PERI - TETHYS PROGRAMME

THIRD
MOSCOW WORKSHOP
May 13-15,1997
Geological Faculty, Moscow State University

ABSTRACTS

organizing committee:

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MOSCOW, 1997

Programme of the Third Moscow Peri-Tethys Workshop
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PALEOMAPS/PALEOGEOGRAPHY sessions.

MAY 13

I. Carboniferous-Permian-Triassic
(Chairmen: A.S.Alekseev and A.M.Nikishin, Moscow)

1. Yu.A. Volozh et a. (Carboniferous-Permian) (95-96/21, 95-96/61)
2. Kotlyar G. et al. (Permian-Triassic) (95-96/17)
3. Molostovskaja I. et al. (Permian-Triassic) (95-96/31)
4. Nikishin A.M. et al. (Carboniferous-Permian) (95-96/44)
5. Nazarevich B.P.. Nikishin A.M.et al. (Triassic) (95-96/44)
6. Dvorianin E., Stovba S. et al. (Carboniferous-Triassic) (95-96/12)
7. Volozh Yu.A. et al. (Triassic) (95-96/21, 96/117)

II. Jurassic
(Chairmen: V.S.Vishnevskaya. Moscow and J.Thierry. Dijon)

1. Vishnevskaya V.S.et al. (95-96/18)
2. Volozh Yu.A. et al. (95-96/21. 96/117. 95-96/61)
3. Vuks V.Ya. et al. (96/112)
4. Panov D.I.. Nikishin A.M. et al. (95-96/44)
5. Panov D.I.. Kopaevich L.F. et al. (96/118)
6. Nazarevich B.P.. Ilina V.V.. Nikishin A.M et al (95-96/44)
7. Molostovsky E.A. et al. (96-95/07)

MAY 13-14

III. Cretaceous
(Chairmen. E.J.Baraboshkin and L.F Kopaevich. Moscow)

1. Baraboshkin E., Alekseev A. et al. Cretaceous history of the Russian Platform (95-96/43).
2. Vishnevskaya V.S. et al. (95-96/18).
3. Amon E. Cretaceous history of the Urals region (95-96/10).
4. Molostovsky E. Cretaceous history of the Volga-Ural. Black Sea and Peri-Caspian regions (95-96/07).
5. Baraboshkin E., Kopaevich L.. Nikishin at al. Cretaceous of the Scythian Platform (95-96/44. 95-96/43).
6. Volozh Yu.A. et al. Cretaceous of the Scythian-Peri-Caspian-Turan region (95-96/21. 96/117. 95-96/61).
7. Kopaevich L.. Baraboshkin et al. Cretaceous of the Turan Platform (96/118)

MAY 14

IV. Paleocene-Eocene
(Chairman: I.Khokhlova. Moscow)

1. Khokhlova I. et al. (95-96/11).
2. Scherba I.G.. Nikishin A.M. et al. (95-96/44).
3. Zhelezko V. et al. (95-96/19).
4. Beniamovsky V., Kopaevich L. et al. (96/118)

5. Volozh Yu.A. et al. (95-96/21. 96/117. 95-96/61).

V. Oligocene-Quaternary
(Chairman: S.Popov. Moscow)

1. Popov S.. Stolyarov A. et al. Oligocene-Lower Miocenc (95-96/25)
2 Goncharova I.. Scherba I. et al. Middle-Upper Miocene (95-96/25)
3. Paramonova N.. Scherba I. et al. Pliocene (95-96/25)
2. Bazhenova O. et al. (95-96/75)
3. Volozh Yu.A. et al. (95-96/21, 96/117, 95-96/61).

TECNONIC INTRAPLATE EVENTS session
(Chairman: M.Kopp. Moscow)

1. Kopp M. et al. (95-96/41)
2. Burtman V. et al. (96/102)
3. Ustinova M.. Nikishin A. et al. (95-96/44)

MAY 15

MODELLING session
(Chairmen: A.M.Nikishin and L.I.Lobkovsky, Moscow)

1 Garagash I. Lobkovsky L.. Brunet M.-F., Volozh Yu. (95-96/61).
2 Artyushkov E.V. et al.. (95-90).
3 Ershov A.V., M.-F.Brunet et al Caucasus region.(95-96/66)
4 Bolotov S.. Ershov A.. Nikishin A. et al. Subsidence history modelling (95-96/66).
5 Korotaev M.. Brunet M.-F.. Ershov A.. Nikishin et al Black Sea Basin modelling (95-96/66).
6 Garagash I.. Schukin Yu.. Lobkovsky L., Volozh Yu. (95-96/21).
7 Goutchenko O. et al. (94-24)
8 Rebetsky Yu. Brunet M.-F.. Nikitina Ye. et al. (95-96/61)

DISCUSSIONS, May 15

LITHOSPHERIC FAILURE IN THE PERI-TETHYAN AREA, ITS POSSIBLE CAUSES AND CONSEQUENCES

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Over most of the Earth, the lithospheric layer has a high effective elastic thickness (Te) and large flexural rigidity D and total strength St. This allows the plates to drift without significant internal deformations. At the epochs of shortening of the lithosphere in fold belts and its stretching in rift valleys the deformation rate increases by 3-5 orders of magnitude as compared to stable cratonic areas, which indicates a drastic drop in D and Te. These quantities are reduced in regions with a thick crust, as well as in regions with a high temperature or large deviatoric stresses in the lithospheric layer. However, rifting or shortening of the lithosphere often occur in cool regions with the crust of normal thickness. In this case, a drop in D and Te is commonly explained by failure in a strongly bent upper part of the lithosphere where elastic stresses exceed a comparatively low strength. Anyway, very large forces are necessary to stretch or shorten the lithosphere in cool cratonic areas. These forces strongly exceed all the known forces which can be acting in the surface plates.

Steep bending of the lithosphere occurs not only near to plate boundaries. The sedimentary basins around the Caucasus, the Black Sea and North Crimean basin, the Turan platform and many other regions include steep slopes which are 4-8 km high and 20-40 km wide. Many of them formed at the epochs of rapid crustal subsidence (1-10 m.y.) without normal faulting and far from active collisional boundaries. The width of the slopes formally corresponds to the values of Te about 3-7 km. The large intensity and high rate of the deformations, however, indicate a temporary loss of rigidity and ductile flow in the lithospheric layer. These data show that lithospheric failure can occur independently on plate-boundary-related processes.

Rapid crustal subsidence which is associated with lithospheric failure could be caused by gabbro-garnet granulite-eclogite phase transformation in the lower crust that catalysed by infiltration of volatiles from the asthenosphere. A strong decrease in the viscosity takes place in the lower crust at the epochs of rapid metamorphism. Contraction of mafic rocks in this layer produces large stresses in the rapidly subsiding upper crust on the margins of the basins. This strongly reduces the viscosity of the upper crust. A viscosity decrease in mantle lithosphere could occur due to filtration of volatiles through this layer. These phenomena could temporarily weaken the whole lithospheric layer.

At the epochs of failure, the lithosphere can be intensely stretched or shortened by moderate forces which are usually acting in this layer. A strong thrusting in the Alps, Carpathians, Caucasus, Urals and Kopet Dagh followed events of failure which are evidenced by steep bending of the basement at the epochs of rapid crustal subsidence. The absence of strong subsidence in the foredeeps of these fold belts at the epochs of plate collision indicates decoupling of the lithosphere beneath the thrust belts and in the foreland regions. This is another indication on lithospheric failure. After collisional events the crustal surface remained near to sea-level. This shows that the forces, which ensured shortening of the lithosphere and thickening of the crust, were low. Steep basement bending also occurred synchronously to rifting in many places in the Pannonian basin, DnieprPrypyat graben and the Baikal rift. Hence stretching of the lithosphere in these basins occurred at the epochs of failure in this layer.

Many sedimentary basins where a rapid crustal subsidence and lithospheric failure took place are characterised by a large hydrocarbon potential. Narrow-wavelength lithospheric deformations which arise at the epochs of failure produce numerous structural traps for hydrocarbons. This was typical of, e.g., the Volga-Urals, Timan-Pechora, Persian Gulf and West Siberia

ALBIAN EVENTS OF THE EASTERN EUROPE.

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Albian sections and their ammonite zonation (fig.1) were investigated by the author in the Mountain Crimea. North Caucasus, Peri-Caspian, Mangyshlak - Tuarkyr area, the Great Balkhan, Kopet-Dag and the Russian Platform in 1976-1996. All of the regions could be classified into three paleobiogeographical regions according to their ammonite characteristics.

1. The region of the Russian Platform (Peri-Caspian excluded) is characterized mainly by the prevalence of West European genera, but with the strong boreal influence in the early Albian (the *Arcthoplites* event).

2. The Crimea - North Caucasus - Kopet-Dag region is defined by the development of the taxa of West European type, but with the restricted development of some endemics, such as *Daghestanites*. The Great Balkhan area is closely allies to that region, but contains some typical forms of the region 3.

3. Peri-Caspian - Tuarkyr region is determined by enormous development of ammonites related to *Sonneratia, Sokolovites* (early Albian), *Anahoplites, Semenovites* (middle - late Albian), etc. The region contains also some typical ammonites from regions 1 and 2.

The Eastern Europe was the system of communicated epiplatform basins during the Albian. It was already demonstrated that all of the regions had sea-connections (Baraboshkin, 1996). The regulation of that system was provided by the tectonic movements, the position of sea level and the climatic control. It was documented series of basin events (stratigraphic gaps, volcanic and anoxic events) that took place in all of three regions or some of them independently on the paleobiogeographic position (fig.2). There are the following events were recognized here.

I. Anoxic events were determined only for the North Caucasus region. The "Paquier Level" was weakly recognized near the base of *Leymeriella regularis* Zone. Dysaerobic events were determined for *Hoplites spathi* and *Oxytropidoceras roissyanum* Zones in Middle Albian. The strongest anoxy was found for the Upper Albian (series of events, including the "Breistroffer Level", fig.2).

II. Volcanic events had the widest distribution around Albian/Cenomanian boundary in Crimea - Peri-Caspian area, but started earlier in Plain Crimea and Trans-Caucasus.

III. The stratigraphic gaps (the 1st order) were occurred almost in each region. They reflect non-deposiotional events in various combinations with erosional events. They were recognized for the Aptian/Albian boundary, basal Middle and Upper Albian, the base of *Mortoniceras inflatum* and *Stoliczkaia dispar* Zones, and for the Albian/Cenomanian boundary.

Examination of the different event data from the Russian Platform and adjacent area to the South demonstrated that the most of events were concentrated in the narrow time intervals, but they did not appear simultaneously. The main sources for the event development were tectonics and sea-level fluctuations forced by the climate changes. Various combinations of those factors and their consequences resulted in the general style of sedimentation (i.e. peleogeography) and the completeness of geological record

EXPLANATION OF FIGURES

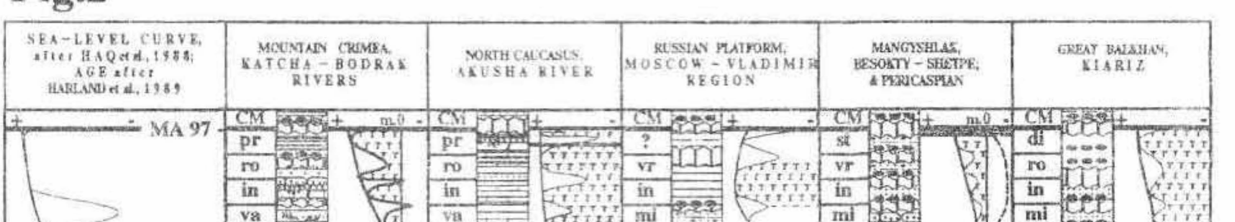
Fig.1. Biostratigraphic zonation of Albian of Crimea, North Caucasus, Russian Platform, Mangyshlak - Peri-Caspian and Great Balkhan area based on ammonites.

Fig.2. Relative sea-level changes, main unconformities, anoxic events and position of volcanoclastic levels in Albian of Crimea, North Caucasus, Russian Platform, Mangyshlak - Peri-Caspian and Great Balkhan. Abbreviations in columns mean names of ammonites zones/subzones and horizons illustrated on fig.2. The legend (for figures 4-5): 1 - sands, sandstones; 2 - soft sandstone / hard sandstone alternation; 3 - silts, siltstones; 4 - clays; 5 - marls; 6 - limestones; 7 - shelly oolitic limestones; 8 - tuff layers; 9 - pebbles, conglomerates; 10 - phosphorite pebbles and conglomerates; 11 - flint levels; 12 - cross - bedding; 13 - hiatuses; 14 - eroded intervals, that could be reconstructed from fossil record in the basal horizons; 15 - erosional surfaces; 16 - hard/softgrounds; 17 - relative sea-level fluctuations of the 1th order; 18 - relative sea-level fluctuations of the 1th order for Peri-Caspian (only); 19 - relative

Fig.1

STAGE	SUBSTAGE	E.J.BARABOSHKIN, 1996 & in press, CRIMEA — ZONE, SUBZONE	E.J.BARABOSHKIN, in press, NORTH CAUCASUS — ZONE, SUBZONE	E.J.BARABOSHKIN, 1996, RUSSIAN PLATFORM — ZONE, SUBZONE, BEDS	A.A.SAVELIEV, 1992, changed by E.J.BARABOSHKIN, 1996 & in this paper, MANGYSHLAK & PERICASPIAN — ZONE, SUBZONE	V.B.SAPOZHNIKOV, 1973, N.P.LUPPOV, 1981, E.J.BARABOSHKIN, this paper, GREAT BALKHAN — ZONE, SUBZONE
ALBIAN	UPPER	Stoliczkaia (S.) dispar: Mortoniceras (Durnovarites) perinflatum	Stoliczkaia (S.) dispar: Mortoniceras (Durnovarites) perinflatum	Stoliczkaia (S.) dispar: ?	Stoliczkaia (S.) dispar: Pleurohoplites studeri	Stoliczkaia (Stoliczkaia) dispar & Lepthoplites
		Mortoniceras (Mortoniceras) rostratum	Mortoniceras (Mortoniceras) rostratum	Callihoplites vraconensis	Callihoplites vraconensis	Mortoniceras (Mortoniceras) rostratum & Cantabrigites
		Mortoniceras (Mortoniceras) inflatum	Mortoniceras (Mortoniceras) inflatum	Mortoniceras (Mortoniceras) inflatum	Mortoniceras (Mortoniceras) inflatum	Mortoniceras (Mortoniceras) inflatum
		Hysteroceras varicosum	Hysteroceras varicosum	Semenovites (Semenovites) michalskii	Semenovites (Semenovites) michalskii	Semenovites (Semenovites) michalskii
		Hysteroceras orbignyi	Hysteroceras orbignyi	Semenovites litschkovi: Semenovites (Planihoplites) pseudocoelonodus	Semenovites litschkovi: Semenovites (Planihoplites) pseudocoelonodus	Hysteroceras orbignyi
		Dipoloceras (Dipoloceras) cristatum	Dipoloceras (Dipoloceras) cristatum	Semenovites (Semenovites) tamalakensis	Semenovites (Semenovites) tamalakensis	Dipoloceras (Dipoloceras) cristatum
	MIDDLE	?	Euhoplites lautus	Anahoplites rossicus	Anahoplites rossicus	Anahoplites rossicus
			?	?	Euhoplites lautus	Anahoplites daviesi
			Daghestanites daghestanensis	Hoplites (Lautihoplites) dentatiformis	Daghestanites daghestanensis	Daghestanites daghestanensis
		Anahoplites intermedius	Anahoplites intermedius	Dimorphoplites pretethydis	Anahoplites intermedius	Anahoplites intermedius
		?	Oxytropidoceras roissyanum	Hoplites (Lautihoplites) volgathensis	Hoplites (Hoplites) spathi	Hoplites (Hoplites) spathi
		Hoplites (Hoplites) spathi	Hoplites (Hoplites) spathi	Hoplites (Hoplites) spathi		
		?	Lyelliceras (Lyelliceras) lyelli	Hoplites (Hoplites) benettianus	Lyelliceras (Lyelliceras) lyelli	Hoplites (Hoplites) benettianus
			Pseudosonneratia (Isohopl.) eodentata	Pseudosonneratia (Isohopl.) eodentata	Pseudosonneratia (Isohopl.) eodentata	Pseudosonneratia (Isohopl.) eodentata
	LOWER	Douvilleiceras mammillatum	Douvilleiceras mammillatum: ?	Douvilleiceras mammillatum: Otohoplites raulinianus	Otohoplites crassus	Douvilleiceras mammillatum
			Protohoplites (H.) puzosianus	Protohoplites (H.) puzosianus	Protohoplites (H.) puzosianus	
			?	Cleoniceras (C.) floridum	Sonneratia (E.) vnigri: Sonneratia (E.) caperata	
			Cleoniceras (C.) floridum		Sonneratia (E.) rotula	
			?	?	Sonneratia (E.) solida	
				Sonneratia (G.) perinflata	Sonneratia (G.) globulosa	
		?	Leymeriella (Neoleymeriella) regularis	Leymeriella (N.) regularis: ?	Leymeriella (N.) regularis: Beds with Leymeriella (Neoleymeriella)	Leymeriella (Neoleymeriella) regularis
				Beds with Anadesmoceras	Beds with Anadesmoceras	
		Leymeriella (Leymeriella) tardefurcata	Leymeriella (Leymeriella) tardefurcata	Leymeriella (L.) tardefurcata: ?	Leymeriella (L.) tardefurcata: Leymeriella (Leymeriella) acuticostata	Leymeriella (Leymeriella) tardefurcata
				Arcthoplites (Arcthoplites) jachromensis	Arcthoplites (Arcthoplites) jachromensis	
				?	Arcthoplites (Subarct.) probus	

Fig.2



sea-level long-term fluctuations; 20 - assumed relative sea-level short-term fluctuations for reconstructed intervals. 21 - anoxic and dysaerobic intervals; 22 - Tethyan water influence; 23 - Boreal water influence; 24 - European province water.

RUSSIAN PLATFORM IN THE CRETACEOUS: PALEOBIOGEOGRAPHICAL EFFECT OF THE BOREAL / TETHYAN INFLUENCE

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The investigation of the Cretaceous of the Russian Platform (RP) has the long story. It was resulted in producing of series of paleogeographical maps (Atlas.... 1961, 1968). However, the new data received during the last ten years makes to review the geological history of that area at least for the Cretaceous.

There were several stages of RP development in the Cretaceous:

1. **Early Berriasian.** Depends of the point of view in determination Jurassic (Volgian)/Cretaceous (Berriasian) boundary, there are several different ways to reconstruct paleogeography of RP:

a) Absence of Lower Berriasian sediments or presence of their continental analogues.

b) Shallow water coarse-grained sedimentation with phosphogenesis and small hiatuses or partially continental and fresh - water sedimentation.

2. **Late Berriasian - Valanginian** Very shallow sea to continental conditions and non - deposition environments existed on the RP. Late Berriasian is characterized by strong influence of Tethyan water in the beginning, when representatives of family Berriasellidae (*Riasanites, Transcaspiites*) penetrated from Caucasus and Transcspia through RP to the Poland and probably, even to the Spitsbergen (Ershova, Korchinskaya, 1980). Latest Berriasian to Valanginian shows exceptionally Boreal ammonite assemblages. Only in Peri-Caspian findings of Tethyan ?*Neohoploceras* are known (Gordeev, 1971).

3. **Early Hauterivian.** Continental environments and non-deposition all over the RP. The existence of marine sediments and the presence of Lower Hauterivian fauna is very discussionable. There is only one place with early Hauterivian *Homolsomites* known in the Jaroslavl region

4. **Late Hauterivian.** Shallow sea conditions, which were locally accompanied by anoxic events (Uljanovsk-Saratov & Peri-Caspian Syneclise). During this time the Boreal/Tethyan meridianal straight was opened. Upper Hauterivian ammonite assemblage is the same that in England (Rawson, 1971), Germany, Spitsbergen (Ershova, 1983) The fauna penetrated from Poland and Spitsbergen through the RP to the south, up to the Northern Caucasus and Crimea, where mixed assemblages are known (Baraboshkin, 1995).

5. **Barremian.** Shallow water and continental condition with poor bivalve assemblages and belemnites *Oxyteuthis*. Probably, the fauna was oppressed by water freshening. Barremian fossils (bivalves, belemnites) supports mainly Boreal fauna assemblages. There is the only evidence of the presence of Tethyan fauna in the RP, but not supported by recent investigations.

6. **Early - middle Aptian.** Shallow sea conditions with areal anoxia (the North-East of RP). Early Aptian ammonite assemblages (*Tropaeum, Aconeceras*, etc.) shows equal conditions in the RP, to the North (Spitsbergen, Ershova, 1983) and to the South (N.Caucasus, Crimea, Middle Asia, Mediterranean, etc.) with fauna of European type. The meridianal Boreal/Tethyan connection passed through the RP.

7. **Late Aptian.** Near-shore and continental environments with rare everybionthic fauna. Formation of large unconformity.

8. **Early Albian.** Near-shore, deltaic and shallow marine conditions. Early Albian contains typically Boreal faunas with *Arcthoplites, Cymahoplites* and *Anadesmoceras*, which migrated southward (Baraboshkin, 1996). The boundary between Tethyan/Boreal assemblages existed in Peri-Caspian.

9. **Late early Albian to middle Albian.** Shallow water environments with intensive phosphatogenesis and numerous hiatuses. During latest early Albian to middle Albian ways of ammonite migration passed from west and from

the south and to the north of RP (Baraboshkin, in press) and similar assemblages existed in Spitsbergen (Nagy, 1970; Ershova, 1983). Mangyshlak (Mikhailova, Saveliev, 1989), Poland (Marcinowski, Wiedmann, 1990).

10. **Latest middle Albian to Upper Albian**. Shallow water sea spread almost the whole RP, anoxic conditions prevailed in this time. In the late Albian RP basin isolated from Boreal basin and typically European fauna spread over RP (Baraboshkin, 1996)

11. **Cenomanian - middle Turonian**. Sallow-water sea with terrigenous sedimentation existed all over the RP. The sequence contains numerous stratigraphic unconformities marked by phosphorite horizons.

12. **Middle Turonian - Coniacian - early Santonian(?)**. Spreading of the sea conditions (maximum of transgression during the late Turonian). The carbonate sedimentation predominated in this time The south margin of the RP was completely submerged and the chalk sedimentation took place there.

13. **Late Santonian - Campanian**. The carbonate sedimentation in the warm water in the south part of the RP existed. To the north chalk-marly succession changed into siliceous one (Saratov-Ulyanovsk Depression). There are two opportunities in the interpretation of that fact: (1) the strong nutrient input by the big river, which forced high productivity of diatoms and (2) an opening of the north-east sea connection with the West Siberian Basin.

14. **Maastrichtian**. The deformations of the RP near the Campanian/Maastrichtian boundary resulted in the basal Maastrichtian unconformity. It was the time of reducing of sea conditions, but the carbonate sedimentation was still prevailed in the south-east part of the RP. The latest Maastrichtian is characterized by the well-recognized regressive conditions.

THE COMPARATIVE ANALYSIS OF MAIKOPIAN SERIES ORGANIC MATTER FROM NORTHERN AZERBAIDJAN AND KERTCH PENINSULA

O.K.Bazhenova, M.L.Saint-Germes, N.P.Fadeeva

Geochemical methods included the pyrolysis, extraction in Soxlet apparatus, gas liquid chromatography, cromatomass-spectrometry were investigated the Maikop Series OM in the two regions: Northern Azerbaijan and Kertch peninsula. Both the regions have been characterized by great thickness of the Maikop deposits, clayey content, and rather satisfactory outcrop. Besides, these regions are the marginal ones. it is especially interesting, because these particular areas are characterized by broad development of mud volcanism

The successions, described on Kertch Peninsula include, probably, the Maikop series middle part - i.e. the Karleut horizon of the Oligocene age and Batisifon horizon of the Miocene age. The succession in the Northern Azerbaidjan included whole interval of Maikop Series (mk$_1$ - mk$_3$): Angekharan, Khilmilly, Shikhzagirly, Perkeshkiul-2, Sumgait and Siyaky.

Low degrees of OM transformation of both regions have been proved by the pyrolysis results - Tmax changes within the range of 401-426 C, i.e. the rocks haven't reached the "oil window" level.

OM content within the succession in both area varies rather dramatically. The concentration of Corg in the most samples studied equal of Clark values for clayey rocks In the successions of Kertch Peninsula modal values 1.0-1.2%, some interlayers was fixed enriched by OM up to 4-7%, the genetic potential of its up to 7-12 mg HC/g rock, i.e. they get into the category of the high potential oil source rocks. However even in these enriched interlayers HI values are not high (maximal HI values approach 212 mg HC/g Corg), with modal values - 60-80 mg HC/g Corg). On the Van-Krevelen diagram all the samples occur in the field of III type kerogen (Fig) In the successions of Northern Azerbaidjan layers with more high content Corg -10-15%. Extremely rich source facies for oil are marked in the Perekyushkul succession-about 20%. This sample is characterized by extremely genetic potential (123.5 mg HC/g rock). Its hydrogen index values are also increased - 570 mg HC/g Corg, i.e it belongs to the I type kerogen and presents the perfect oil source rock. Therefore the Maikop series of Kertch Peninsula can be treated as gas source, first of all: they have also some oil potential, but is not high, as compared to other regions of the Caucasus-Scythian region. Maikop series of Northern Azerbaidjan have been characterized by the source rock with different potential-from the poor to excellent; frequent intercalation of interlayers with differ OM type marked.

Rate of OM bituminization is relatively high (6-12%): with the increased bituminization occurring at lower catagenetic levels (R^0<0,5). Chromotographic analysis show that bitumens, obtained from different regions for all divisions, are to a greater extent similar to each other. The peculiar feature of most of the chromatograms is bimodal distribution with predominant maximums at C_{18} and C_{19}, C_{21}nn-alkanes, as well as the presence of large "hump" in the high molecular field, including (besides non-identified compounds) n-alkanes C_{29} and C_{31}, polycyclic naphthene -

steranes and triterpanes. The values some coefficients varies sharply: Ki =0,2- 5,6, Pr/Ph=0,3-7,7. This values in samples from Kercth varies more sharply. The most part of the samples studied characterized by the increased odd ratio within the high molecular alkanes (Kodd=2-3) area, with the increasing share of high molecular alkanes and, mainly, C_{31} and C_{29}. Typical distribution of steranes is relatively equal, with insignificant predominance of C_{28}, thus proving the OM mixed type presence.

Though the Maikop sediments accumulated during marine conditions, they significantly differed. These were, probably, the cavities on the shelf, were organic material, drifted from the land in both detrital and soluble form, was

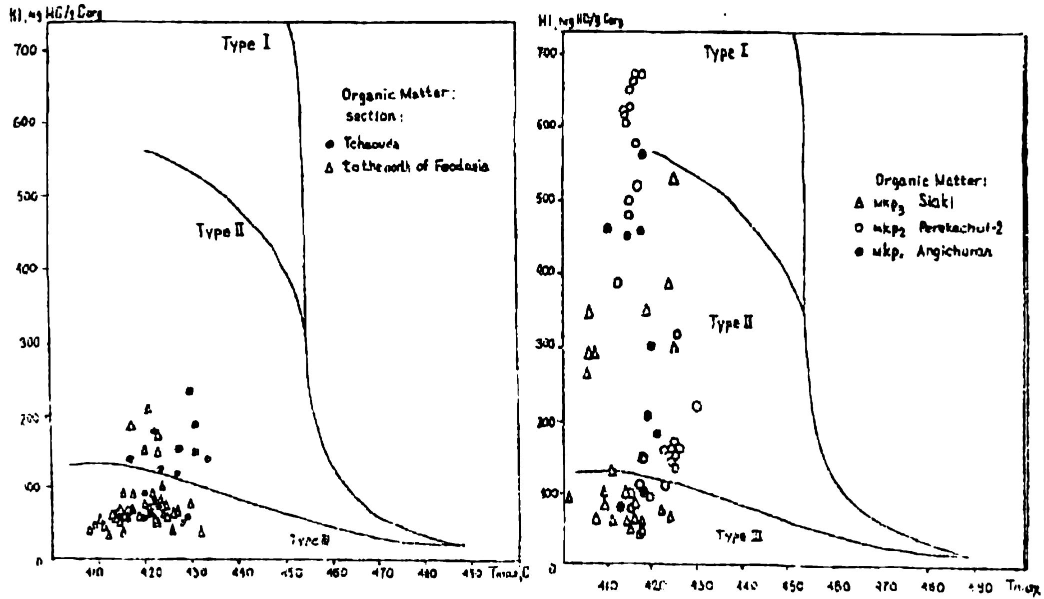

Fig.I ORGANIC MATTER TYPE OF THE MAIKOP DEPOSITS

KERTCH PENINSULA NORTHERN AZERBAIJAN

halted, then being intensively reprocessed by bacteria. Hydrogen sulfide contamination environments, regularly occurring in deep parts of the Maikop sea and Azerbaidgan part, didn't affect the modern territory of the Kertch peninsula. Probably it has been just the increased gas source potential (the realization of which had already occurred earlien protocatagenetic stage, when collector were absent), which has produced gas saturation of the silty-clayey formation; gas is escape as mud volcanism.

Among all the earlier studied regions of the Maikop series distribution the discussed successions of the Northern Azerbaijan are characterized by the highest oil-source potential. The alternation of oil and gas source rock members along the sequence favours the realization of their oil-source potential. The comparative analyses of OM from the Maikop Series has shown that the two above regions contain immature OM of the mixed origin which accumulated in the unified Maikop Sea. Strong differences in the amount of the source potential of both the OM and whole series had resulted rather from the strongly different bioproductivity and sedimentary environments and diagenesis of OM, than from different biocenoses.

HISTORY OF THE SCYTHIAN PLATFORM IN THE LIGHT OF THE QUANTITIVE ANALYSES

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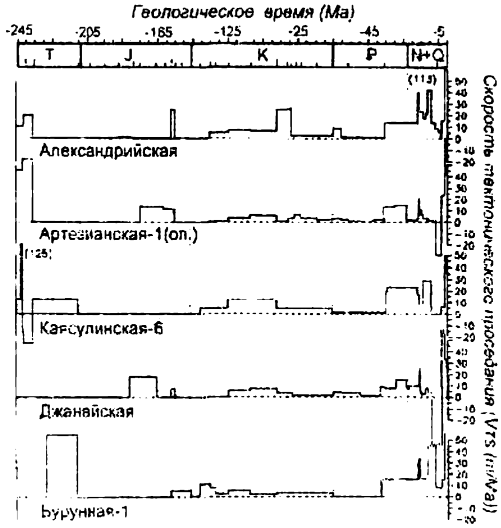
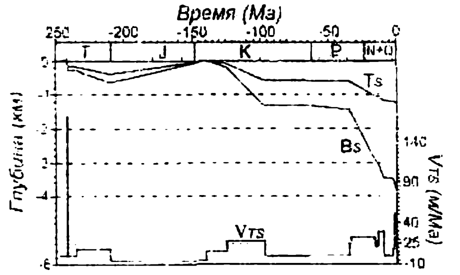
Numerical computer analysis and modelling of 6 the geological processes, based on data of field observations and borehole cuttings have become an inavoidable brunch of sedimentary basins studying.

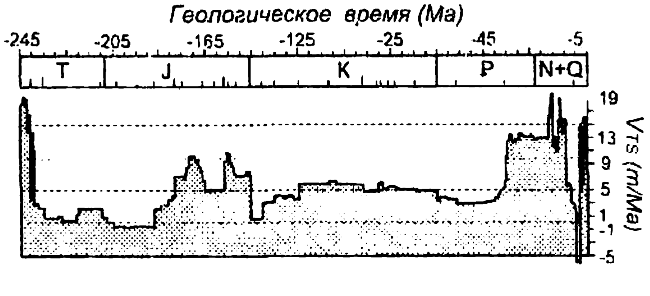
Analyses of numerical characteristics allows comparison of origin histories of both as of different tectonic zones in a single basin an as of different basins distant in space and time as well.

We used data of 128 wells sited in different tectonic units of the Scythian platform to explore its origin.calculation of complete basement subsidence (Bs). tectonic subsidence (Ts) and their velocities (Vts,Vbs) were fullfilled in backstripping analyses technique with decompaction correction [1]. These quantities are shown in charts (Fig.1) which are given in comparison to subsidence velocities. The average values of these parameters were also calculated(2). The chart of the average velocities of tectonic subsidence changes (Fig.2) reflects the main stages in the Scythian Platform history which coincided with different tectonic epochs. the results of the above mentioned analyses is marking out the next development stages in the history of the Scythian platform and their dynamic interpretation.

1. Early- Middle Triassic - rifting
2. Norian - Rhattian : orogeny molasses basin formation;
3. Hettangian - Early Plinsbachian: high standing of the region;
4. Late Plinsbachian- Toarsian: rifting, formation of the Crimea - Great Caucasus Trough;
5. Aalenian - Bajocian: rapid subsidence of southern and South-Eastern parts of the region
6. Late Bajocian - Bathonian: reduction of subsidence of southern part and upraise of Nothern one of the region :
7. Pre - callovian : uplifting, deformations.
8. Callovian- Tithonian : the new phase of intensive subsidence;
9. Early - Middle Berriasian phase of rapid uplift:
10. Late Berriasian - Barremian.
11. Barremian - Aptian transition short inversion in western part of the platform
12. Aptian- Eocene: stable subsidence of the whole region, complicated by phases of weak acceleration or moderation of subsidence (the most noticeable phases of increasing subsidence occured in Aptian - Albian. Cenomannian and Campagnian):
13. Oligocene - Early Miocene early collisional phase for the rapid subsidence ;
14. Middle Miocene - Quartenary: origin of molasse basin and inversion of Karpinsky Swell. Five impulses of descending can be distinguished: Tchokrakian -Karaganian. Middle- Late Sarmatian. Pontian. Akchagylian and Quarternary (16.5-15.0. 12.4-9.7. 7.0-5.0; 3.7-1.8; 1.6-0 Ma accordingly).







CRETACEOUS AND PALEOGENE FACIES AND PALEOENVIRONMENTS OF THE AFGHAN TADJIK DEPRESSION AND ITS MOUNTAIN FRAME.

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Neritic, lagoonal, lacustrine and fluviatile Cretaceous and Paleogene deposits are distributed in the Afghan-Tadjik depression and its mountain frame. In early Neocomian time a sedimentation of red colored clastic and clay non marine deposits took place in the Afghan-Tadjik depression. Marine transgression began in Hauterivian time. The sea came from the West. The transgression was pulsate. Non marine environments returned to the depression in early Barremian time. Next transgression began in late Barremian and reached maximum in late Albian time when most of the depression and its frame ware occupied by the Tadjik sea. In late Cretaceous time the Tadjik sea spread over the territory of the Afghan-Tadjik depression and its mountain frame. In the Cenomanian, Turanian and early Senonian time it was an area of neritic and lagoon sedimentation. Lagoon environments was widespread in the Santonian age. In the Campanian age part of the territory was an area of denudation. Wide transgression occurred in late Senonan time and neritic environments are peculiar for the Maastrichtian age. In the Paleocene and the most part of the Eocene epochs a shallow sea and its lagoons occupied the territory of modern Afghan-Tadjik depression and its mountain frame. The sea had left this territory in the late Eocene and returned in early Oligocene time. After the Ruppelian age the sea left discussed region for ever. All facies zones are cut by late Cenozoic Vakh - Transalay and Darvaz - Karakul faults. A significant part of a territory of the Cretaceous - Paleogene Tadjic Basin is covered by the Pamir during the Pamir - Tien Shan late Cenozoic interaction Facies of the easternmost part of the Cretaceous-Paleogene Tadjik sea are preserved in western part of the Tarim depression. Eastern parts of facies zones of southern slope of the Afghan-Tadjik Basin were deformed and moved far northward in late Cenozoic time. They constructed the External belt of the Pamir. Most spectacular is a picture of Paleogene facies zones, where southern facies zones of the AfghanTadjik basin are replaced northward in a distance of 300-400 km.

KINEMATICAL AND FLEXURAL MODELLING OF THE FORE-CAUCASUS MOLASSE BASINS.

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The Late Cenozoic evolution of the Eastern Fore-Caucasus molasse basin was controlled by the collisional history of the Caucasus segment of Alpian-Hymalaian fold belt The collisional history of Caucasus area has started at the Eoc/Ol. boundary when north-dipping subduction was changed by collision in the Transcaucasus area with Tauride-Anatolice terranes It led to the uplifting of the Transcaucasus region, compressional tectonics in the northern areas and subsidence of broad area including Fore-Caucasus and Caucasus. Black Sea and South-Caspian Sea. Starting from the paleotectonical and paleogeographical reconstructions we have made the burial history restoration, which formed the basis for dynamical modelling of the basin.

More than one hundred deep wells situated in Eastern and Western Fore-Caucasus basins and in the Crimea were backstripped and the resulting burial histories were averaged to produce statistically averaged burial history of the whole basin. The compaction correction was made on the base of porosity-depth dependencies calculated on the base of porosity data for Western Caucasus basins. Detailed seismostratigraphical interpretations of 3 regional seismic sections (crossed all main structural units of Eastern and Western Fore-Cacausus molasse basins) were considered as "stratigraphical record the basins subsidence histories. 2D burial histories of the basins were restored. Wells situated along profile were used to validate geological interpretation of seismic lines.

The results of kinematical restoration forms the basis for dynamical flexural modelling. In general, it was proposed three models of the Fore-Caucasus molasse basin dynamics: (1) common model of flexural elastic response of lithosphere orogen loading, (2) model of foredeep basin origination due to viscous convective movements in the crust and upper mantle (Mikhailov et al., 1997); (3) model of foredeep basin origination due to basalt-eclogite phase transition in the lower crust (Artyushkov, 1993). It is seen from the 2D restorations, that Maikopian basin (36-17) differs from Chokrakian-Quternary basin (16-0 Ma). The shape of Maikopian basin is flattened with slight dipping to the south, the characteristic wavelength much more than size of the section (more than 1000 km). On the other side the geometry of molasse basin (Chokrakian-Quternary) has a characteristic shape with flexural deepening to the orogen and forebulge outside. The characteristic halfwave length is near 300 km similar to halfwave length of elastic flexure. This shape is typical for flexural foreland basins formed due to elastic flexure of lithosphere in response to orogen loading. Such basins was recognized broad across Alpian-Hymalaian orogenic belt (Pirenean, Alpian, Carpathian, Hymalaian foreland basins). So, we use the first model for Chokrakian-Quaternary stage. The geometry of the molasse basin is defined by the flexural properties of the lithosphere, intraplate stresses and loading of the mountains and sediments. The knowledge of the basin geometry allow us to estimate orogen loading force. Knowledge of the basin shape through the time (from 2D kinematical restoration) allow us to obtain loading history through the time.

In present time the modelling was done for Eastern part of Fore-Caucasus. The results of forward modelling shows the good agreement between backstripped and modelled basin geometry. The fitted level of intraplate stress was far from critical value and its influence on basin shape has a second order effect. The EET values falls into the range 50-60 km. The interplay between orogen and basin lithosphere was incorporated into the model through the left corner deflection and bending moment. Their distributions shows the growth of orogen loading with time and relative fall in Late Akchagylian-Quaternary associated either with erosion or with and weakening of connection between basin and orogen.

The regional deep seismic reflection profiles were used to construct crustal-scale regional cross-sections. Thermal model of lithosphere (based on the recent heat flow corrected on sedimentation in basin areas and erosion in orogen areas), crustal sections and experimental rheological relations for rock-forming minerals were adapted to produce rheological sections of the region and estimate the distribution of flexural rigidity of basin lithosphere. It is in general agreement with the result of forward flexural modelling.

The cause for Maikopian subsidence is enigmatic but, probably, it may be related with change in subduction system and induced large scale processes such as mantle convection

EVALUATION OF STRESS STATE OF EAST EUROPEAN PLATFORM

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(Geological Institute of RAS)

It is executed calculation of stress state of East European platform within the framework of the problem on the balance of elastic plate, loading in its plane by active tectonic forces. We considered two variants of loading. According to the first variant active tectonic forces are realized on the northwest border and on the south border of platform. On the second variant active efforts act on south-west border. We calculated the displacements and stresses. It allows to carry out an analysis of orientation of possible zones of failure. There was assumed that tectonic damages realize on the planes, to which shear stresses exceeds the cohesion and internal friction.

Planes of failure are oriented to main stresses under angle $\phi = \pi/4 \pm \varphi/2$

where φ is a friction angle. On Fig.1 and Fig.2 are shown the planes of shear failure at right and left orientations. Length of planes corresponds to the value of maximum shear stress. Analysis shows that first variant of loading (Fig.1) gives a pattern of possible planes of failure which is the most correspondence to distribution of faults.

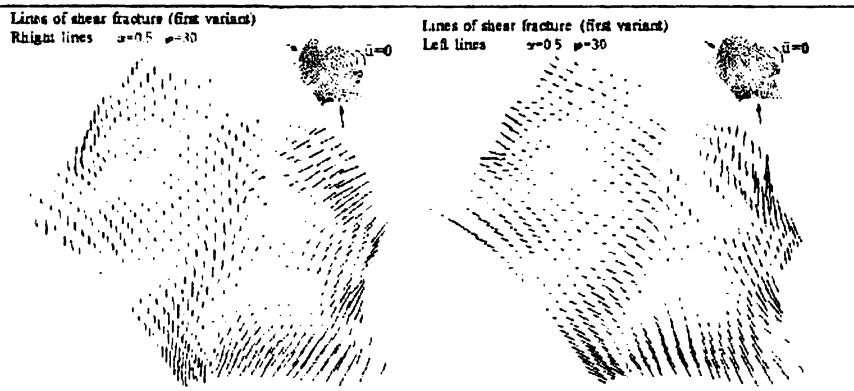

Fig.1

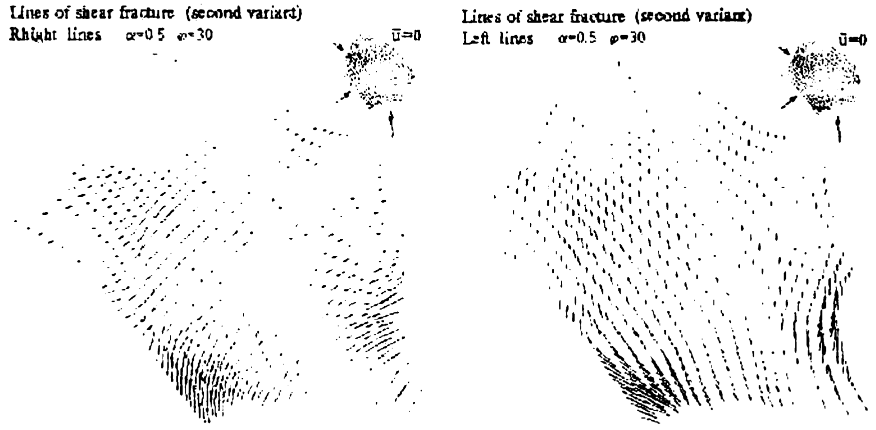

Fig.2

NUMERICAL MODELLING OF PRECASPIAN BASIN SUBSIDENCE AS A RESULT OF ECLOGITE PENETRATION BENEARH EARTH CRUST DURING VENDIAN COLLISION

Garagash I.A., Lobkovsky L.I., Volozh Yu.A.
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Precaspian depression is one of the deepest sedimentary basin. The depth of sediment cover in its internal part reaches 22-24 kms. Study of sediment history has resulted in conclusion that the modern structural plan of Precaspian depression was generated not later then early Paleozoic and remains constant till now. In its limits, since the end Riphean and till now there occurs continuous tectonic subsidence of central part of Precaspian depression. Thus in a time are strictly saved tectonic outline of this structure. The rates of subsidence in a time vary.

Since Devonian and down to beginnings Mesozoic there occured fast tectonic subsidence, which basically has generated modern shape of Precaspian depression. This process is not connected with thinning of the earth crust, as far as a significant extension of the earth crust did not at occur this time.

The listed features of Precaspian depression formation can be explained by eclogite penetration beneath earth crust during Vendian collision. This assumption is agree with seismical data according to which under crust in Precaspian basin there are lenses of rocks with increased density by thickness about 15 km. Above these lenses on surface local positive gravity anomalies of very high intensity are observed.

Preliminary calculations show that the formation of eclogite lenses in Precambrian results in fast subsidence on a depth of the order of one and half kilometers. Further the accumulation of sediments results in the increase of subsidence as it is shown by dotted line on the Fig.1. To the beginning of Devonian the deflection reaches eight kilometers. In a interval between Devonian and Mesozoic the velocity of subsidence grows, and then decreases, resulting finally to the subsidence about fifteen kilometers. The calculated subsidence curve qualitatively coincides with geological curve at obvious quantitative differences in Precambrian and Mesozoic. Variation in parameters of problem allows to achieve the best quantitative coincidence with geological data.

The maximal subsidence coincides with centres of eclogite lenses, whereas the zones of maximum effective shear stresses, reducing to crust failure place on their perimeter. It is visible that the shear stress distribution agrees with distribution of faults.

Calculations show, that deflection of the lithosphere plate in central part of Precaspian depression is accompanied by small lifting about several ten meters on its borders. It established that this high in width of the order of 50-100 km continuously surrounds Precaspian depression and it is coincided with many opened oil and gas deposits. So, for example, in North Caspian region the high passes through Tengiz deposit and deposits of Buzachi peninsula.

On other Fig. 2 the distribution of the displacements and main shear stresses inside section of Precasoian basin under weihgt of penetrated eclogite lenses and tangential tectonic forces are shown. For calculation was used the elasto-plastic Mohr-Coulomb model.

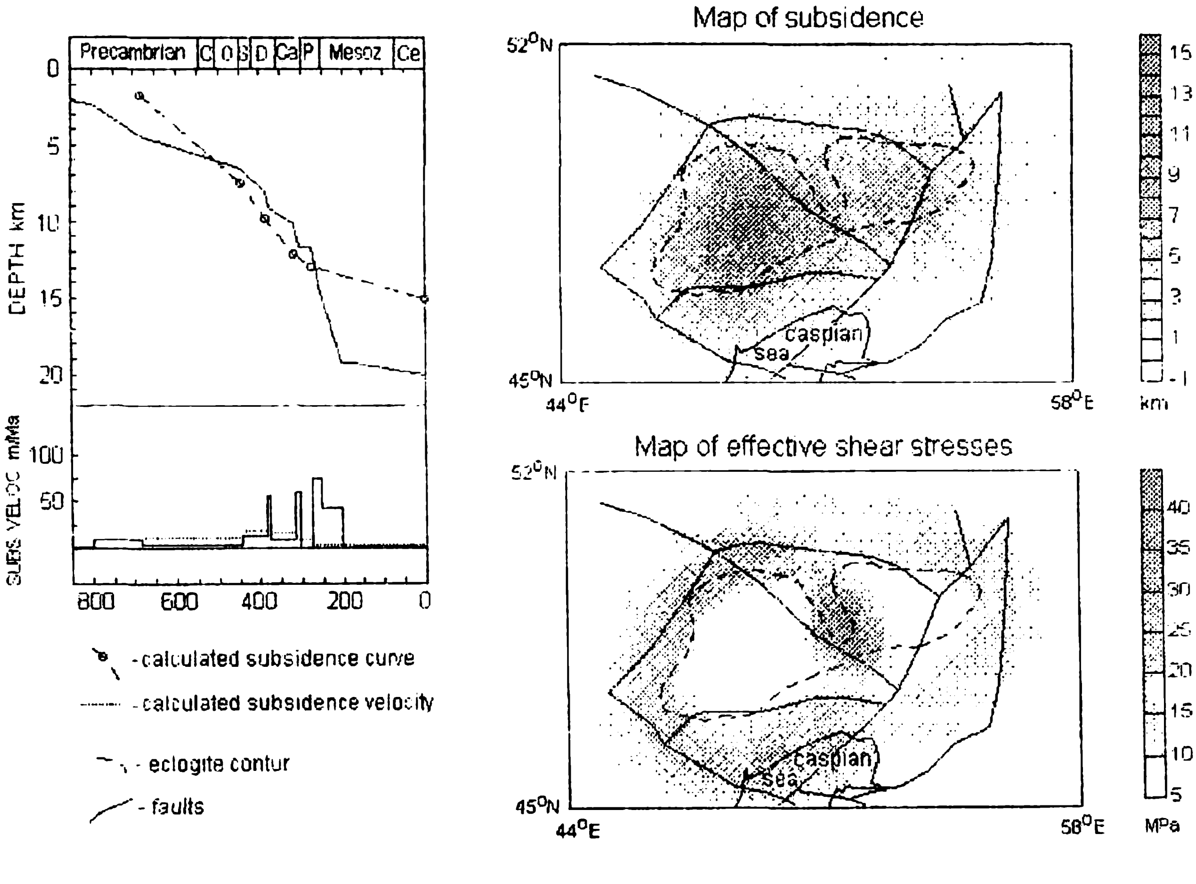
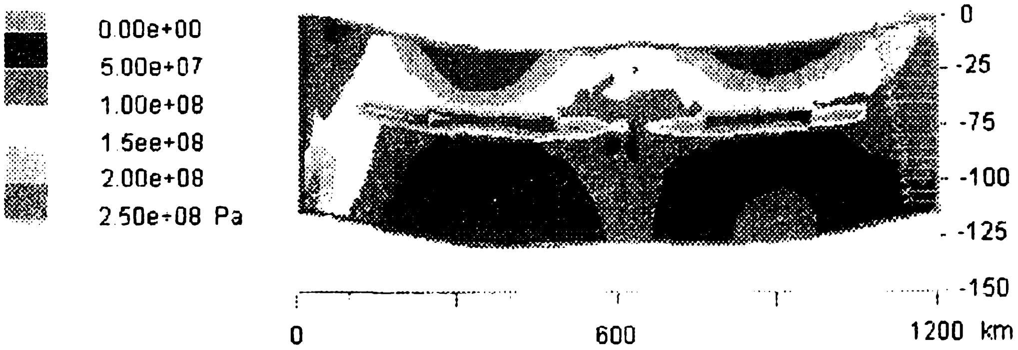


Fig.1

Fig.2

Distribution of the displacement and main shear stresses in section of Precaspian basin (Mohr-Coulomb model)



MAGNETOSTRATIGRAPHY OF THE LOWER APTIAN SUBSTAGE FROM THE MIDDLE VOLGA REGION

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Preliminary results have been obtained of detailed magnetostratigraphic study of the Lower Aptian section (about 60 m thick) from Ulyanovsk (Middle Volga Region). The section is characterized by extraordinary stratigraphic completeness. E.Yu.Baraboshkin recognizes the *Deshayesites weissi* (?), *D. forbesi, D. deshayesi, D. grandis, Tropaeum bowerbankii* ammonite Zones in the Lower Aptian and *Aconoceras nisus* Zone in the Middle Aptian within the section. The presence of the Upper Aptian is also supposed. The completness of the section makes possible to propose the Ulyanovsk Aptian section as the reference section for the Volga Region and probably for the Central and Southern Russian Platform.

On the whole, oriented samples from 102 stratigraphic levels were examined. Reliable paleomagnetic determinations are available for the samples from 78 levels, which makes it possible to construct a paleomagnetic column for the section.

The section is characterized by chiefly normal polarity, with three magnetozones of reverse sign against its background: one of them is associated with the base of the Aptian stage, the other two are situated in the uppermost of the section.

The lower **R**-magnetozone, stratigraphically equivalent to the lowermost of the *D. weissi* (?) Zone, is confirmed by the samples from 13 stratigraphic levels; it is 8 m thick. Most probably, the zone recognized is the analogous to the **MO** chron from the scale of linear magnetic anomalies.

The middle **R**-magnetozone lies in the uppermost of the *Aconeceras nisus* Zone. This zone, 3 m thick, is substantiated by four samples.

The section is crowned with the **R**-magnetozone comprising the deposits, conventionally assigned to the Middle Aptian or possible, to the basal Upper Aptian. This magnetozone, 4 m thick, is substantiated by 6 oriented samples.

In the stratigraphic respect, the R-magnetozones recognized, and first of all the lower R-magnetozone (analogous to MO), are reliable stratigraphic bench marks for synchronous correlations of the deposits both, on the regional and global scales.

Paleomagnetic correlations of the magnetostratigraphic sections from Ulyanovsk and the North Mediterranean (Channell, Cecca, Erba, 1995) testify to the temporal synchroneity of the zonal stratigraphic boundaries in these regions. Both, in the Lower Aptian section from Ulyanovsk, and in the sections from Northern Italy, the R-magnetozone from the base of the Aptian is associated with the lowermost of the D. *weissi* Zone.

In the geophysical aspect, the data obtained from the Ulyanovsk section, confirm the point of view, stating that the regime of the Aptian nominal field after the epoch of reverse polarity MO, was repeatedly complicated by reversals (Pospelova, 1976; Guzhikov, Eremin, 1995).

Coordinates of the Early Aptian geomagnetic pole were calculated from the results of the paleomagnetic determinations: longitude L=209°, latitude F=67°

UPPER CRETACEOUS - PALEOGENE MICROPLANKTON STRATIGRAPHY AND GEOLOGICAL EVENTS OF THE NORTHWESTERN TURAN PLATE AS INDICATOR OF THE CONNECTION BETWEEN PERITETHYS AND WEST SIBERIA BASIN (GRANT 95-96-11)

Khokhlova I.E., Radionova E.P, Beniamovskii V.N., Sherbinina E.A., Oreshkina T.V.
Geological Institute RAS, Academy of Sciences, Pyzhevsky per., 7

In the Paleogene for the study region the change of carbonate sedimentation into siliceous one is typical. Most of investigators consider the changes in the water-change between basins as main causes of these processes. According to the most popular model of Berger (1970), two types of inter-basin circulation are the most typical. The first is so-called "lagoon" type, when deep waters flows out the system, being replaced by surface waters. This type of circulation is accompanied by carbonate sedimentation. Accumulation of siliceous sediments is connected with the reverse process - that of "estuary " type, when deep waters flow into a basin, and surface waters flow out it. Types of basins change due to both tectonic and eustatic reasons. In the northern part of the Turan Plate and in the area of the connection between PeriTethys and Arctic oceans (Turgay Passage)
the type of basin has been changed during the Paleogene more than once. 22 sections of the Upper Cretaceous - Paleogene sediments containing calcareous (Buzachi and Mangyshlak Peninsulas) and/or siliceous microfossils (northern Turan Plate and Turgay Passage) were stratigraphically subdivided and correlated. On the basis of this study and the paleogeographic schemes for the Thanetian and Ypresian (NP 12 nannoplankton Zone) time slices were done. In the Lowermost Paleogene (Danian Stage) a shallow-water marine basin with a well-known assemblage of mollusks, brachiopods, foraminifera etc occupied a great area of the Eurasia, biogenic siliceous accumulation was considerably restricted and probably took place only in the Volga River Region. Biosilica accumulation spread in Zelandian and Thanetian to the south, east and west, achieving its maximum in the Ypresian, the last one can be considered as an interval of wide-spread siliceous accumulation. Thick siliceous units of the western Siberia and Eastern Ural belong to the Early Eocene and contain abundant siliceous microfossils - diatoms and radiolarians. Lower Eocene terrigenous-siliceous sedimentation took place in northern PeriCaspian basin, and even in the northern areas of the Turan Plate. In the western part of the Turan Plate (Buzachi and Mangyshlack Peninsula) Paleocene-Upper Eocene sediments are represented by mainly carbonate sediments (marls and limestones), subdivided on the basis of nannoplankton and planktonic foraminifera (all foraminiferal Zones of the Crimea-Caucasus zonal scheme were distinguished), and correlated to the standard zonal shemes. Paleocene-Eocene sediments of the Turan Plate' western and central part can be easily correlated to European Paleogene Stages as well (Naidin, Ben'yamovsky, Kopaevich, 1996). In northern direction, Paleogene sedimentation transforms into clayey-carbonate (northern part of the Turan Plate), where planktonic forams diappear, and siliceous
microfossils begin to be used for stratigraphical subdivision. In the area of
connection between two oceanic basins- PeriTethys and Arctic basin (Turgay Passage) in S-N direction
clayey-carbonate Paleocene-Eocene sediments turn into mainly clayey-siliceous. In northern Turgay (Sokolovsky and Kachar quarries) Ypresian sediments of the Kachar Formation lie non-conformably on carbonate sandstones of the Paleocene Sokolov Formation (Sokolovsky quarry), or on the Cretaceous sediments (Kachar quarry). Paleocene sediments

were distinguished on the basis of nannoplankton (CP7 Zone) and diatoms (Coscinodiscus uralensis Zone). Upsection nannoplankton disappear.
and Ypresian sediments are dated according to the presence of radiolarians of the Petalospyris fiscella regional Zone and Phormocyrtis striata striata standard Zone. Bartonian-Priabonian terrigenous Chegan Formation, containing dynocysts of D12 Zone, lies above with an erosion. In southern Turgay Passage Eocene sediments are subdivided into: Tasaran. Saksaul, and Chegan Formations (Yanshin, 1953), and Paleocene-Lowermost Eocene sediments were proposed to be subdivided into: Belsher (Atanbass), Baimurat, Shalkarteniz and Taups Formations (Ben'yamovsky et al., 1993). Ypresian sediments are represented by terrigenous-carbonate sediments of the Taups Formation with foraminifera of the Globorotalia subbotina Zone, and terrigenous-carbonate-siliceous sediments of the Tasaran Formation of the Late Ypresian-Early Lutetian age. Thanetian nannoplankton and planktonic foraminifera which were found in sections in Turgay Passage, testify to the great invasion of the PeriTethys warm waters far to the North as
a result of the Thanetian transgression after the hiatus accompanied by erosion on the Zelandian-Tanethian boundary. The connection between the Tethys and Arktic Basin through the Turgay Passage existed evidently in the Thanetian and was greatly increased in the Early Eocene (Ypresian time).

RADIOLARIANS AND SPONGE SPICULES ON THE MAIN BOUNDARIES OF PALEOCENE.

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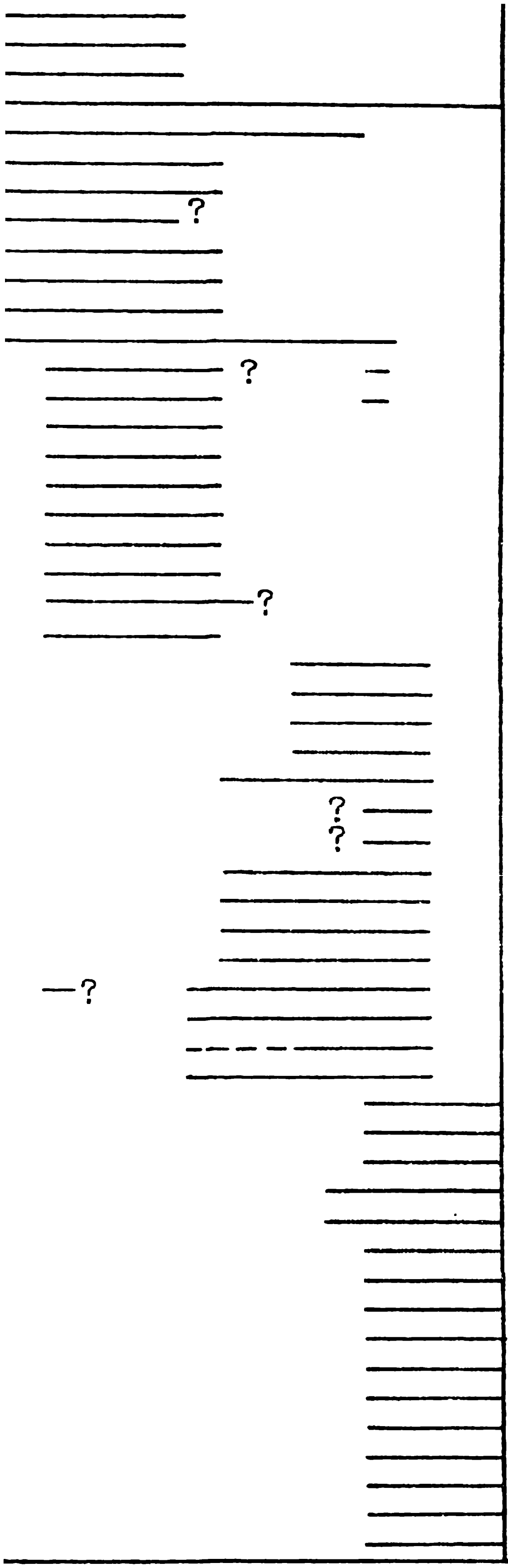
The onset of the Circum Antarctic and others Current in the end of Cretaceous and in the beginning of Paleocene affected the evolution of siliceous microorganisms. Radiolarian assemblages also rejuvinated during the late Paleocene. Radiolarians appeared to be more mobile. Within the North Russia and its rim as an example, we may see that new genera and species (about 30) of clathrocyclides, acropyramidae, lampromithrides, spongurides and others appeared even in the late Campanian. Simultaneously more than 50 Cretaceous species died out: the genera of typical Cretaceous nassellarians Pseudodictyomitra, Thanarla, Xitus, Lithostrobus, Coniformia disappeared. The replacing of the Cretaceous radiolarian fauna is not completed with this. The genus Amphipyndax more typical for the Late Cretaceous died out in the early-middle Paleocene, and other genera characteristic of the Cretaceous became extinct: Theocapsomma, Dictiomitra, Lithocampe, Stichomitra, Nepsciadiocapsa, Sciadiocapsa, Theocampe from nassellarians and Pseudoaulophacus, Archaeospongoprunum, Orbiculiforma, Phaseliforma, Cromyomma, Patulibracchium, Staurodictya and others among spumellarians. These evolutionary changes happened for radiolarians at the Late Cretaceous/Paleogene boundary may be observed in the section of the NE Russia. Similar radiolarian events are observed in the southern part of the Russian platform.
The latest Maestrichtian-Paleocene is noted for the appearance of numerous spumellarians: stilospheres (S. goruna, S. minor), amphispheres (A. spinulosa), spongurusses (S. bilobatus, S. Mollis), spongotrochuses, as well as new genera of nassellarians: Buryella, Dyplocyclas, Clathrocycloma, whereas Bekoma appears in the late Paleocene.
The predominance of nassellarians over spumellarians characteristic of the Campanian-Maestrichtian changes by predominance of spumellarians over nassellarians just at the Cretaceous/Paleogene boundary. Extinction of Cretaceous genera throughout the Paleocene, and appearance of typical Cenozoic genera and species a bit later, near the Paleocene/Eocene boundary, were recorded in the Pacific and Peri-Tethyan Raalms.
A very diverse sponge spicules and fragments of sponges were found within Paleocene - Eocene intervals.
The presence of asymmetric and twisted sponge spicules and thick sponge fragments in the bottom of the Sokolovsky Paleocene Section shows unnormal solt regime and shallow-water conditions.
Sponge spicules indicate the edge of continental slope condition in the end of Paleocene up to Eocene time.

1. Range of species at the Early Cenozoic boundaries



Orbiculiforma campbellensis
O. renillaeformis
Stichomitsa livermorensis
Cornutella californica
Bathropyramis sanjoaquinensis
Theocampe vanderhoofi
T. altamontensis
T. cf. yaoi
Amphipyndax stocki
A. stocki var. C
A. plousios
Clathrocyclas sp.
Lithomespilus mendosa
Stylosphaera? minor
S. goruna
Protoxiphotractus aff. perplexum
Amphibrachium cf. mucronatum
Prunobrachium? incisum
Spongurus mollis
Anthocyrtella? limbata
Stichomitra alamedaensis
Eucyrtidium granulata
Spongodiscus resurgus
Prunopyle elliptica
P. occidentalis
P. ovata
Spongurus bilobatus
Fipetta? conus
Lamprocyclas cf. maritalis
Spongurus minor
Amphicraspedium prolixum
A. murrayanum
Amphymenium splendiarmatum
Spongodiscus americanus
S. cruciferus
S. craticulatus
S. communis
Heliogiscus lentis
Xiphosphaera irinae
Lithelius hexaxyphophorus
Bathoropyramis victori
B. scalaris
Theocorys cf. reticulata
Spongolena? lataformis
Stylosphaera megaxyphos
Calocycalas? litos
C. semipolita
Orosphaeridae
Calocycloma? ampulla
Rhopalodictyum californicum
Stylosphaera eocenica
Periphaena dupla
Lophocomus titanothericeros

JURASSIC - PALEOGENE SUCCESSIN OF THE TURANIAN PLATFORM: LITHO- AND BIOSTRATIGRAPHY AND PALEOGEOGRAPHY

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The Turanian Platform is located between Kopet-Dag Mountains to the South, Russian Platform to the West-North, part of Uralian fold belt and West Siberian Platform to the North and Caledonian Kazakhstan orogenic structures to the East. It rests on Late Palezoic - Early Mesozoic folded basement and has got Jurassic-Neogene sedimentary cover The basin evolution includes the following main cycles. Early Jurassic - rifting, volcanism (on the north). only terrestrial sedimentation Middle Jurassic is presented by mainly terrestrial sediments in the north areas and shallow marine in the south Late Jurassic begins a long period of marine mainly carbonate sedimentation with several sequences divided by gaps of unequal duration. However several intervals of dominantly terrigenous marine sedimentation are evident. especially inside Albian-Cenomanian-Early Turonian and Oligocene.

The Lower-Middle Jurassic stratigraphy is based on the data of palinostratigraphy and rare remains of marine fossils. The Lower Jurassic is subdivided on the several local foramations, changing each other at the vertical and horizontal directions. At the base of these formations the weathering crust and angular unconformity are discovered These formations are presented by alluvial deposits in the lower part and by sandstones and clays with coal-beds in the top. The age of these formations can be determine as Sinemurian - Toarcian. The middle Jurassic is subdivided on the five local vertical sedimentological units. These formations consist not of only terrestrial, but shallow marine sediments also For the terrestrial parts coal-beds are very typical. The total thickness

Late Jurassic stratigraphy is based on the ammonites and bivalves fauna. Foraminiferal assemblages are very important for several intervals also.In Oxfordian main northern part of Turanian Platform was covered by shallow sea with mainly terrigenous sediment accumulation of clays, silts, and in some areas marls The total thickness of Oxfordian of this facial type is up to 150 m. In southern part (Tuarkyr. Kopet-Dag) Oxfordian consist of shallow water limestones up to 50-200 m. The Kimmeridgian and Tithonian could not be differentiated because they represented by thick limestone unit. In North Ustuirt area and Peri-Caspian basin limestones mainly contain boreal ammonite and brachiopod fauna. which is very similar to Volgian assemblage. In southern part of Turanian Platform Tithonian consist of very shallow water algal and oolitic limestones. During late late Jurassic all Turanian Platform was the area of shallow water carbonate accumulation. But as result of tectonic activity Neocomian terrigenous complex unconformably overly the Jurassic. and in vast territories of south Ustuirt. Buzachi and Mangyshlak Penninsula the late Jurassic carbonates were completely eroded.

The Lower Cretaceous of the Turanin Platform have an intermediate character between Mangyshlak and Kopet-Dag region. The existence of Bernasian - Hauterivian sediments in Karakum-Aral-Kyzylkum area is very problematic. The interval is usually represented by red-coloured lagoonal and (?) shallow - marine deposits of Chelpek, Saraplin and Sandykachin Formations. There a few finds of marine oysters and rare *Buchia* are known from that interval. The dating of the Barremian is possible only due to correlation with Kopet-Dag and Mangyshlak sections. It is represented mainly by evaporites (in the base) and carbonate oncolite succession with orbitolinids (in the top). It changes into continental sediments to the north-east. The Aptian sediments transgressively cover the rocks below (up to Triassic). They are represented by terrestrial shallow-marine succession with bivalves and ammonites. The succession contains numerous unconformities marked by phosphorites and erosional surfaces Albian succession of the Turanian Platform is very similar to that one of the Mangyshlak - Peri-Caspian area. It starts with the shallow-marine terrigenous sequence (Lower+Middle Albian) and finishes by the cross-bedded alluvial member with plant remains.

Biostratigraphic framework of the Late Cretaceous is based on the ammonite, inoceramid and foraminiferal zonations. These zonations permit very high resolution for stratigraphiacal correlation. The Upper Cretaceous is characterized by two main sedimentological units: marine terrigenous sediments are characterized Cenomanian-Middle Turonian interval and carbonate sedimentation is typical for Upper Turonian - Maastrichtian. Terrigenous sediments are presented by sand, sandstones and silt. The carbonate facies are represented by carbonate clays. marls, diverse chalks and detritic limestones. There is one practically regional unconformity in the Upper Cretaceous sequence of the Turanian Platform - at the Cenomanian/Turonian Boundary. This is correlated with so-name "Mid-Cenomanian event" and has a different duration at the different parts of this structure. Six more fine sedimentological units are differentiated into all Upper Cretaceous interval, which is represented by genetically related beds, members and formations. In their origin all these small units are related to eustatic sea level changes. Some of sequence boundaries are correlated with "spikes" of coastal onlap graph in Vail curve. Probably all Late Cretaceous interval coincides with quickly increasing global sea level, but very short fall interval have been established also. Thickness of these sediments are up to 500 m. .

Paleocene-Eocene interval is representeded only by marine sediments. Foraminifera and nannofossils are most important for stratigraphical investigations. Lower Paleocene (Danian-Montian) limestones coincides with most shallow water episode during all Paleogene. Very interesting Danian outcrops are distributed at the North Mangyshlak area. The thick rhytmically bedded sequence of detritic sandy limestones and horizons of chert nodules are typical. In outcrops many remains of echinids exist heir, but in boreholes only forams and nannoplankton give the possibility for subdivision and correlation. Thickness about 100 - 150 m. Thanetian sections are represented by three lithofacies: 1. "particolored" limestones, and marls ; 2. strong calcareous clays and marls; 3. siliceous noncalcareous sediments. Thickness - 10 - 50 m. Ypresian-Lutetian interval is represented by alternation shallow water carbonate sediments and typical basin facies. Ypresian-Lower Lutetian is characterized by several lithofacies from shallow water nummulitic limestines till limestones, and marls with dark layers. Siliceous facies is distributed at the northern part of this area. Middle Lutetian is characterized by distribution of shallow water facies, and Upper Lutetian is represented of typical basinal facies. The basinal facies are distributed also during Bartonian and Priabonian.

The special position within the sedimentary cover has Oligocene Maikop Group - thick terrigenous mainly clinoform bodies. This interval correlate with important orogenic tectonic event inside the Tethian orogenic belt.

INTRAPLATE DEFORMATION OF THE SCYTHIAN AND SOUTHERN EAST EUROPEAN PLATFORMS AS A RESULT OF PRESSURE FROM THE ARABIAN PLATE

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Gentle structures of the Volga region and Scythian plate represented by swells, flexures and domes are traditionally considered a result of vertical movements. However a detailed geokinematic mapping of the Peri-Arabian collisional area carried out in accordance of our Project as well as field observations of the intraplate structures made us to propose directly opposed point of view that they emerged due to the northward directed horizontal pressure produced by the Arabian plate. Similar concepts have already been advanced by some researchers [Kopp, 1991; Krasnopevtseva, Schukin,1996; Leonov, 1995; Makarov, 1996; Nikishin, 1995; Sim, 1995] however as a rule they all are based on theoretical assumptions but not studies of the dynamics and kinematics of formation of the intraplate structures of their own. A step forward in this direction was made by scientists who proved a manifestation of the neotectonic submeridional compression in the Donets basin and Cis-Caucasus [Korchemagin, Emets, 1987; Rastsvetaev et al., 1987].

Our investigations captured a territory of the Lower Volga region which is more distant from the collisional belt than the above regions.Field works conducted in the area of the Karpinsky ridge and Ergeninsky escarpment using mesotectonic and geomorphological observations, as well as a thorough analysis of the published geological and geophysical data, have been found that the neotectonic structure of the Karpinsky ridge formed under the dextral transpression and northward underthrust of the Scythian platform caused by a pressure from the Greater Caucasus. The Ergeninsky escarpment considered by previous authors as a steep abrasional slope of an atectonic origin is in fact a synsedimental deep-seated normal fault.

The collected material, along with the seismic reflection and drilling data, allows to advance a hypothesis that the domain of narrow uplifted and sinked blocks separated by submeridional flexures, namely, the Don-Medveditsa zone of dislocations, Hopior basin, western Pricaspian basin etc., is a sort of a "basin-and-range" realm which has formed due to the E-W extension of the platform basement but is manifested only in the coherent flexuring of the platform cover at the earth surface. If it is so it may be safely suggested that in an extreme northern part of the zone of a dynamic influence of the Arabian indenter, the collisional extensional deformation like the occuring in the Baikal rift region takes place.

BLACK SEA BASIN - MODELLING OF THE BURIAL HISTORY.

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Black Sea is situated to the south from the East- European Craton, to the south from the Russia and Ukraine and to the north from the Turkey. Black Sea today is deep-water basin,its depth is nearly 2-2.5 km.

Deep-water part of the Black Sea consist of two basins - Western Black Sea basin and Eastern Black Sea basin, divided by Andrusov ridge. Western Black Sea basin has oceanic crust and Eastern Black Sea basin have very thinned continental crust. In gravity they are marked by two positive anomalies. Heat flow of the Black Sea reached 20-30 mWt/m2.

Back-arc origin of the Black Sea basin is proposed in the Mid-Late Cretaceous. The back-arc rifting took place in Aptian-Albian times and oceanic crust spreading occured in the Late Cretaceous time within the Western Black Sea basin. Spreading epoch coincides with subsidence of basin shoulders

The thickness of Cretaceous- Quaternary sedimentary cover of the Black Sea vary from 15 km in the Eastern Black Sea basin till 18 km in the Western Black Sea basin. Wells penetrate only upper part of the sedimentary cover (Neogene-Quaternary). The structure of the cover is known only by seismic data. Sediments of the Black Sea consist of 5 complexes: upper Cretaceous (2-3 km) and Paleocene- Eocene (3-4 km), they are mostly carbonates; Oligocene- Lower Miocene (Maikopian, 5-6 km), Middle-Upper Miocene (1-2 km) and Pliocene -Quaternary (3-4 km). According to seismic data sediments of the Oligocene and Miocene lays nearly horizontally.

1D backstripping and 2D kinematic restoration was done for the Black Sea basin and Crimea region. Tectonic subsidence peaks were obtained for Late Cretaceous, Oligocene- Early Miocene and Pliocene-Quaternary. The tectonic subsidence rates for those events are 30, 45 and 90 m/Ma. The same results are obtained for 2D modelling. Analyzing paleo-water depth finded rapid subsidence of the floor of the basin during Oligocene- Early Miocene

Thermal modelling of the lithosphere of the Black Sea show its heterogeneity and greater rigidity of the lithosphere in the central part of the basin.

Shape of the tectonic subsidence curve for Black Sea are not typical for curve of tectonic subsidence for post-rift cooling, model of the post-rift can't explain rapid subsidence in Oligocene - early Miocene and Pliocene-Quaternary time

Modern stress fields for Black Sea environment shows compression. Compressional model with lithosphere syncline-like flexure is proposed for explanation the rapid subsidence of the Black Sea basin in Oligocene - early Miocene and Pliocene- Quaternary .

PECULIARITIES OF THE EARLY CRETACEOUS TECTONIC ACTIVITY IN THE CAUCASUS AND WESTERN CENTRAL ASIA ACCORDING TO MAGNETIC SUSCEPTIBILITY OF SEDIMENTARY ROCKS

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Analyses of the magnetic properties in the Lower Cretaceous deposits from the Cis-Caucasus (Molostovsky, 1996; Guzhikov, Molostovsky, 1996), have allowed to reveal several impulses of tectonic activation in the Hauterivian and Barremian; the impulses were accompanied by drift of magnetic terrigenous material from the magmatic complexes of the Central Caucasus into the Cis-Caucasian basin.

Extension of petromagnetic research to the regions of the Western Central Asia has shown, that such animation of the Late Kimmerian tectonic activation had manifested itself in a vast area of the northern margin of the Peri-Tethys. Moreover, the results of magnetic susceptibility (k) research in the Barremian-Aptian from the Bolshoi Balkhan and Central Kopet-Dag (Fig.) made possible to reconstruct individual features of the Early Cretaceous dynamics of tectonic movements in each region.

Geologic interpretation of the petromagnetic data was based on the following premises: petromagnetic differentiation of the layers with allothigenic ferromagnetic materials within a section, reflects sedimentation rhythms conditioned by geodynamic reconstructions in denudation areas and, first of all, by the changes of the sourcelands (Guzhikov, Molostovsky, 1995; Molostovsky, 1996).

Against the general background of low magnetic susceptibilities of the Upper Barremian - Aptian rocks from the Bolshoi Balkhan, (k=1-20 10^{-5} SI units), a highly magnetic interval is clearly seen in the base of the Aptian stage (k=25-50 10^{-5} SI units).

In the Central Kopet-Dag, the Lower Barremian is marked with minimum magnetization (k=2-10 10^{-5} SI units). k values increase up to 8-18 10^{-5} SI units In the uppermost Barremian. The Aptian deposits differ from the Barremian ones in increased magnetism (k=15-28 10^{-5} SI).

Based on the petromagnetic relationships, one can conclude the following:

- The tectonic activity has the Aptian age in the west Central Asia. Determination of the sources of the terrestrial matter for the Cretaceous of Kopet-Dag and Bolshoi Balkhan paleobasins is discussional. N.P.Luppov (1938), A.Allanov (1968) and others, believes that land spreaded southward from Kopet-Dag in the Aptian. I.A.Rezanov (1959) thought, that the main land existed in the north. M.Sh.Tashliev (1971, 1992) used to support the former point of view, but later he concluded that the source of terrestrial matter was placed in the north.
- The Karabogaz land with the highly magnetic Paleozoic and Early Mesozoic magmatic complexes of Krasnovodsk region, used to provide terrigenous material to the area of Bolshoi Balkhan only in the beginning of the Aptian age. Later on, judging from the substantial magnetism reduction in the Aptian and Albian deposits, it was no longer important as a distributive province.
- The weakly magnetized sedimentary cover of the Turanian Platform was probably the principal sourceland for the areas of Bolshoi Balkhan and Central Kopet-Dag during the Aptian. The highly magnetic derbies of volcanic rocks from the Elburs could not reach the sedimentary basin The subduction zone northward from the Elburs volcanic arc was probably acting as a natural trap for magnetic material (Kazmin, 1996).

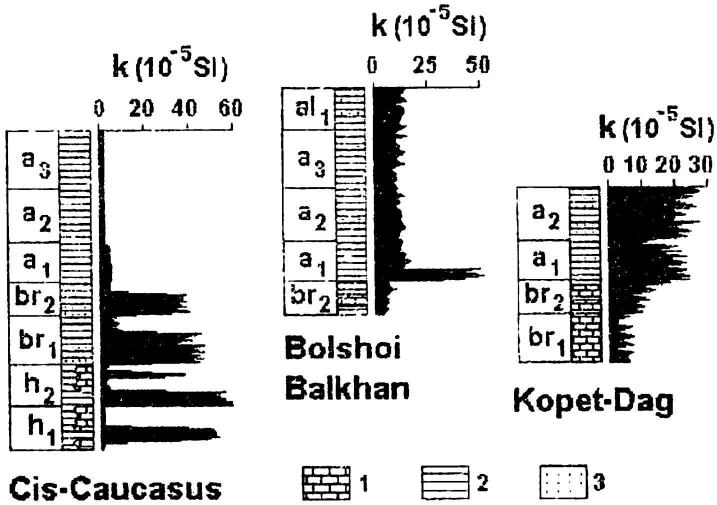

Fig. Magnetic susceptibility of the Lower Cretaceous of the Cis-Caucasus and Western Central Asia.
Legend: 1 - carbonate rocks, 2 - terrigenous deposits, 3 - sandstones.

BASIN GEOCHEMIC EVOLUTION OF THE OLIGOCENE AND LOWER MIOCENE IN THE CIS-CAUCASIA AND CIS-CASPIAN.

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Petromagnetic indications of the paleogeochemic settings are based on the analyses of varying natural scalar magnetic characteristics of the rocks, the variations being caused by authigenic magnetic minerals. Additional information is acquired from the changes of magnetic properties upon heating or artificial magnetization of the samples. Over 12 petromagneticsections have been studied from the Maikopian series in theCis-Caucasia and Cis-Caspian (Oligocene + Lower Miocene), with magnetization carried principally by authigenic pyrrhotine and greigite, and to a small extent by allothigenic magnetite.

Analyzed were magnetic susceptibility (**k**), natural remanent magnetization (**Jn**), remanent saturation magnetization (**Jrs**) and k changes upon heating up to 500^0 magnetic effects were manifested, caused by transitions of paramagnetic pyrite and siderite into magnetite.

Certain regularities were revealed in the changes of rock magnetic properties over a stratigraphic section; the properties were shown to be stable within the Maikopian paleobasin. Varying scalar characteristics were interpreted as indications of changing geochemic settings in the paleobasin /1/.

The Oligocene portion of the section through the Maikopian series in the Cis-Caucasia and Cis-Caspian is characterized by extremely low and homogeneous magnetism (**k** - $10\text{-}25*10^{-5}$ SI units , **Jn**-$5.0*10^{-3}$ A/m). These parameters increase substantially in the Lower Miocene part of the scale, where the values vary within $40\text{-}200\ 10^{-5}$ SI units geochemic information was acquired while analyzing **kT** and **Jrs** parameters.

The Lower Oligocene throughout the Caspian-Cis-Caucasian region is characterized by stable low **Jrs** and **kT** values with **kT/k** ratios of 10-20 (Fig.1).

In the Upper Oligocene from the Central Cis-Caucasia, **kT** values increase, and the **kT/k** ratios = 15-100, with low **Jrs** preserved. The termomagnetic data reveal finely dispersed pyrite in clays. Similar **kT** increases are observed in the Cis-Caspian sections through the upper part of the Lower Oligocene (Solenovskaya fomation); in the Eastern Cis-Caucasia, outbursts of both **kT** and **Jrs** values are recorded, which is caused by the presence of authigenic pyrrhotine and greigite (Fig.1).

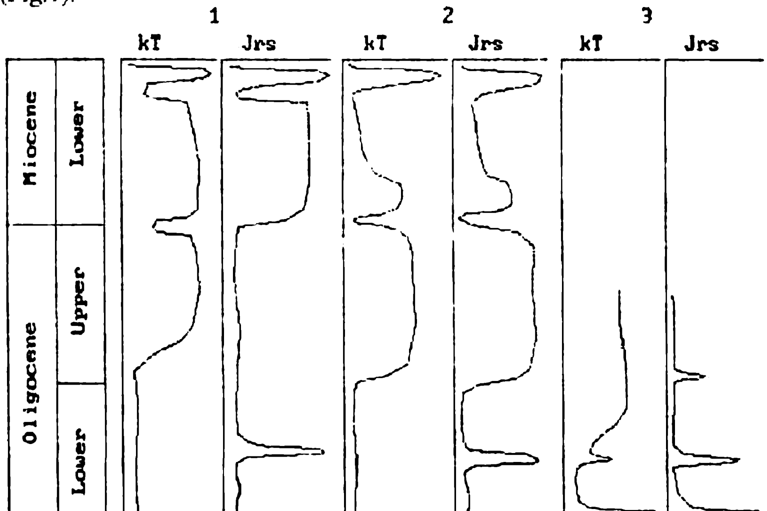

Fig.1. Petromagnetic characteristics (kT, Jrs) of Oligocene and Lower Miocene Central Caucasus (1), Eastern Caucasus (2) and North Cis - Caspian (3).

The Miocene portion of the Maikopian series is characterized by two petromagnetic rhythms, marked by **Jn** and **k** variations. The lower one is established to comprise the Karadhzalginskaya and Olginskaya formation, the upper rhythm corresponds to the Ritsevskaya suite and is documented, besides the North Caucasus, in the Crimea (Korolevskaya formation) and Georgia (Kotsahursky horizon).

Evolution of paleogeochemic settings, based on petromagnetic data, is reflected in a generalized form by the following scheme Rather favourable oxygenic regime was established in the basin during the period of the Early Oligocene transgression, with limited sedimentation rates /2/. Only brief anoxide events are recorded, accompanied by appearance of sulphide magnetic phases.

In the Late Oligocene, after an abrupt optimization of gas regime, a long lasting period follows of stable hydrogen-sulphide contamination /2/. Accumulation of dark-coloured silts enriched in non-decayed organic matter, has stimulated intense formation of authigenic sulphides: pyrite in the Central Cis-Caucasia, pyrrhotine-greigite in the Eastern Cis-Caucasia and Cis-Caspian.

In the Lower Miocene, similar geochemic settings persisted with certain variations, but due to some sulphur deficiency, substantial portion of iron was fixed in magnetic phases and siderite. In the end of the Early Miocene, after elimination of the connections with the ocean, the geochemic settings within the regressing Maikopian basin are levelled, which is recorded in ubiquitous formation of highly magnetic sediments with authigenic pyrrhotine-greigite mineralization /1/.

On the basis of petromagnetic data, two major stages are outlined in paleogeochemic evolution of the Maikopian basin. The first one, equivalent to the Early Oligocene, is marked with deep-water marine sedimentation with normal oxygenic regime. The second stage corresponds to the Late Oligocene and Early Miocene, and is characterized by intensive hydrogen-sulphide contamination.

Brief normalization periods of paleogeochemic settings are recorded in petromagnetic curves by falling **kT** and **Jrs** values. Stratigraphically, these levels correspond to the carbonate clays horizons at the Oligocene/Miocene (Alkunskaya formation) and Upper-Lower Oligocene (Virgulinella layers) boundaries. These intervals are apparently widely distributed and reflect the consequences of temporary restoration of the links with the ocean.

The data acquired allow to use magnetic rhythms for revealing the cyclicity in the development of the Maikopian basin, for recognition of individual stages and boundaries, and, consequently, the ranks of definite stratigraphic units. There are prospects of extending similar correlations to the Oligocene basins of the Central Para-Tethys.

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PALEOGEOGRAPHY OF THE KAZANIAN AGE IN THE VOLGA-URAL REGION

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The Kazanian transgression of the Boreal Sea was preceded by substantial tectonic structure reconstruction in the whole of the region. During the Ufimian age, a major linear depression of submeridional strike was formed in the eastern margin of the Russian Plate, parallel to the Cis-Ural Marginal Trough (Makarova et al., 1971; Ignatyev, 1996). In the Kazanian age, the depression has expanded westwards and involved a vast area from the Arctic coast to the Cis-Caspian. This has determined the scale of the Boreal transgression and configuration of the Kazanian marine basin, having an extent of more than 2000 km in the north-south direction and ranging in width from 300 to 700 km.

Eastwards from the marine basin, in the Cis-Urals, a vast zone of continental sedimentation was formed, with intense accumulation of red-bed terrigenous sediments of alluvial-lacustrine and proluvial genesis. The Kazanian Sea practically did not penetrate into the region of the Cis-Ural Marginal Trough. There is no reliable information on availability of marine facies in the Peri-Caspian Depression, either. Elevation of the Kama and Bashkir Archs may be supposed to have been limited by eastward advancement of the sea in the northern and central parts of the Volga-Ural region. Linear systems of numerous salt-dome elevations acted as the chief barriers for the sea (Molostovsky, Molostovskaya, 1995).

Clear meridional zonality in distribution of the marine and continental facial fields, represents the characteristic feature of the Kazanian sedimentogenesis.

In the western littoral zone of the Early Kazanian marine basin, stretching through the left-bank region of the Lower and Middle Volga, Samara and further on, to Vologda, dolomites, dolomite limestones and marls were accumulating.

In the central, the most deep-water part of the sea, extending through the towns of Kazan, Kotelnichi, Kotlas, normally marine limestones, clays, marls and sandstones were being formed. Diverse biocoenoses are associated with the reefogenous facies in the central part of the sea; these are represented by foraminifers, ostracods, brachiopods, bryozoans, corals, crinoids, nautiloids and conodonts.

The eastern facial zone runs as a narrow band (100-170 km) from the latitudinal bend of the Ural River, through Western Bashkiria, to ther lower streams of the Kama and further northwards. Grey-coloured littoral-marine, lagoonal and deltaic terrigenous, more rarely carbonate rocks were precipitating there, occasionally alternating with layers of red-bed terrigenous rocks. Numerous copper ore manifestations, small brown coal and lignite deposits are associated with the transitional facies of the eastern zone. Ostracods and bivalves prevail in depleted biocoenoses.

In the southern part of the basin, within Buzuluk Depression, in addition to marine facies, evaporites were precipitating intensively. Non-marine terrigenous sedimentation regime was established in the center of the Cis-Ural Trough and in the by-boarder part of the Peri-Caspian Depression. The analogues of marine facies there were represented mainly by grey-coloured aleurolites and clays of seashore lakes, lagoons, limans and submarine deltas.

A redbed molasse zone occupied the marine plain boardered by the mountain Urals from the east. Sandy-clayey sediments of lacustrine and alluvial-lacustrine genesis were accumulating there. In the immediate vicinity of the Urals, those were alternating with gravel-pebble sediments of vast proluvial fans

In the Kama and Belaya basins, red-bed molasse used to penetrate the platform region as far as to 52-53 didn't exceed the limits of the eastern part of the Cis-Ural Marginal Trough. In some areas surrounded by salt-dome elevations, narrow linear lagoons were originating, with intense carbonate-terrigenous sedimentation (Molostovsky, Molostovskaya, 1995).

Tectonic activization of the Urals and positive motions in the platform in the middle of the Kazanian age, have substantially changed the general paleogeographic settings. The second stage in the Kazanian marine basin evolution is marked with rapid westward regression. This was followed by expansion of the field of red-bed molasse development: the boundary of the field was shifted 120-180 km westwards.

Climate aridization and disrupted connections with the open Boreal Sea resulted in intense salinization of the relict Kazanian sea.

Clear facial zonality, characteristic of the transgressive stage in its development in the Late Kazanian age, is almost not pronounced. Dolomite limestones, marls, dolomites and gypsums were depositing over the most of its water area. Evaporites were precipitating most intensively in the Buzuluk Depression and some small salt-geneating lagoons. Depleted coenoses are represented mainly by bivalves, ostracods and gastropods.

Three principal source areas may be recognized on the basis of facial analyses and the studies of lithologic and mineralogic compositions and petromagnetic characteristics. 1) the Baltic shield, composed of metamorphic rocks, in the north-east; 2) the western, gently sloping land, composed of the Lower Permian sulphatic carbonate rocks; and 3) the mountain Urals.

The sedimentation process was mostly influenced by the Ural region; denudation there was accompanied by intensive drift of terrigenous material into the Cis-Ural Trough and the adjacent regions of the Russian Plate.

Judging from the petromagnetic data, during the Kazanian age, the Trough constituted a narrow depressional morphostructure, accumulating the bulk of highly magnetic material carried along from the greenstone band in the eastern to the north of this volcanic belt: the West Black Sea basin, East Black Sea basin, extension of the Great Caucasus trough and the origin of the rift system in the Northern-Crimea region. The rifting took place partially along the former magmatic belts: for example remnants of the same Bajocian volcanic arc exist in the Eastern Pontides and in the southern Crimea. At present different phases of rifting can be recognized but it is impossible to carry out a kinematic restorations; a number of rifting phases occurred - Hauterivian-Barremian, Aptian-Albian (especially Middle-Late Albian), Cenomanian-Turonian Senonian. Ocean crust spreading took place in the West Black Sea Basin in the latest Late Albian-Cenomanian-Turonian and possibly later. Tension events took place all around the Scythian Platform in Mid-Cretaceous time. Pre-Maastrichtian inversion tectonics took place in the inner part of the East-European Platform.

14) Paleocene-Eocene history. In the Paleocene, subductional volcanism was very weak (or absent) in the Transcaucasus-Pontides belt; a possible rift phase took place in the Eastern Black Sea basin. During the Eocene (especially Mid-Eocene) Transcaucasus-Eastern Pontides subductional volcanic belt was very active; at the time of the maximum subductional volcanism, a relative rapid platformal subsidence of the Scythian and East European platforms took place.

15) Orogeny at the Eocene/Oligocene boundary-Early Miocene. At the Eocene/Oligocene boundary the north-dipping subduction system was changed by collision of the Pontides-Transcaucasus-Alborz area with Tauride-Anatolide and Central-East-Iran-Lut terrane. It led to the uplift of the Transcaucasus region and to compressional tectonics along the Black Sea-Scythian area.

16) Middle Miocene-Quaternary orogeny Arabia/Europe Miocene-Quaternary continent-continent collision led to collision tectonics and orogeny in the Caucasus-south-Crimea region, and to syncompressional subsidence of the Black Sea basin.

The following five main driving mechanisms are proposed for the East-European-Scythian Platform subsidence: 1) rifting and postrift thermal subsidence. This model of the subsidence is relatively well constrained as we have a number of rift stages which occurred: after every of the rift phase a postrift subsidence took place. 2) loading by a new orogen and compressional stresses. Real regional subsidence of the Scythian Platform started, for example, in the Aalenian and mainly Bajocian simultaneously with orogenic events in the Caucasus-South Crimean belt. Hence the start of the foreland-type subsidence was connected with the orogeny. 3) subduction-related subsidence of a broad region. The maximum of the volcanic activities of the Pontides-Transcaucasus-Alborz subduction magmatic belt took place in the Bajocian, Albian-Late Cretaceous and Eocene. At the same times maximum subsidence of the Scythian Platform and southern part of the Russian Platform takes place. This supports a causal connections between activity of the subductional magmatism and subduction itself with a broad platformal subsidence. 4) syncollisional gentle folding of the continental lithosphere. East-European continent underwent gentle whole lithospheric deformations with typical wave-length 400-600 km. During the Oligocene-Neogene, Late Triassic-Hettangian and Carboniferous-Early Permian orogenies. 5) syncollisional inversion. Nearly all paleorift basins underwent inversional tectonics simultaneously with orogeny at the plate bounaries.

We have prepared new versions of paleogeographic maps for Peri-Tethys Programme for Triassic, Jurassic, Cretaceous, Eocene. The key unsolved problems are the following: 1) stratigraphical correlations and paleontological data (for many time intervals we used data for a larger times, the correct paleontological data for buried formations are absent and it is impossible to have them in a future few years); 2) we have used borehole log data for many formations without investigations of sediments, so the paleoenvironmental interpretations are not correct in every areas; 3) the correct locations of many wells were not published and we used approximate positions of wells.

BIOGEOGRAPHICAL APPROACH TO THE CENOZOIC PALEOGEOGRAPHIC RECONSTRUCTIONS OF THE NORTHERN PERI-TETHYS

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Paleogeographic reconstructions of the Alpine Foldbelt vicinity are the most complicate aspect of the Cenozoic Peri-Tethys paleogeography. The key information on the time and place of the geodynamical events can be received from the stratigraphic and geographic areals of main fossil groups: marine plankton and benthos as well as terrestrial vertebrates and flora. The historical - biogeographical approach is especially usefull for the restorations of the Late Cenozoic events, when actualistic method is still admissible.

Terrestrial vertebrates. for which any constant seaway represent an insurmountable barrier, are the very important group for the restorations of land bridges. From areal pattern of the Early Cenozoic mammals is followed that direct connections between the Asia Africa and Europe were absent. Euro-Asian migrations were possible through the North America only. But in the Middle Eocene *Prodinrodon* of asian origin could extended to the South-East Europe (know from the Transilvania and Austria). Faunistic integration of the Trans-Caucasian, Asia Minor and South-East Europe had grown enough in the Early Oligocene to make these territories as an entire biochoria. Consequently, the main Tethys - Paratethys sea strait, which was restricting the vertebrate Eocene - Oligocene spreading, took place more westward. It was the North Alpine depression. The latter had been connected with the North-sea basin through Rhine graben system. I.P.Berger (1996) disapproved this seaway before the Chattian. But the Rupelian marine benthic fauna of the Belgium, Mainzer basin, Elsas as well as Tirol (Herring) and Bavaria is very similar. Tis similarity is difficult to be explained otherwise then by direct paleogeographical connections.

On the other hand, the Gibraltar region had not been insurmountable barrier for the land mammals during the Paleogene: Sciuromorpha, Adapisoricidae in the latest Paleocene - early Eocene, *Paratherium* in the early Eocene, creodonts (*Hiacnodon, Apterodon, Pterodon*) in the latest Eocene - early Oligocene could expand to the North Africa from the Europe. Since North Alpine depression had been filled by molassic deposits during the Oligocene, "Slovenian corridor" between the Alpine and Dinariden fold systems became the main seastrait connecting Tethys and Central Paratethys. It was widely opened during the Late Oligocene - Early Miocene, and was closed in the middle Miocene (Serravalian - Late Badenian). Nevertheless, the polyhaline marine fauna of the Paratethys evidents, that Ocean connections were not lost before the Sarmatian. It is possible, that they existed eastward - through the Serbian - Macedonian and Vardar or Strimon depressions. the North Egean area and Mesohellenic tranch.

The Tethys - Indo-Pacific seaway through the Mesopotamian strait was opened before the Langhian (Adams et al., 1983). But vertebrate data evidents, that the first terrestrial connections took place in the Middle Burdigalian, when African mammals had reached the Western Europe (Fahlbusch, 1981) Continental regime became prevailing in the Mesopotamian area and mammals integration reached maximum in the middle Miocene. when even Ursidae and Cervidae could come to the North Africa.

So, the dinamical aspects of the biogeography, based on the paleontological data, provide a valuable information for paleogeography and geodinamical restorations.

INVERSION STRUCTURES OF THE RUSSIAN PLATFORM: THE HISTORY OF THE OKA-TSNA SWELL.

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There are many inverios structures inside the Russian Platform. They are located above Riphean and Devonian paleo-rifts usually. For exapmles Sukhona-Soligalich Swell is located above the Middle-Russian aulacogen of the Moscow basin. Zaraisk-Starozhilovo, Oka-Tsna, Kolamna and Zubova Polyana swells are located above the Pachelma aulacogen. Kudinovo and Moskvaretsky swells are located above the Moscow aulacogen. Molokovo Swell is located above the Kreststy aulacogen. Oka-Klyazma, Sura-Moksha and Kerensk-Chembar swell go along the Tokmovo High. Vyatka Swell goes along the Vyatka aulakogen. Some swell are located in the Mezen basin System of Cretaceous-Cenozoic anticlines are located along the Pre-Volga Upland.

This work is focuses on the history of the Oka-Klyazma, Oka-Tsna, Kerensk-Chembar system of swells which goes along a boundary of the Pachelma aulacogen and Tokmovo High. The lenght of the system of the wells is nearly 500 km, and the width is up to 30-60 km.

To study the system of wells we have used data of 10 wells. Four khrono-stratigraphical sections and 18 lithology-facial profiles for different levels were prepared.

The following epochs of deformations were recognized preliminary for this system of swell:
1) End of Famennian - minor faulting;
2) End of Visean - minor deformations;
3) End of Permian - origin of anticline folds;
4) Pre-Jurassic times - activization of anticlines;
5) End of early Callovian - grow of anticlines;
6) Pre-Oxfordian times - additional grow of anticlines;
7) Valanginian - possible phase of anticlines grow;
8) Early Santonian - new phase of folding;

9) Cretaceous/Paleogene boundary - possible phase of anticlines grow;
10) Neogene - possible minor faulting.

Additional studies are needed to investigate precise history of the swells. Generally, numerous epochs of inversion tectonics took place in the history of the Russian Platform.

JURASSIC AND CRETACEOUS RADIOLARIAN ZONATIONS OF THE NORTH EUROPE.

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Jurassic to Cretaceous radiolarians were studied from the Moscow - Volga regions of the Russia, Crimea, Romanian and Ukrainian Carpathians enabled us to assign them to some of zonal schemes and to propose the possible correlations.
The Peri-Tethyan radiolarian assemblages are dominantly Boreal in character. These types of Mesozoic zonations have not been described previously. The Oxfordian Amoeboceras alternans Strata contain numerous Parvicingula jonesi and can be correlated with Epistomina uhligi foraminiferal Zone in the North Peri-Tethys. The lower Kimmeridgian Parvicingula vera Zone is probably equivalent to the lower Kimmeridgian Crucella crassa Assemblage of Kozlova (1971, 1995) and correlates with the Buchia concentrica Zone, A. ravni ammonite Zone and Epistomina unzhensis foraminiferal Zone as well. Probably this interval corresponds to Kimmeridge Clay Hydrocarbon Formation of the North Sea which contains a lot of P. jonesi (Dyer, Copestake, 1989).
The Middle Volgian Parvicingula haeckeli Zone is correlated as closely as possible with the Parvicingula papulata Zone and belong to the Dorsoplanites panderi Zone which can be correlated with the Evolutinella emeljanzevi-Trachammina septentrionalis or Saracenaria pravoslavlevi foraminiferal Zone (Kozlova, 1995) in Pechora Basin and Lenticulina biexcavata Zone (Ljurov, 1995) in Sysola hydrocarbon Basin and Parhabdolithus embergeri nanneplankton Zone in Middle Volga hydrocarbon Basin. We can trace this Zone in Southern England and North France.
The upper Volgian-lower Berriassian Parvicingula blowi Zone probably corresponds to the Pseudocrolanium planocephala Assemblage established by Kozlova (1995) for Pechora Basin.
The upper Berriassian-lower Valanginian Parvicingula khabakovi - Willinedellum salumicum Zone is widespread in Siberian and Russian platforms within Bojarkia mesezhnikowi Zone. Owing to numerous Parvicingula boesii it is possible to compare this Zone with Tethyan ones.
The radiolarian species Porodiscus kavilkinensis Aliev, Orbiculiforma nevadaensis Pessagno, Distylocapsa micropora (Squinabol), Dictyomitra communis (Squinabol), D. gracilis (Squinabol), D. ferosia angusta Smirnova, Theocampe cylindrica Smirnova et Aliev, T. simplex Smirnova et Aliev, Archaeodictyomitra simplex Pessagno, Obeliscoites turris (Squinabol), O. perspicuus Squinabol, O. cf. vinassai (Squinabol), Xitus antelopensis Pessagno, Crolanium cuneatum (Smirnova et Aliev), C. triquctrum Pessagno were recognized from the Russian plate and Crimea. The Late Aptian-Albian Crolanium cuneatum Zone can be recognized here.
Sections from the Brjansk, Kaluga and Vladimir areas yielded radiolarians Alievium superbum (Squinabol), Actinomma ? davisensis Pessagno, Praeconocaryomma universa Pess., Crucella irwini Pess., Orbiculiforma multa (Kozlova), Archaeospongoprunum venadoensis Pess., which probably belong to the middle-late Turonian Archaeospongoprunum venadoensis Subzone of the Turonian or to the Turonian-Coniacian Alievium superbum Zone (Pessagno, 1976; Schaaf, 1989). The upper parts of the considered sections contain Archaeospongoprunum bipartitum Pess., A. triplum Pess., Alievium praegallowayi Pess., Dictyomitra striata Lipman, Dictyomitra ? formosa Sq., Pseudodictyomitra tiara (Holmes) and probably correspond to the lower Coniacian Archaeospongoprunum triplum Subzone of the Coniacian Alievium praegallowayi Zone of the Pacific province (Pessagno, 1976) or to the Coniacian A.bipartitum - A.triplum Zone of the Russian platform (Vishnevskaya, Kazintsova, 1990; Amon, De Wever, 1994) or to the Coniacian assemblage of the Deva Beds from Romania, which belongs to the Alievium praegallowayi Zone.

Age		Radiolarian zonation	Nannoplankton Zone (Nikiforova, 1987) Kopaevich et al.,1979	Foraminiferal Zone (Amon, De Wever, 1994) (Kuznetsova, 1984)	Buchia zone (Sey,Kalacheva, 1994)	Ammonite Zone (Meseznikov, 1984)
Maastrichtian		Amphipyndax tylotus-Amphibrachium sibiricum (Bragina, in press)	Nephrolithus frequens Lithraphidites quadra			
Campanian			Broinsonia parca Tetralithus ovalis Arkhangelskiella specillata	Cibicidoides voltzianus		
Santonian		Orbiculiforma quadrata-Lithostrobus rostovzevi		Gavelinella stelligera		
		Euchitonia santonica-Alievium praegallowayi	Marthasterites furcatus	Gavelinella infrasantonica		
Coniacian		Archaeospongoprunum bipartitum - A. triplum	Tetralithus otscurus	Gavelinella praeinfrasantonica		
Turonian		Spongotripus aculeatus-Alievium superbum				
Cenomanian		Pseudodictyomitra pseudomacrocephala		Gavelinella cenomanica		
Albian		Crolanium cuneatum				
Aptian						
Barremian						
Hauterivian						
Valanginian		Parvicingula khabakovi-Williriedellum salumicum				
Berriasian= Ryasanian		Parvicingula blowi-Pseudocrolanium planocephala			okensis	meseznikowi
Volgian	Upper		Parhabdolithus	Lenticulina muesteri	piochii-terebratuloides	nodiger
				A. aquilonicus-M. impropria		subditus
			embergeri	Placopsilina-A. polyhimnius		fulgens
	Middle	Parvicingula haeckeli P. papulata Kozlova, 1994		L. ponderosa-S. pravoslavievi	mosquensis-russiensis	nikitini
						virgatus
						panderi (zarajsk, pavlovi)
	Lower	Parvicingula vera	Watznaueria communis	V. kirillae-P. bieleckae	rugoza-mosquensis	pseudoscythicus
						sokolovi
						klimovi
Kimmeridgian		Crucella crassa Kozlova, 1994	Vekshinella stradneri	H. monstratus-P. pseudorjas. L. kuznetsovae-E. praetatar.	tenuistriata concentrica	autissiodorensis eudoxus cymadoce
Oxfordian		Parvicingula jonesi			lata	alternans
Callovian						

The Santonian Euchitonia santonica Zone is characteristic Boreal Zone widespread both in Siberian and Russian platforms and in Pre-Caucasus and Carpathians. Campanian Prunobrachium articulatum Zone (Lipman, 1952) has not analogues in the Tethyan scales.
Age data were also supported by foraminiferal assemblages, which have some affinities with European ones. They are similar to Western Siberian Boreal associations, but include several Tethyan taxa.
Biostratigraphic correlations of microfossils (radiolarians, foraminiferas, nannoplankton) and macrofossils groups (ammonites, buchias) are proposed(tabl.1) in order to establish the synchronicity of events and consequently of more general geological processes.

THE CHARACTERISTICS OF MIDDLE - LATE JURASSIC SEDIMENTATION IN THE CENTRAL AND NORTH - EAST PARTS OF THE EAST - EUROPEAN PLATFORM.

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The epoch of Middle - Upper Jurassic sedimentation in the East - European Platform was a critical period when after prolonged continental activity marine sedimentation took effect. Over that period the sediments were being amassed with diverse lithologic composition and mixed orichtocenosis of transient and endemic forms of faunas.
In those deposits a variety of useful components were concentrated and localised giving rise to production - scale reserves of combustible shales, bituminous clays, coals, phosphorites, glauconite sands, etc.
In this respect, special interest is drawn to the above mentioned deposits so as to reveal the specific features of sedimentation process and to reconstruct the history of sedimentation and biotic evolution. The importance of the latter is emphasized by the fact that by now a number of hypotheses have been introduced which differ in interpretation of the co-existence within these deposits of ammonites and members of other faunal groups either belonging to other palaeozoogeographic provinces or not characteristic of the West - European Sections or almost never found there. Among the hypotheses those deserve special mentioning which state the existence of "sea straits" between the Boreal and Tethyan Realms, as well as between west (Siberian) and east(Russian) provinces and "cold streams" or bariers. The above assumptions have motivated by authors to undertake an integrated study of the Middle - Upper Jurassic marine deposits in the central and north-east parts of the East-European (Russian) Platform with the use of palaeocological, lithological - facial and stage after-stage analyses and the account of previously published stratigraphic, lithologic and tectonic data. The faunal composition was examined with thropic groupings resolved, as well as mineral and morphocomponent composition of rocks, with background deposits and those due to events discriminated and compared, and their areal and sectional relations identified. The results of these studies are shown in the following 81 sections and 4 schematic paleogeographical maps.

THE TURANIAN PLATE: TECTONICS AND EVOLUTION OF THE SEDIMENTARY BASINS

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The goal of this project includes to build-up the structural-lithological maps as a synthesis of the paleogeographical maps for several time intervals of the Mesozoic and Cenozoic evolution history of sedimentary basins of the Scythian and Turanian plates.

The region of study covers the territory from the Caspian Sea eastern shoreline to the eastern boundary Karatau-Ulutau Faults Zone. Structurally the region embraces the southern activated margins of the Scythian and Turanian epi-

Paleozoic plates with heterogeneous basement. It caused the differences in the evolution history of sedimentary basins located on Precambrian, Paleozoic and Kimmerian blocks.

Mesozoic - Cenozoic history of sedimentary basins of this region may be subdivided into some stages:

1) closure of the Urals Tjan Shan ocean and the junction Kazakhstan and East-European continents; 2) collision of theTethys and the origination of intracontinental folded structures of Donbass-Tuarkyr during Late Permian - Early Triassic, followed by accumulation of continental and shallow marine terrigenous and volcanogenous paragenesis; 3) Early -Middle Jurassic riftogenesis with the formation of Caucasus-Kopetdag margin basins, Murgab-Aral and Middle Jurassic Turgaj rift systems; 4) the formation of vast troughs with an epicontinental carbonate-terrigenous sedimentation during Late Jurassic - Cretaceuos; 5) complicated transgressive-regressive polycyclic evolution of margin basins during Late Mesozoic - Cenozoic within shelf seas, mostly with terrigenous-carbonate and evaporite strata. Mesozoic sequences thickness is up to 5-6 km, may locally be in excess of 10 km in the central parts of depressions.

Seismostratigraphical studies available data indicated three structural-tectonical units separated by unconformities. These units demonstrated different compressive stress levels during different time interval. The deformation episodes are locally distributed: Riphean folded impulse was localized within Astrakhan- Aktjubinsk zone. Devonian impulse - within South Emba region. Permian-Triassic one- within Donbass-Tuarkyr zone. and Jurassic one - within Transcaucasus. pre-plate and plate sedimentary complexes within Scythian and Turanian plates.

Mesozoic accumulation of sedimentary sequences, types of lithological facies and their distribution reflected the evolution of climatic, geodynamic and eustatic events. There are Permian - Lower - Middle Triassic terrigenouse; Upper Triassic terrigenous-carbonate; Lower-Upper Jurassic terrigenous (occassionally coal-bearing); Upper Jurassic - Valanginian carbonate (sometime evaporite); Hauterivian - Albian terrigenous (red-coloured in the east); Upper Cretaceous carbonate and Cenozoic complexes within sedimentary basins of Turanian platform.The some maps demonstrate the distribution and thickness of these complexes.

TRIASSIC FORAMINIFERS OF THE MANGYSHLAK.

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At present time, there are new data, which change the conception about the distribution of the Triassic foraminifers of the south part of Russia and adjacent countries. This requests to carry out more detailed study of the Triassic foraminifers from the above-mention territories and generalization of these results. Therefore the study of Triassic and Jurassic foraminifers of the Gorny Mangyshlak was proposed within the framework of the project " Mesozoic of Mangyshlak (West Kazakhstan): stratigraphic and structural evolution"(leaders. Prof. M.Gaetani, Dr. V.Ja.Vuks, Dr. L.F.Kopaevich) of the Peri-Tethys Programme. This is one of the main objects of the above-mentioned project. The search of foraminifers in Triassic of the Gorny Mangyshlak was successful finished, because the first time the Triassic foraminifera assemblages were discovered.

In the Triassic of the Southern Mangyshlak there are only two foraminifera assemblages from the drilling hole materials in the North Rakushechnaya area (Aliev, Alekseeva, Hofman, 1976). The first foraminifera association was established in the argillite beds of the upper part of the Yuzhno-Zhatybayiskaya Formation and the age of this deposits corresponds to the upper part of the Middle Triassic. The second foraminifera assemblage was determined in the terrigenous deposits from the Severo-Rakushechnaya Formation and the age of these rocks conforms to the Upper Triassic.

The recent study of thin-sections from the Triassic of the Gorny Mangyshlak has allowed us to make the first findings of foraminifers. The Tartaly Formation overlies the Dolnapa Formation conformably and consists of grey argillites with limestones beds. In the Tartaly Formation microfauna and fragments of macrofauna were found : in the Dorikranites beds there are abundant recrystallized fragments of macrofauna, microgastropods and single primitive foraminifers; in upper part of the Tirolites beds there are rare agglutinated and calcareous foraminifers; in the Columbites beds there are abundant recrystallized fragments of macrofauna, microgastropods, ostracods and more varied foraminifera assemblages, therefore in this interval the beds with Nodosaria hoae have been established. Foraminifers of the last assemblages are more typical of the Lower Triassic (Olenekian) of the North-West Caucasus and Precaucasus. Besides, foraminifers, this age is definited by ammonoids as the Olenekian. The Karadzhatyk Formation overlies the Tartaly Formation conformably and represented by argillites, siltstones and sandstones with limestones beds. This formation corresponds to the upper part of the Olenekian and there are not foraminifers. The Karaduan Formation overlies the Karadzhatyk Formation conformably and consists of sandstones and argillites with conglomerates beds. In the Karaduan Formation there are abundant recrystallized fragments of macrofauna, microgastropods, ostracods and assemblage of the primitive foraminifers. Usually, these foraminifers very often occur in the Middle-Upper Triassic. In addition to foraminifers, this age is definited by bivalves as the Anisian. The Akmysh Formation overlies the Karadzhatyk Formation with an erosional contact and is mainly represented by limestones. In the Akmysh Formation there are oolites, algae, abundant fragments of macrofauna and rare calcareous foraminifers. The age of this formation corresponds to the Carnian (Alferov and others 1977).

The first described assemblages enable us to supplement the common picture of development of the Triassic foraminifera associations of the Mangyshlak and the Central Asia in general and fauna characteristic of the Triassic Formations of the Gorny Mangyshlak. The first findings of foraminifers from Triassic of the Gorny Mangyshlak allowed us to confirm the point of view about division of the above-mention deposits, which was accepted in Samarkand (Alferov and others, 1977). At last, it is necessary to mark that there are a lot of general species in the Triassic associations of the Caucasus and Mangyshlak.

PALEOGENE OF THE TURAN PLATE (LITHOSTRATIGRAPHY, BIOSTRATIGRAPHY ON SHARKS TEETH SYSTEMS, GEOLOGICAL CORRELATION)

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Biostratigraphy of Paleogene was studied in to seven regions Ustyurt, Mangyshlak, Kysilkum, Tashkent, Fergana, Syr Daria River region, Turgay. During the field campaign was studied 53 key Paleogene sections. For detailed stratigraphy was used the teeth systems of pelagic sharks and another fossils. In this works on Mangyshlak peninsula participated by Drs Christian King, David Ward (from England), Hedi Oberhansli (from Germany), Nikolay Udovichenko (from Ukraine) and author. The Paleogene formations of the Tashkent and Fergana was studied by Drs Nikolay Udovichenko. The Paleogene sections of the rest regions investigated by Dr Victor Zhelezko.

Paleontology determinations of Paleogene fossils was fulfilment by Drs Vladimir Benjamovsky (Foraminifera), Olga Vasilyeva (Dinoflagellata), Irina Tabachnikova , partly Etienne Steurbaut (Nannoplankton), Genneta Kozlova (Radiolaria).

The study plan of Paleogene biostratigraphy is as follows - the study of key Paleogene sections of the different regions.

- the study of taxonomy and evolution of the teeth system of the Lamnoid pelagic sharks and the development of chronological scale on selachian fishes, more then 50,000 shark teeth were collected and processed by the author. Furthermore, several collections by the following scientist were studied as well L. Gluckman, M. Akhmetiev, V. Pronin, N Udovichenko, A. Levina, V. Kozlov, V. Benjamovsky, and others. - the analysis of vertical and horizontal distribution of other kinds of fossils.

At present we have studied in details the taxonomy and evolution of eleven genus of pelagic Lamnoid sharks: Paleohypotodus, Jaekelotodus, Glueckmanotodus, Striatolamia, Otodus, Carcharocles, Isurolamna, Borealotodus, Lamiostoma, Synodontaspis, Macrorhizodus. The stages of improvement of teeth systems in continuous series this genera made it possible to distinguish 19 biochronozones. Zonal scale on sharks is correlated with zonal schemes of other groups of fossils.

Shark zones have a wide horizontal spreading, with their help it will be possible to make correct paleogeographical maps. We have a set of paleoenvironmental maps: ypresian, lutetian and rupelian stratigraphic interval.

THE CHRONOSTRATIGRAPHYCAL ZONAL SCALE OF THE UPPER CRETACEOUS ON PELAGIC SHARKS AND CRETACEOUS STAGE BOUNDARIES.

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The only remains of sharks, their teeth, have a very wide distribution in the Cretaceous sediments of the word. Our collection includes 150,000 separate upper Cretaceous shark teeth. This is an important paleontological material, but generally the taxonomy of Cretaceous shark have not been well studied.

Recently, the phylogenetic lines Eoanacorax-Paleoanacorax-Squalicorax, Acrolamna, Protolamna, Eoanacorax, Eostriatolamia and Scapanorhinchus have been studied by L. Gluckman and the author; they have composed a shark zones scale for the Upper Cretaceous.

Zone L1 - Eoanacorax dalinkeviciusi (upper Albian). Sharks:Eoanacorax dalinceviciusi. Type section: Esiat formation of Lithuania (Gluckman and Shvajaite 1971).

Zone L2 - Palaeoanacorax volgensis (Upper Albian - Lower Cenomanian) Sharks. Paraisurus compressus, Cretodus sulcatus, Cretoxyrhina denticulata, Leptostirax rochebruni, Palaeoanacorax volgensis, Eostriatolamia gracila, Scapanorhynchus praerhaphiodon. Type section: Koksyirtau mountain on
the Mangyshlak peninsula, Kazakhstan (Gluckman, Mertinene 1971, Zhelezko 1995).

Zone L3 - Palaeoanacorax obliquus subserratus (Lower Cenomanian). Sharks: Pseudoisurus tomosus, Cretoxyrhina ex gr. denticulata, Acrolamna ex gr
sulukapjenica. Cretolamna ex gr. appendiculata, Palaeoanacorax obliquus subserratus, Scapanorhynchus eorhaphiodon Type section: Sulukapy section
on the Mangyshlak peninsula (Gluckman and Zhelezko 1971).
Zone L4 - Palaeoanacorax obliquus obliquus (Lower-Middle Cenomanian). Sharks. Acrolamna saratovi Palaeoanacorax obliquus obliquus Type section: Koksyirtau. Mangyshlak (Gluckman, Zhelezko 1971. Zhelezko 1995).

Zone L5 - Palaeoanacorax pamiricus (Upper Cenomanian - Lower Turonian). Sharks: Palaeoanacorax pamiricus. Paranomotodon angustidens. Cretolamna
ex gr. appendiculata Type section: Koksyirtau. Mangyshlak (Gluckman. Shvajaite 1971. Zhelezko 1995).

Zone L6 - Palaeoanacorax intermedius (Lower Turonian). Sharks: Cretolamna denticulata, Palaeoanacorax intermedius, Scapanorhynchus darvasicus. Type section: Aksyirtau mountain, Mangyshlak. (Gluckman, Shvajaite 1971, Zhelezko 1995).

Zone L7 - Squalicorax sagisicus (Upper Turonian) Sharks: Cretoxyrhina mantelli. Squalicorax sagisicus, Ptychodus polygirus. Type section:
Sulukapy. Mangyshlak peninsula (Gluckman. 1980. Zhelezko 1995)
Zone L8 - Squalicorax falcatus (Coniacian). Sharks: Squalicorax falcatus. Cretoxyrhina mantelli. Type section: Sulukapy. Mangyshlak (Zhelezko 1977. 1995).

Zone L9 - Squalicorax santonicus (Lower Santonian). Sharks: Acrolamna crassicornis, Protolamna macrorhiza. Squalicorax santonicus, Scapanorhynchus temiricus. Ptychocorax dolloi (Gluckman, Zhelezko 1979. Zhelezko 1988,1990).

Zone L10 - Squalicorax papulovi (Lower Santonian). Sharks: Acrolamna acuminata. Protolamna macrorhiza. Squalicorax papulovi. Eostriatolamia aktobensis, Scapanorhynchus temiricus. Type section: Dmitrievsky village on the Kubley River. Aktjubinsk administrative region, Kazakhstan (Zhelezko 1988).

Zone L11 - Squalicorax kaupi (Upper Santonian). Sharks: Acrolamna acuminata, Protolamna aduncata suberecta, P. arcuata orica, Squalicorax kaupi, Eostriatolamia segedini, E. venusta, Scapanorhynchus rhaphiodon. Type section: the section near the Dmitrievsky village on the Kubley River (Gluckman, Zhelezko 1979).

Zone L12 - Squalicorax lindstromi (Lower Campanian). Sharks: Acrolamna acuminata dilatata, A. arcuata arcuata. Squalicorax lindstromi, Eostriatolamia lerichei. Type section: the Dmitrievsky village (Gluckman, Zhelezko 1979).

Zone L13 - Squalicorax plicatus (Lower Campanian). Sharks: Protolamna kopingensis, Squalicorax plicatus, Rhaphiodus ex gr. texanus. Type section: the section N64 on the Kubley River, 15 km to west from Dmitrievsky village (Gluckman, Zhelezko 1979).

Zone L14 - Unnamed (Upper Campanian). Sharks: Pseudocorax ex gr. levis. Squalicorax ex gr. uilicus. Type section: Aksyirtau section, Mangyshlak peninsula (Zhelezko 1994).

Zone L15 - Squalicorax uilicus (Upper Campanian). Sharks: Squalicorax uilicus. Type section: Kenjaly River near the Kenjaly rain-way station. West Kazakhstan (Zhelezko 1977).

Zone L16 - Squalicorax pristodontus (Maastrichtian). Sharks: Squalicorax pristodontus, Pseudocorax affinis. Microanacorax yangaensis. Type section: Aksyirtau, Mangyshlak (Zhelezko, 1977).

The joint finding of shark teeth and other fossils make it possible to solve questions concerning stage boundaries. So far the Albian /Cenomanian, Cenomanian/Turonian and Santonian/Campanian boundaries have been documented in this way. The Albian/Cenomanian boundary is situated at the base of the beds with Acrolamna sulukapjenica; the Cenomanian/ Turonian boundary is located at the base of the beds with Acrolamna gaja; the Santonian/ Campanian boundary is located at the base of the beds with Squalicorax lindstromi.