fully anoxic bottom waters at the end of sapropel formation, when the water column was reventilated by thermohaline circulation (Higgs et al. 1994). In contrast of the conclusions of Pruysers et al. (1993) the hypothesis of the upper peak being a hydrogenetic (primary) signal is here accepted. Therefore, in accordance with the Ba profile, the Mn-rich layer above "ghost" sapropel S-2 was formed by hydrogenetic precipitation at the time of bottom water reventilation, and thus indicates the original top boundary of the former sapropel. This view is substantiated by trace element geochemistry of the Mn-rich layer. Using ferromanganese crusts as an analogue, high Co contents in the Mn-rich layer and ratios of Co to Cu, Ni and Zn, resp., well above 1:1 suggest a hydrogenetic origin of the Mn phases. In light of recent indications of water column anoxia up to the photic zone during times of sapropel deposition (Bosch et al.

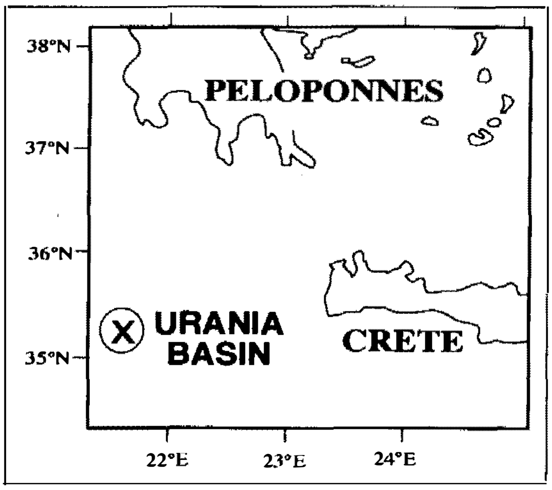

Fig. 1: Location of the Urania basin in the eastern Mediterranean.

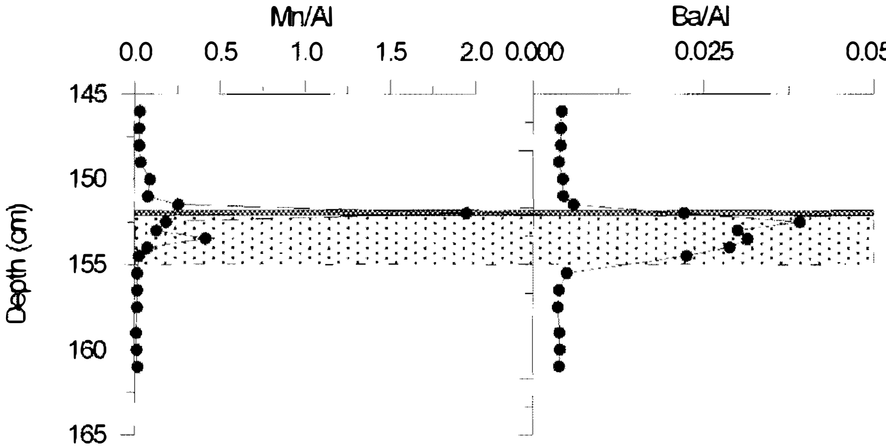

Fig. 2: Concentration profiles of Mn and Ba 156-161 cm bsf. The dark bar represents the Mn-rich layer, the light grey bar indicates the inferred thickness of the former sapropel. Mn and Ba concentrations are divided by Al contents (element/Al*10⁴) in order to account for dilution by different carbonate contents.

1998), we suggest that large volumes of water were anoxic then, containing high amounts of dissolved Mn. Return to oxic water conditions and restoration of thermohaline circulation at the end of sapropel deposition led to the precipitation of Mn oxides, which scavenged trace metals (preferentially Co) and formed a thin, sharply defined layer on top of the sapropel.

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Zyklostratigraphie und Biomarker in den oberen Kössener Schichten (Alpine Obertrias)

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Die Kalke und Mergel der oberen Kössener Schichten wurden im hervorragend aufgeschlossenen Profil Eiberg (Kufstein, Tirol) sedimentologisch, mikrofaziell, geochemisch und geophysikalisch bearbeitet. Sowohl die Geländeaufnahme wie auch die entnommenen Proben und die daraus gewonnen Daten wurden an einem einheitlichen Vertikalmaßstab aufgehängt. Alle Geländedaten wurden quantifiziert, so daß sie, ebenso wie die Ergebnisse der Laboruntersuchungen und der Mikroskopie zusammen in eine Matrix eingetragen werden können. Geländebeschreibungen, so-