Anatomy of the Late Eocene \ earliest Oligocene carbonate-siliciclastic shelf by integrating sedimentological and quantitative palaeoecological data (Transylvanian Paleogene Basin, Romania).

32nd International Geological Congress
Florence, August 20-28, 2004

Kovács, J.Sz.
Babes-Bolyai University , Cluj-Napoca, Romania
Eötvös Loránd University, Budapest, Hungary

Arnaud-Vanneau, A.
Joseph Fourier University
Grenoble, France

Schuster, R.
Austrian Geological Institute
Wien, Austria

Bucur, I.I.
Babes-Bolyai University
Cluj-Napoca, Romania

Kázmér, M.
Eötvös Loránd University
Budapest, Hungary

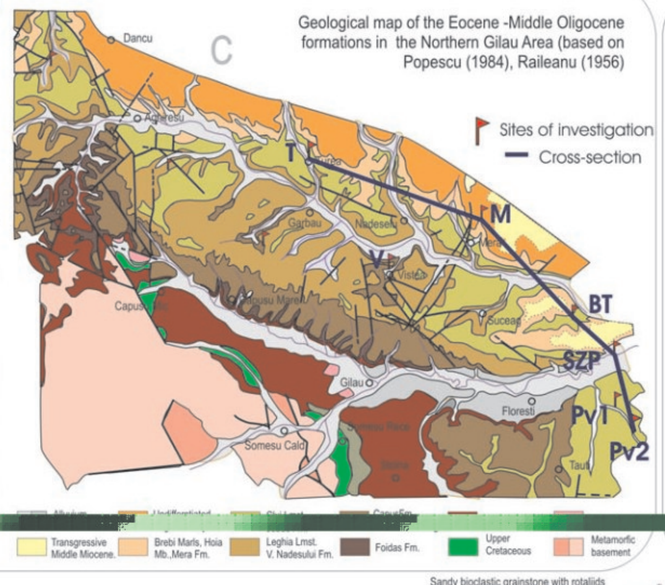
Introduction

In the sedimentary record of the Transylvanian Paleogene Basin (TPB), Romania, two greater continental-marine sedimentary cycles were distinguished from historical times. The first cycle (*Jibou Fm.-Calata Group*) is characterized by greater thicknesses and coarser sediments, and as a consequence by stronger tectonical activities. The second cycle (*Valea Nadesului Fm. - Turea Group)* is less affected by tectonical inversions, permits greater influence to the eustatic control of the accommodation (e.g. contemporanity of the Brebi Marls Condensed Section with a European maximum of sea-level rise, this work).

The existence of Upper Cretaceous-Paleogene piggy-back basins (e.g. Puini basin, Tarnave basin), within the subsurface of the Transylvanian Depression, were suggested by seismic sections published by Ciulavu (2000).

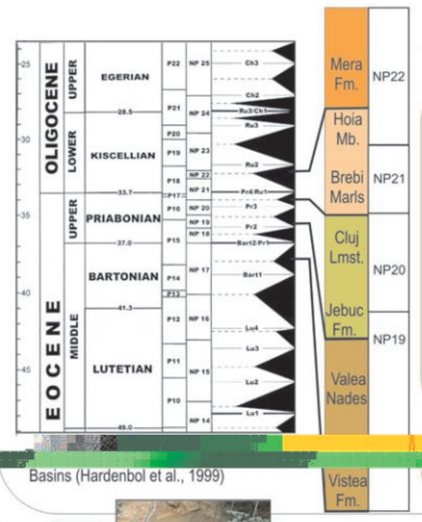
The investigated sedimentary succession - the Turea Group deposits - are supposed to be sedimented in a more eastern member of the **piggy-back thrust sequence**. The spatial distribution of the transgressive deposits is mainly driven by the inherited topography and is autocyclically controlled, while allocyclicity can be more visible close to the Condensed Section.

Localization of the studied profiles (A) and their stratigraphic range (B). Map and sedimentological log from Györfi et al. (1999) and Proust & Hosu (1996)



Geological map of the Eocene -Middle Oligocene formations in the Northern Gilau Area (based on Popescu (1984), Raileanu (1956)

Synthetic curves of relative sea-level changes through the *Turea Group* depositional period (Priabonian- Earliest Rupelian) in the Transylvanian Basin



Basins (Hardenbol et al., 1999)

The time control

The time-correlation of TPB formations based on Mészáros (1992)

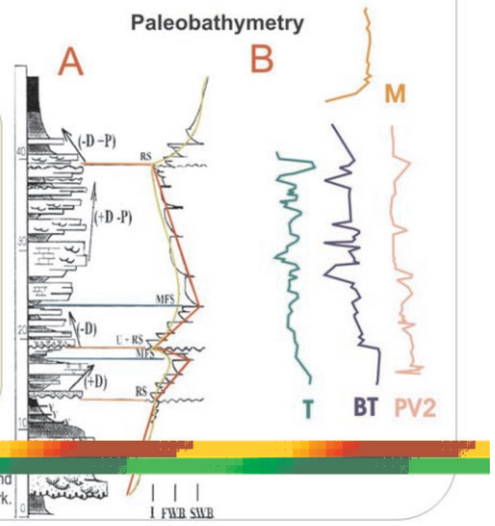
The time interval from 40 Ma until now is characterized by a continuous increase of the Sr-seawater ratio.

The correlation of the sample $^{87}Sr/^{86}Sr$ with an age value is based on the assumption that the sample equilibrated with the seawater during the time of its formation and the ratio was not influenced later on.

In most cases the $^{87}Sr/^{86}Sr$ ratio of a sample will be rised by later processes.

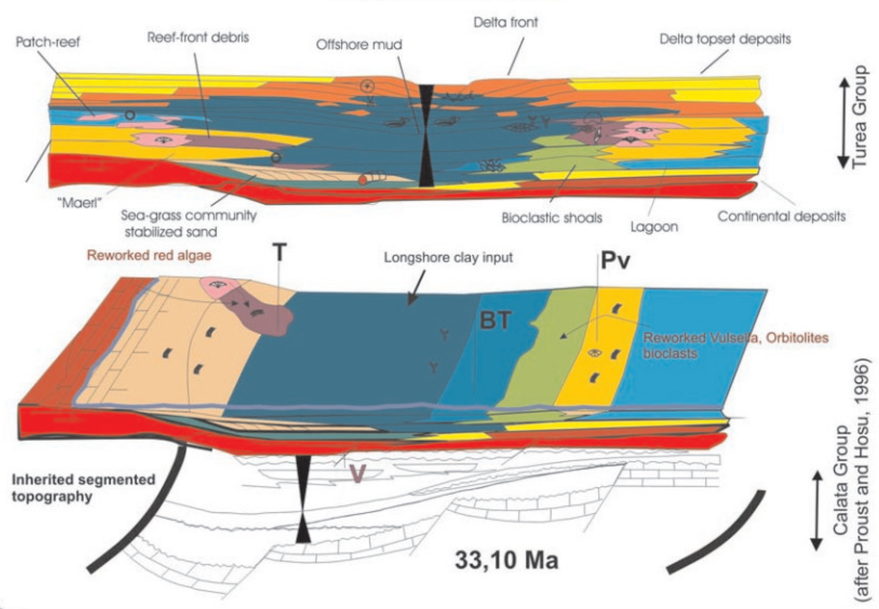
In general, our $^{87}Sr/^{86}Sr$ data are showing slightly younger ages 33,8-27,8 ± 0,2Ma (Uppermost Eocene-Lower Oligocene) then previous paleontological works for the Turea Group deposits.

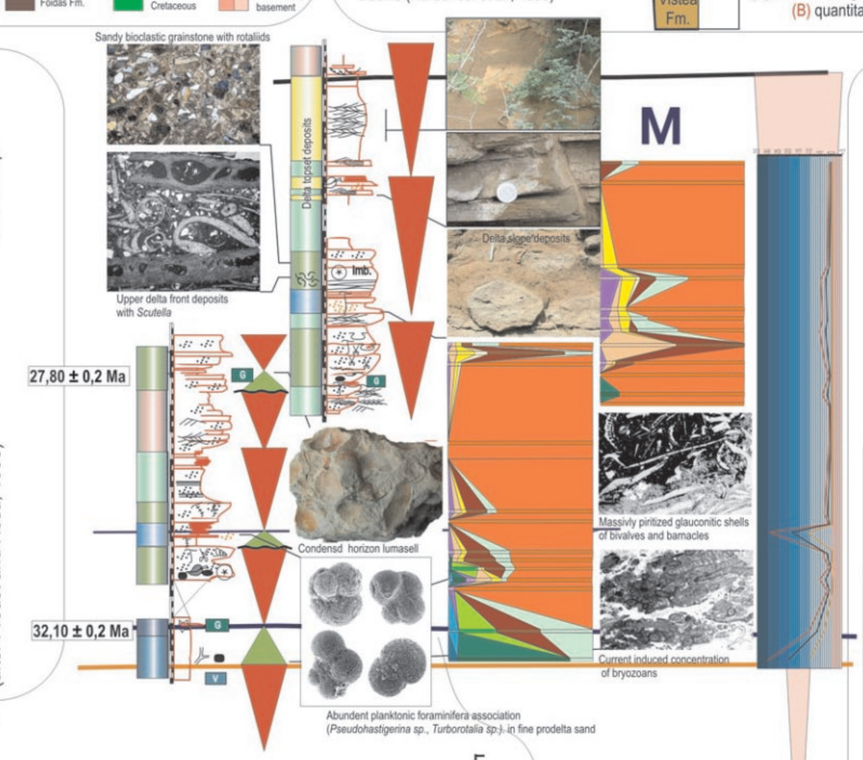
Paleobathymetry

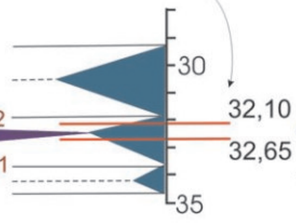


(A) sedimentological data (Codrea & Hosu, 2001), and (B) quantitative palaeoecological data, this work.

Depositional model







Interpretation of Sr^{87}/Sr^{86} isotopic data

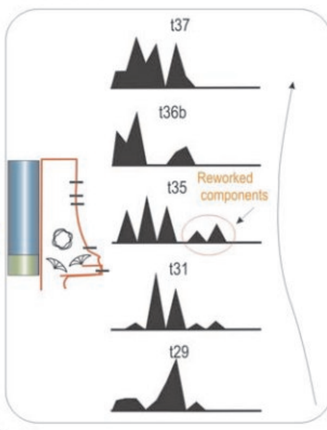
33.10	37.10	33.00
True ages	Bioclasts reworked from the hinterland	Possibly shale-contaminated sample

Methods

Each ecological assemblage and sedimentological paleoenvironment in shallow water shelf is directly or indirectly linked to water depth. The paleoenvironment is represented by a microfacies and sea-level changes correspond to changes in microfacies and qualitative/quantitative composition of bioclasts. Thus, a qualitative, quantitative and statistical analysis of bioclasts describes precisely paleoenvironments and is one of the most sensitive indicators of any paleoenvironmental changes, usually linked to relative sea-level changes or changes in accommodation space. Vertical fluctuations of each ecological assemblage percentage along a section reflect sea-level changes at that point and allows acquisition of relative paleobathymetry.

By this reasoning a quantitative paleoecological tool was outlined and applied successfully in different geological time-intervals, ranging from the Cretaceous of France (Arnaud-Vanneau, 1980) and Spain (Bernaus, 2000), to Paleocene (Gonzáles-Lara, 2000).

In this work, counted data were acquired from thin-sections of carbonates and siliciclastics (average size of utile surface: 4cm x 6cm) and embedded artificial microfacies (average size of utile surface: 2cm x 2cm).



By developing the counting technique of *'thin-section mapping'*, counted specimens could be easily reviewed,and the database was quickly refreshed when needed.

In a preliminary report (Kovács and Arnaud-Vanneau, 2004), we defined 6 Paleoecological Assemblages and one group made of echinoderm fragments for the Late Eocene-earliest Oligocene of the Transylvanian Paleogene Basin (Pv 2 section). These assemblages are composed of organisms constituting a biota, which lived more or less in the same paleoecological environments and were deposited at similar depth during that same time. After the analysis of additional outcrops (Sections BT, T, M, Pv1, Szp, V), these preliminary assemblages were further refined.

The quantification of *relative seaward or landward shifting of the paleoecological assemblages* allowed us to estimate the possible minimum and maximum paleodepth of deposition of the communities studied.

References

Arnaud-Vanneau, A. 1980, Micropaléontologie, paléoécologie et sédimentologie d'une plate-forme carbonatée de la marge passive de la Téthys: L'Urgonien du Vercors septentrional et de la Chartreuse (Alpes occidentales). Geologie Alpine, mem. 11, 874 p.

Bernaus, J.-M. 2000, L'Urgonien du Bassin d'Organya (NE Espagne): Micropaléontologie, Sédimentologie et Stratigraphie Séquentielle. Géologie Alpine, Mémoire H. S. 33,1-140.

Codrea, V., Hosu, A., 2001, The Paleocene - Eocene formations and the Eocene/ Oligocene boundary in the Jibou area (Sălaj county). In: Field Trip Guide, 4thRegional meeting of IFAA, 93-107.

Gonzáles-Lara, J. C. 2000, Le Paléocene du Chiapas (SE du Mexique): biostratigraphie, sédimentologie et stratigraphie séquentielle, Phd thesis, p.235, Grenoble.

Györfi, I., Csontos, L., Nagymarosy, A. 1999, Early Tertiary structural evolution of the border zone between the Pannonian and Transylvanian Basins. In: Durand, B. Jolivet, L., Horváth, F. & Séranne, M. (eds) The Mediterranean Basins: Tertiary Extension within the Alpine orogen. Geol. Soc. Spec. Publ. 156, p. 251-267, London.

Hardenbol, J., Thierry, J., Farley, B.M., Jacquin, T., De Graciansky, P.-Ch. and Vail, P.R., 1999, Paleogene Chronostratigraphic chart. In: Mesozoic and Cenozoic sequence stratigraphy of European Basins, SEPM Spec. Publ., 60.

Kovács, Sz., Arnaud-Vanneau, A., (2004, in press), Upper Eocene Paleobathymetry approach based on Paleoecological Assemblages (preliminary report from the Plesca Valley 2. outcrop, Transylvania), in: Proceedings on the 4-th Symposium of the Romanian Society of Paleontologists, Cluj-Napoca.

Mészáros, N., 1992, Nanofossil zones in the Paleogene and Miocene deposits of the Transylvanian Basin. Knihovnicka ZPN, 14b (2), 87-92.Proust, J.N., Hosu, A. 1996, Sequence stratigraphy and Paleogene tectonic evolution of the Transylvanian Basin (Romania, eastern Europe). Sed. Geol. 105, p. 117-140.

Depositional environments

High Tide	Backshore / Continental
Low Tide	Foreshore
Min. Wave Base	Shoreface
Fair Weather W.B	Outer Inner ramp
Storm weather W.B	Inner Middle ramp
Ramp profile breaking point	Outer Middle-ramp
Toe of slope	Proximal outer ramp
	Distal outer ramp

Legend

Biota
- Planktonic foraminifera
- Small biseriat foraminifera
- Miliolids
- Rotaliids
- Lenticular Nummulites
- Large and flat Nummulites
- Ostracods
- Fragments of red algae
- Massive thalii of ingeniculate red algae
- Corals (well-preserved/ leached)
- Annelids
- Balanids
- Bryozoans
- Gastropods
- Gryphea sp.
- Crab scrissors
- Sirenid bone
- Echinolampas, Scutella

Facies components
- Root traces
- Intraclasts
- Ooids
- Driftwood, plant fragments
- Thalassinoides, Ophiomorpha
- Other biot.(vert., Horiz.)
- Rhodoids
- Rip-up clasts
- Single bioevent
- Composite bioevent
- Tempestite
- Pirit, Fe oxi-hidroxides
- V Verdine facies
- G Glauconite
- Coelestin Gypsum
- Siliciclastic, arcosic sand

Scalebar 1m

Sedimentary structures
- Flow ripples
- Bipolar cross-lamination
- Tabular cross lamination
- Low angle cross-stratification
- Trough cross-bedding
- Horizontal lamination
- Hummocky cross-stratification
- Nodular bedding
- Channel incisionl
- Red algal ncrustation horizons
- Slump
- Slide
- Imb. Imbrication
- Ravinament surface