PERI-TETHYS PROGRAMME

SECOND
MOSCOW WORKSHOP
May 28-30, 1996,
Geological Faculty, Moscow State University
and Geological Institute, RAS

ABSTRACTS

organizing committee:

Prof. ***J. Dercourt*** *(UPMC,Paris),Dr.****S. Crasquin*** *(UPMC,Paris)*
Prof. ***A. Nikishin*** *(Moscow State University)*
Prof. ***B. Sokolov****(Moscow State University)*
Prof. ***Yu. Leonov*** *(Geological Institute,RAS,Moscow)*

MOSCOW, 1996

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PROGRAMME

28 May, 1996. Moscow State University

Morning 10-13h. Chairmen: J.Dercourt and B.Sokolov

95-21: Yu. Volozh: Seismostratigraphy of sedimentary basins of South-Eastern part of the Northern Peri-Tethys.
95-53: V. Kazmin: Tectonic evolution of the Black Sea Basin.
95-41: M.L. Kopp: Geokinematic map of the area of dynamic influence of the Alpine-Mediterranean collisional belt on the Eurasian and Gondwanian platform framing (Late Cenozoic).
95-90: E.V. Artyushkov: Basic regularities and physical mechanisms of formation of the Peri-Tethyan foreland basins.

Afternoon 14-18h. Chairman V. Kazmin

95-43: E.J. Baraboshkin: Mid-Cretaceous Peri-Tethys Basins of Eastern Europe: sea-level changes, Paleooceanography and basin evolution.
95-66: A.V. Ershov: Numerical kinematic and dynamic modelling of the North-Caucasus-Crimea and Transcaucasus molasse basins during the Cenozoic collision.
95-27: I.G. Scherba: Paleogeography and tectonics of the Caucasus Paleogene Basin.
95-52: Yu. Rebetski: Caucasus-Crimea foreland fold-and-thrust belt and basin: structure and paleostress.
95-44: A.M. Nikishin: North-Caucasus-Crimea (Scythian) sedimantary basin: stratigraphy, tectonics, magmatism, basin evolution and modelling.

29 May, 1996. Moscow State University

Morning 10-13h. Chairman A. Nikishin

97-05: A. Molostovsky: Development peculiarities of the Voga-Ural, Black Sea and Caspian paleobasins reflected in scalar characteristics and paleomagnetism of the Mesozoic-Cenozoic formations.
95-61: L. Lobkovsky: Peri-Caspian and Caspian Sea: Regional tectonics and subsidence history.
94-36: V.I. Zhelezko: Stratigraphy, lithology and sedimantation terms in Pri-Caspian Basin during Late Paleozoic, Mesozoic and Cenozoic.
95-75: O.K. Bazhenova: Sedimentology and organic geochemistry of the Maikopian series.

Afternoon 14:30-17:30h. Chairman V. Vishnevskaya

95-24: T.A. Grunt: Evolution and biogeography of Permian brachiopod assemblages from the Russian Platform, Fergana and Pamir region.
95-25: S.V. Popov: Paleogeography and evolution of the Late-Eocene-Pliocene, North-East Peri-Tethys.
95-12: S. Stovba and E. Dvorianin: Sedimentological models of the perspective of the successions of the oil-and-gas-bearing basins of the Ukraine.

30 May 1996. ***Morning 10-13h. Moscow State University. Chairman S. Stovba***

95-11: I. Khokhlova: Detailed Paleogene Stratigraphy of the South Russian Platform on the base of four microplanktonic groups.
95-18: V. Vishnevskaya: Stratigraphic correlation of Mesozoic microfauna from Eastern Europe.
95-10: E.O. Amon: The Urals as a natural borderland of Peri-Tethys European paleobiogeographic belt during Upper Cretaceous time.
95-31: I. Molostovskaya: Correlations between marine and continental domains in Southern Ural and Peri-Caspian depression from Upper Permian to Lower Triassic.

30 May 1996. ***Afternoon. Russian Academy of Sciences, Geological Institute.***
General meeting - conclusions - discussions

SOME FEATURES OF THE URAL PALEOTECTONICS DURING LATE CRETACEOUS TIME

Edward O. AMON

INSTITUTE of GEOLOGY and GEOCHEMISTRY, URALS BRANCH of RUSSIAN ACADEMY of SCIENCES. 620151 Ekaterinburg, Pochtovyi per. 7. RUSSIA. Phone (3432)511-997, Fax (3432)515-252, E-mail root@igg-e-burg.su

In the Northern Eurasia the Ural mountain country places on the line of joint of ancient Russian (East-European) platform and posthercynian Ural-Siberian platform. Ancient platforms joined with young by systems of deep faults, and in the zone of joint of Russian platform with Ural mountain structure it was become by the forming of Preduralian (Preduralie=CisUrals) foredeep (middle CarboniferousTriassic). Beginning from Middle Triassic the foredeep terminates it existence and from that time the sedimentation is located just only in the limits of synclines of northeastern and southeastern margins of Russian platform.

The deposits Late Cretaceous Russian and PriCaspian seas are known along the southern part of joint of the Urals and Russian platform. These deposits are obliged by occurrence of the transgressions of Late Cretaceous seas, caused by the insignificant general downwarping of a southern part of West-European and Ural-Siberian young platforms in the beginning Late Cretaceous. To the East from Ural mountain country this immersing has caused the invasion of Arctic-Boreal transgression in more southern parts of a West-Siberian plate and it connection with seas, covering Turanian plate, in separate epochs of Late Cretaceous.

The joint of a Ural mountain structure with contiguous to it from East by a West-Siberian plate had flexural-like character, becoming in step-by-step immersing of the basement of a platformic cover of West-Siberian plate in eastern direction. Cretaceous deposits, as a rule, lay practically horizontally, as it is peculiar to formations of platformic cover. However in the zone of joint of Ural structure with West-Siberian platform are known the several local of dislocations of horizontal occurrence of rocks layers of Cretaceous (and Paleogene) age, but also cased by display of disjunctive tectonics.

The zone of joint of Ural structure with West-Siberian plate tested almost continuous downwarping since Early Jurassic, and in duration of whole Late Mesozoic and Cenozoic. In the East part of this zone, along meridian of Tyumen City, the common thickness of platformic cover makes on the average 2000 m. This process of downwarping in zone of transitions of Urals into West-Siberian plain proceeds and presently.

Thus, during whole Cretaceous period, the western contact of Ural epihercynian young platform, were in the zone of joint with ancient Russian platform, did not display the tectonic activity; and as opposed to it the eastern joint with West-Siberian plate was noted by increased tectonic mobility, kept these features up to Quaternary time inclusive. The history of sedimentation in the zone of joint of Ural epihercynian structure and West-Siberian plate during Cretaceous period (but also in subsequent Cenozoic era) shows, that these two large structural areas display self differently.

In first half of Cretaceous period the downwarping is tested the northern part of West-Siberian plate and northeastern part of Russian platform, that results in constant presence of marine basins on both sides of modern Pripolar and Polar parts of Urals. The sea on Western party of Ural took the region of Pechorian syncline. The depression, crossing from the Southwest to Northeast the Russian platform, connected marine basin of Pechorian basin with seas of the South of platform.

The partial reorganisation of the tectonic plan of region has taken place in the beginning Late Cretaceous, when has ceased to exist the subdiagonal depression of Russian platform and the connection of the sea of Pechorian syncline with southern seas was stopped. Instead of it owing to ingression of the West-Siberian sea through Polar Urals there was the forming of a gulf of this sea in Polar Preduralie. The depression located in western part of a West-Siberian plate was developed to more southern regions along East slope of Urals, that has caused connection of boreal oceanic basin with seas of ScythianTuranian plate. This depression was continued to exist during whole Late Cretaceous, but strait, connected boreal basin with sea of Turanian plate, became isolated, arose again, that, naturally, was reflected in character of the West-Siberian sea and it biota.

In Albian time the area of accumulation of marine terrigenous deposits continues to be increased, and its downwarping occurs with greater speed and intensity, than in Aptian. In Early-Middle Albian it is began the marine transgression, sea is developed onto significant part of Zauralie (Zauralie=TransUrals), but in Late Albian time are observed its some freshwatering and shallowing. First one occurs in result of narrowing of a strait, connected the West-Siberian sea with the boreal seas, and second one - largely for degree of conglomeration of a material, brought from lifted Urals in Priuralian part of West-Siberian plate, from region of Taimyr Peninsula and Novaya Zemlya Islands, and from Siberian platform in regions Latitudinal Priobie.

Volume of Albian deposits it is much more than volume of Aptian deposits, and is maximum for Zauralie. At the same time among them the large distribution there are fine-grained clayey sediments. According to the prevalence of clayey deposits, the Albian land was more less high and dismembered, than in Aptian, and was covered by thick crust of weathering, which has served as an initial material for clayey Albian deposits.

In Cenomanian, comparatively with previous Albian stage, on Urals and in Zauralie occurred the reduction of area of marine sedimentation and decreased its speed of immersing, the area of erosion (land) is increased and lifted intensively. In result it, from Urals was took away the significant quantity of terrigenous material, among which the considerable role belongs to rather more coarse-grained silty deposits. On greater part of Zauralie at this time is appeared the mode of lowland-like alluvial plain, probably, with large quantity of bogs and pools of epicontinental type.

From the beginning of Turonian, the immersing of Zauralie occurs slower, but transgression started at Turonian is gradually expanded, covering all new and new areas. The index of compensation of tectonic immersing is the comparatively stable composition of Late Cretaceous marine deposits, among which in majority of cases on significant area prevail clayey deposits.

Turonian is time of relative tectonic rest. At this time the immersing of accumulation area and uplifting of erosion area occur to considerably smaller speed and on small grade. Alongside with increase of the size of accumulation area the volume of deposits sharply decreases. The sediments of Turonian sea are represented mainly by clayey rocks formed in gulfs appeared during sea invasion onto dismembered continent.

In Coniacian-Santonian time the is expanded, the area of accumulation tests a little bit more intensive immersing, and land - rather more intensive uplifting, than in Turonian, these processes have very small speed and in marine basin arrived comparatively smaller quantity of terrigenous material. The increase of volume of deposits largely occurs at the expense of formation of biogenic siliceous rocks. Some revival of erosion it is possible to know by the increase in comparison with Turonian a role of sandy-silty material especially in coastal part of basin. The land at this time, had low and feebly dismembered relief.

Campanian time in tectonic relation largely is similar to ConiacianSantonian. Expansion of transgression and increase of the sedimentation area at this time proceeds; the its immersing occurs to small speed and on small size. The erosion area, continuing to reduce, tests more intensive uplifting, proceeding with a little bit greater speed. In result in basin arrives greater quantity of terrigenous material. Accumulation of biogenic siliceous deposits at the same time proceeds, but them sedimentation occurs simultaneously with terrigenous material.

After short-time regression of the sea occurred in the beginning of Maastrichtian comes new transgression, heaviest on area distribution for whole Cretaceous. Simultaneously with increase of the accumulation area, the erosion area decreases. The immersing of first one and uplifting of second one occur in Maastrichtian on smaller size, than in Campanian, but to a little bit greater speed. The volume of sediments, among which prevails terrigenous material, decreases.

Maastrichtian sea of Western Siberia through wide strait connected with southern basins and was rather warm, that has found reflection in accumulation carbonate deposits - marls - in the South of Zauralie, whereas on greater part basin the clayey rocks were formed, and on extreme north proceeds the sedimentation in small volume of siliceous deposits. Among sediments of this age the heaviest speed of formation have marls.

In the end of Cretaceous period comes regression of the sea, which was proceeded to develop in Early Paleocene. Area of accumulation is reduced and accordingly erosion is increased. As downwarping of first one, and uplifting of second one occur to much smaller speed and on smaller size, than in Maastrichtian. The volume of accumulated deposits, among which prevails terrigenous-clayey material, decreases. In coastal part of pool there is the formation of manganese ores. On intensity of vertical movements this time, as well as Turonian time, is possible to consider as time of relative tectonic rest. In Middle-Late Paleocene begins the transgression of Paleogene sea and increase of the sedimentation area.

ON BASIC REGULARITIES AND PHYSICAL MECHANISMS OF FORMATION OF THE PERI-TETHYAN BASINS

E.V.Artyushkov[1], *M.A.Baer*[1], *P.A.Chekhovich*[2], *L.V.Panina*[3], *and I.G.Scherba*[4]

[1]Institute of Physics of the Earth, B.Gruzinskaya 10, Moscow, 123810, Russia
[2]Institute of Lithosphere, Staromonetnyi per., 22, Moscow, 109180, Russia
[3]Geological Faculty, Moscow University, Vorob'yevy gory, Moscow, 119899, Russia
[4]Geological Institute, Pyzhevskyi per., 7, Moscow, 109017, Russia

The Tethyan fold belt is bounded by deep foreland basins. According to popular ideas, such basins form due to flexing of a thick lithosphere at the epochs of convergence in the adjacent thrust belts. It is supposed that at epochs of convergence the lithosphere preserves its density and thickness. On the other hand, the crustal subsidence often occurred without convergence in the intraplate areas, and it was commonly associated with no significant lithospheric stretching. Under such conditions, a density increase was necessary to produce the subsidence. This poses a question, as to whether or not the crustal subsidence of the same kind occurred in the foredeeps of thrust belts.

The analysis of the evolution of the foredeeps of the Caucasus, Carpathians and Southern Urals has shown that the crustal subsidence in these basins occurred at the times when no convergence took place in the thrust belts. Thus, a strong convergence in the Greater Caucasus in the Middle Jurassic resulted in no significant subsidence in the Caucasian foredeep. In the Early Oligocene, 130 m.y. later, a rapid crustal subsidence formed a deep water basin in this region without significant stretching. The subsidence took place 25 m.y. before the next convergence in the Late Miocene. Since that time the nappes on the southern slope of the Greater Caucasus were moving southward. This could not produce a significant downflexing of the lithosphere in the Caucasian foredeep to the north of the Caucasus. Up to [illegible] km of the Upper Miocene–Pleistocene deposits, however, formed in this basin.

A strong crustal subsidence on the western margin of the East European platform formed the initial foredeep of the East Carpathians in the Middle Miocene. This took place between two epochs of strong convergence in the Carpathians. When the nappe, up to 12–14 km thick, was superimposed on the inner part of the basin, the crustal uplift rather than subsidence occurred in the adjacent outer part of the foredeep that emerged above sea level. Then a strong crustal subsidence up to 8 km took place in the foredeep of the southeastern Carpathians in the Late Miocene – Early Pleistocene. This occurred after 98% of convergence in the Carpathians was already over.

The foredeep of the Southern Urals is at the same time the eastern margin of the Pre-Caspian basin. The subsidence began 1650 m.y. BP in the Early Riphean. Up to 10–16 km of the deposits had already been formed before the onset of convergence in the Urals. As in the other foredeeps studied, no increase in the subsidence rate took place at several short epochs of convergence in the thrust belt in the Late Silurian – Triassic. Two rapid subsidences occurred without convergence in the thrust belt at the end of the Carboniferous and in the Late Permian – Early Triassic with a deposition of up to 3–7 km of sediments. Both the seismic profiling and drilling data indicate no significant stretching in the foredeep.

The additional analysis has shown that all the Uralian foredeep, 2500 km long and up to 10–2[illegible] km deep, formed independently on convergence — at times when no collision occurred in the thrust belt.

A strong crustal subsidence without convergence or stretching of the upper crust requires stretching of the lower crust or a density increase in the lithosphere. Under the above foredeeps the Moho is either flat or warped down which precludes the first possibility. It is most probable that the foredeeps formed due to contraction of mafic rocks in the lower crust due to a gabbro – to garnet granulites – to eclogite phase transformation. This is in agreement with the data on the seismic velocities and electrical conductivity in the lower crust of the Urals and their foredeep.

At the epochs of collision thick nappes that were superimposed on shelf regions in the above fold belts remained at a low altitude above sea level. High mountains formed much later. For example the crustal uplift that produced the present Carpathians began in the Late Pliocene — 8 m.y. after superposition of the Carpathian nappe on the platform margin. In order to keep thick nappes at a low altitude, a large density increase was necessary in the lithosphere. The geological and geophysical data show that no large slab pull was acting in the above fold belts at the epochs of nappe superposition on the platform margins. Under the Eastern Carpathians and Urals a layer of garnet granulites, up to 20 km thick, with V_p = 7,4–7,9 km/s and the density 3200–3400 kg/m^3 exists in the lower crust. These rocks most probably formed at the time of crustal subsidence and nappe superposition on the platform margins. In the Carpathians tis occurred quite recently — in the Middle Miocene. Delamination of mantle lithosphere and dense mafic rocks in the lower crust or expansion of garnet granulites after their heating by the astenospheric upwelling can be a cause of formation of high mountains in fold belts.

The absence of crustal subsidence at the front of thick nappes in the Caucasus, Carpathians, and Urals indicates decoupling of crustal movements under the nappes and in the foredeeps. This indicates disruption of the lithosphere. Furthermore, in the above foredeeps, steep basement slopes formed without significant stretching when there was no convergence nearby. Many slopes are 4–10 km high and only 10–40 km wide. The high intensity of the deformations indicates a complete failure in the lithospheric layer and viscous flow in the upper crust. Steep slopes usually formed at the epochs of rapid crustal subsidence which required eclogitisation in the lower crust under volatiles infiltration from the astenosphere. Migrating through mantle lithosphere, volatiles can strongly reduce its viscosity. Rapid metamorphism in mafic rocks in the lower crust is known to be associated with a strong viscosity drop. Contraction in the lower crust leaves the upper crust without its support from below. This produces the stresses in the upper crust which are comparable with the lithospheric pressure. A strong decrease in the viscosity should occur in this layer due to the dependence of viscosity on deviatoric stresses. As a result, volatiles infiltration into the lithosphere with rapid metamorphism in the lower crust can result in failure in the whole lithospheric layer.

Lithospheric failure has been also revealed in many other basins, e.g. in the Black Sea, North Crimea and Pre-Caspian basin and on the Turan platform. This is a main phenomenon in continental lithosphere which allows the formation of fold belts and rifted basins under moderate stresses that are commonly acting in this layer.

The above results show that the evolution of thrust belts and their foredeeps is quite different from that predicted by flexural model. Both the crustal subsidence in the foredeeps and mountain building in the thrust belts are associated with density changes in the lithosphere rather then with convergence. Thrust belts form at the epochs of lithospheric failure with a practical disappearance of elastic layers.

MID-CRETACEOUS PERI-TETHYS BASINS OF EASTERN EUROPE:

SEA-LEVEL CHANGE, PALEOCEANOGRAPHY AND BASIN EVOLUTION

E.J.Baraboshkin*, L.F.Kopaevich*, A.A.Alexandrova*, A.S.Alexeev, A.G.Olferiev***, A.J.Guzhikov****, B.W.Fouke*****, J. Van Hinte*****, W.Schlager*****, A. Nederbraght*****, J.J.Podladchikov*******

* *Department of Historical and Regional Geology, Geological Faculty, Moscow State University, RUSSIA.* ** *Department of Paleontology, Geological Faculty, Moscow State University, RUSSIA.* *** *Geological Survey 'Centrgeologia', Moscow, RUSSIA.*
**** *Geological Institute, Saratov, RUSSIA.*
***** *Free University, Amsterdam, NETHERLANDS.*

East - European basins in the Mid - Cretaceous unites Russian Platform (RPB), Per-Caspian (PCB, as a separate part of the Russian Platform Basin) and Scythian Platform (SPB) basins.

During the Mesozoic development of the area was controlled by different forces:

1. Praemesozoic structure activation and innovation of some tectonical directions (for all Basins). It determined general configuration of main structures, intensity of subsidence/uplifting, sea-water connections.
2. Proximity to the Tethys Ocean (mainly for SPB), which controlled both tectonics and sedimentation.
3. Salt tectonics (PCB only) determined completeness of sections and style of sedimentation.
4. Sea-level fluctuations (for all Basins) defined Basin connections, fauna migration and type of sedimentation.
5. Climate variations (for all Basins) controlled sedimentation type also.

Russian Platform shows more conservative tendencies with 'traditional' position of main developed structures that usually were inherited from Late Paleozoic. Basin conditions in general were also very conservative: Aptian - Cenomanian sediments are mainly terrigenous, shallow - marine to continental and only for Turonian - Coniacian carbonates are typical. Main stages of the RP development could be compiled as a follows:

1. Aptian. The stage is characterized by fine sediment deposition in the meridianally - oriented strait. During the Early Aptian slow water convection during the high-stand water-level led to oil-shales (Deshayesites deshayesi Zone) origin. In the end of the stage RP area drained.

2. Albian. The stage is characterized by complicated movements and changes in Basin orientation. In the Early Albian Boreal waters penetrated far to the south (through PCB up to Iran). During the Middle Albian the sublatitudal way opened and Black Sea Depression was intensively developed. In the Late Albian northern connection was closed, but basin expanded and even Voronezh Anteclise and Ukrainian Shield were submerged under Tethys water. Active phosphogenesis took place in this time.

3. Cenomanian is the transitional stage with breakish conditions phosphogenesis and mainly terrigenous sedimentation.

4. Turonian - Coniacian is the stage with intensive deepening of the south part of RP and Donbass. Shallow carbonate sedimentation amd phosphogenesis existed.

Peri-Caspian Basin is characterized by large delta progradation along mobilized Hercynic structures of S.Urals and Mugodzhary and simultaneous growth of salt domes. The break in sedimentation (from terrestrial to carbonate) took place in the end of Turonian. There are the following stages of basin development could be recognized:

1. Aptian. The type of sedimentation was the same as in the RPB, including oil-shale formation in the Northern PCB. It was the time of the high-stand water level and slow salt dome rising.

2. Albian. The stage is characterized by quick shallowing of the Basin with near-shore to delta facies in the Early and Middle Albian and delta to continental facies in the Late Albian. The process of delta progradation was the most intensive in Late Albian and crossbedded delta deposits filled eastern part of PCB prolonged the southern part of Mugodzhary Mts. Possibly the event was initialized by the phase of Tethys compression. In opposite to RPB Albian was the time of the low stand water level.

3. Cenomanian - Turonian. The base of Cenomanian is marked by marine transgression and stabilization of shallow water conditions with terrestrial sedimentation and phosphogenesis (even in the Late Cenomanian, during world-wide highstand). It was the time of very active salt tectonics with short stop in growth in the Early Turonian.

4. Coniacian. It was the stage of reducing of the Basin area and the initial phase of carbonate sedimentation.

Scythian Platform was much mobil in comparison with RPB. It differs by high heterogeneity and variety in basin conditions: from deep water to shallow marine and continental. One of the explanation of such phenomena is the location of the SPB close to Tethys Ocean.

1. Aptian. The stage is characterized by regional subsidence of SPB and shallow terrestrial sedimentation. Probably Late Aptian is the beginning stage of Black Sea Basin rifting accompanied by volcanism in the NW Caucasus. Organic-rich shales deposited in some of the North Caucasus depression (Deshayesites weissi Zone). It was the time of new inversion and mountain growth in the end of the Aptian in Crimea.

2. Albian. During the Albian took place an opening of the backarc rift basin on the border of Plain Crimea and RP (Middle Albian) as well as in Pontides. Terrestrial and volcanogenic sediments deposited all over the Crimea. In the same time North Pre-Caucasus basin was separated from the Crimea and PCB and was divided into two depressions by (West and East) submarine elevations (Stavropol Uplifting). The connections of North Caucasian basin with Transcaucasus basin and RPB were difficult because of the shallowness of junctions. During the time very fine clayey sediments were formed there. Series of anoxic event with organic-rich shales origination took place there in Early - Upper Albian during the high water stand.

7. Cenomanian - Coniacian. It was the time of quiet tectonics with carbonate sedimentation (shallow water - to outer shelf flysh sediments). The wide-spread Cenomanian/Turonian anoxic event occurred all over the area.

DETERMINATION OF OM CHARACTER FROM MAIKOPIAN SERIES OF THE RIVER BELAYA SUCCESSION (THE WESTERN PRE-CAUCASUS)

O.Bazhenova[1], M.Saint-Germes[2], N.Fadeeva[1], F.Baudin[2], B.Sokolov[1]
1 Lomonossov State University, Moscow, Russia 2 CNRS-URA 1761 & UPMC, Paris, France

The subject of investigation is one of the basis succession of the Western Pre-Caucasus - the River Belaya succession, which corresponds to the respectively deep sea facies of Maikop Series and is presented mainly by clayey lithotypes.

The purpose of our study is to use data on organic geochemistry for reconstruction sedimentary environments of Maikop Series. Geochemical studies included determinations of OM content, bitumen components, Fe and S-forms, gas-liquid chromatography, pyrolysis, and carbon-petrographic analyses of OM.

The preliminary results have revealed relatively high content of OM (1-4%), with content of bitumen components being not very high (0.01-0.06%, with maximum 0.1%). Bituminazation rate of OM is up 6% (3% in the average). Such concetrations are responsible for low maturation degree of OM (R < 0.5%) and worse kerogen quality. All the samples studied are characterized by high FeS_2 content (1-3.5%), thus testfying to sharp anaerobic conditions during diagenetic processes (probably sedimentogenesis) and large expense of OM. There was established also high SO_3 content (up to 3%). As far as Fe_2O_3 content is high (up to 4%), then, probably, SO_3 and Fe_2O_3 present secondary generations when hypergene processes.

Gas-liquid chromatography of cloroform bitumoids shows that the samples are characterized by great oddness within C_{25}-C_{29} (odd index=2). Samples from Psekhskaya horizon are rather immature (Ki > 1), having great napthene back-ground. In the sample from the Beloglinsky Suite mono-modal distribution was fixed with maximum at C_{19}, Pr/Ph=0.8, and relatively lower concentrations of high moleculas alkanes, which testifies to insignificant role of continental admixture in the original OM. Samples from the Pshekhsky horizon are rather similar by their chromatographic characteristics: distribution of normal alkanes is bi-modal, with maximums at C_{19} and C_{29}, being the indicator of OM mixed content.

Samples from the Septarieva and Morozkina Balka Suites are very similar to those from the Rshekhsky Suite: bi-modal distribition with maximums at nC_{19}-nC_{21} and nC_{29}-nC_{31}, low Pr/Ph (0.2-0.5) and high Pr/nC_{17} and Ph/nC_{18} ratios - especially in the sample 014/3a (the Morozkina Balka Suite): Ph/nC_{18} - 3.4. These ratios are not evidenced in the samples from Karadjalginskaya Suite - 0.4 and 0.4 correspondingly(Fig.1).

According to the distribition character of the same coefficients and character of chromatograms, all the samples studied can be divided into two groups. The 1st group has high Ph/nC_{18} ratios - 1.3-3.4, testifying to sharp reduction enviroments (samples from the Pshekhsky, Septarieva, Morozkina Balka).

For the succession studied, the relatioship between Corg quantity and value of genetic potential is rather a common feature. Values of the latter vary within the wide limits (from tenth share to 16 kg HC, with average 2 kg HC per t of a rock; maximum value being noted in the rocks of the Morozkina Balka Suite). At the same time H&T index, characterizing OM type, is extremely low, not exceeding 200 g HC per g Corg. Maximum values (300-420 g HC per g of Corg) were fixed in the deposits of the Morozkina Balka Suite too. On the diagrams of OM types they correspond mainly to the area of kerogen III type or occur between II and III types of kerogen(Fig.2).

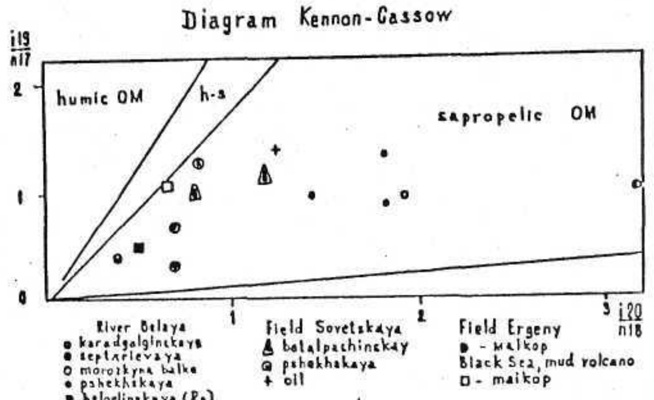


Fig. 1

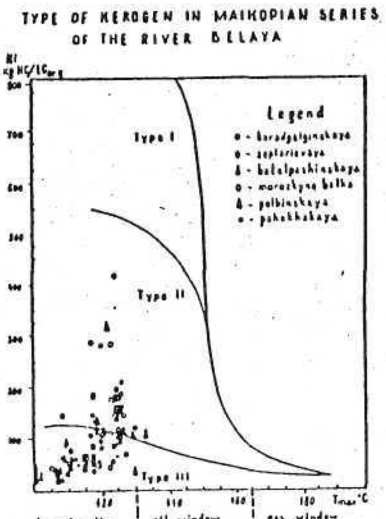


Fig 2

Thus, one can observe some dicrepancy of OM genetic types, being determined by different methods: by HC content of bitumoids with low maturation degree it is purely sapropellic OM; however the results of pyrolisis reve the matter being mixed with shares of humic component. In the whole OM content is defined by th significant share in the original OM of carbohydrate-protein components.

LATE PERMIAN BRACHIOPODS FROM THE EXOTIC BLOCKS OF THE GORNY CRIMEA

Tatjana A. Grunt *(Paleontological Institute RAS)*, **Aleksander S. Alekseev, Marina V. Novikova**
(Moscow State University)

The horizon of the Late Permian olistostroms in the territory of the Gorny Crimea (Lozovskaja structure zone) consists of numerous blocks and boulders of different dimensions composed of grey or dark-grey organic limestones. These blocks are connected precisely with the basal layers (Chenski member) of the normal flysh o Eskiordin Formation. The age of Eskiordin formation is from Middle Triassic to Middle Jurassic. Huje dimensions of some blocks give evidence of local intrageosynclinal sources of drift.

O. Toumansky was the first who in 1917 established the Permian age of these limestones on the basis of the fact that the ammonoids from the locality of Kichkhi-Burnu along the Marta River was identical to that of the Fusulina limestone of Sicily. The cliff of the mount Kichhi-Burnu appears to be built of separate blocks of a light brecciated limestone containing ammonoids, brachiopods, trilobites, corals as well as multitude of fusulinids.

Brachiopods from different parts of this cliff were discovered by G. Veber in 1912. At that time the age of this assemblage was considered to be Late Carboniferous. O. Toumansky in 1937 established Early Permian age of Brachiopods from this locality according to ammonoid data. In 1959 a large brachiopod assemblage containing more than 30 species was collected by O. Einor and M. Vdovenko from the same locality. The age of this brachiopod assemblage was idenified by O. Einor as Late Permian on the basis of numerous fusulinids as well. A. Miklukho - Maklaiy (1957) identified the fusulinids of the limestones from Kichhi-Burnu locality to be Murgabian in age with the presence of fusulinids: *Polydiexodina crimea* Toum., *Brevaxina dyhrenfurti* Dutk., *Verbeekina verbeeki* Geinitz, *Pseudodoliolina ozawai* Yabe et Hanzawa, *Paraverbeekina taurica* Toum., *P. minima* M. - Maclay, *Armenina* ex gr. *karinae* M. - Macl., *Cancellina sphaerica* M. - Macl., *Praesumatrina rossica* M. - Maclay, *P. primitiva* M. - Maclay, *Afghanella elegantula* M. - Maclay, *A. borissiaki* Toum., *A. nalivkini* Toum., *A. magna* M. - Maclay, *Sumatrina rossica* M. - Maclay.

A new collection of braciopods has been collected by T. Leonova and A. Shkolin (the researchers of Paleontological Institute RAS) recently (in 1992). This small collection conaining about 50 specimens of brachiopods belonging to 15 genera and 18 species of different orders of atrticulate brachiopods has been studied just now by T. Grunt and M. Novikova. The following species have been identified: *Orthotichia avushensis* Sokolskaja, *Enteletes geniculatus* Licharew, sp. nov., *Compressoproductus mongolicus* (Diener), *Krotovia jissuensiformis* (Licharew, sp. nov.), *Comiquia modesta* Grant, *Gratiosina gratiosa* (Waagen), *Incisius* sp., *Terebratuloidea depressa* (Waagen), *Wellerella gundarensis* (Licharew, sp. nov.), *Stenoscisma acuminata* (Gemmellaro), *Neophricodothyris pulcherrima* Gemmellaro, *Martinia orbicularis* Gemmellaro, *M. cer...* Gemmellaro, *M. semiplana* Waagen, *Heterelasmina cuboides* (Licharew, sp. nov.), *H. nikitini* (Gemmel... *Hemiptychina darvasica* Tschernyschew, *Rostranteris (Rostranteris) mongoliensis* (Grabau).

Few species which have been identified earlier by O. Einor could be added to this list with confi... These are: *Geyerella tschernyschewi* Licharew, *Leptodus richthofeni* (Kayser), and *Richthofenia cau...* Licharew.

This brachiopod assemblage appears to be most close in taxonomic composition to that from Fus... limestone of Sicily. These data are confirmed precisely also with the presence of ammonoid association m... characteristic for the Wordian Fusulinid limestone of Sicily. Some species of brachiopods (such as *Ent... geniculatus* Licharew, *Krotovia jissuensiformis* (Licharew), *Wellerella gundarensis* (Licharew) or *Heterela... cuboides* (Licharew) are close to Late Kubergandian (Gundara suite) from the South - West Darvaz (... Pamir). Few forms are the same as in the Late Permian (Midian or Early Djoulfian) of the North Cau... section. According to geographic and stratigraphic distribution of brachiopods as well as ammonoid and fus... assemblages, the age of Kichhi - Burnu cliff could be established like Late Kubergandian - Murgabian.

Dominant elements of this Brachiopod assemblage are type representatives of "reef" or bioherm community. Mostly characterisic are *Enteletes, Richthorenia, Leptodus, Incisius, Heterelasmina, Rostranteris* and so on. Taking into account, that during all the Permian rifes and biogemic buildups were characteristic for the northern shallow shelves of Paleotethys we could agree that paleogeographical position of Sicily (so - called Apulea basin) and Gorny Crimea was very close during Early Late Permian.

NUMERICAL MODELLING OF THE EASTERN FORE-CAUCASUS MOLASSE BASIN DURING THE CENOSOIC COLLISION.

A.V.Ershov, M.-F.Brunet, A.M.Nikishin, S.N.Bolotov, S.S.Kosova

In the Eocene (pre-collisional time) the Black Sea-Great Caucasus-Southern Caspian basins were remnant deep-water back-arc basins with oceanic or very thinned continental crust. The subduction zone was to the south of Pontides-Transcaucasus-Alborz belt. At the Eocene/Oligocene boundary the north-dipping subduction was changed by collision of the Pontides-Transcaucasus-Alborz area with Tauride-Anatolide and Central-East-Iran-Lut terrane. It led to the uplifting of the Transcaucasus region and to compressional tectonics along the Black Sea-Great Caucasus-Scythian Platform-Southern Caspian. The subsidence history modelling shows that directly at the Eoc/Oli boundary all recent molasse basins of the Pre-Caucasus area suffered rapid subsidence event; the same took place in the Eastern Black Sea basin, Southern Caspian basin, and Great Caucasus Trough. The width of the region of the rapid subsidence event was up to 600-700 km. Thrust structures began to form along the northern margin of the Great Caucasus, along the boundaries of the Eastern Black basin with Crimea-Caucasus-Eastern Pontides. We study two mechanisms of this regional subsidence accompanided by compressional tectonics: (1) syncollisional compresion and (2) subducted slab roll-back followed by its detachment.

Late Oligocene-Early Miocene (nearly 30-17 Ma ago) was a relative "soft" collision times without prominent recognized events on the subsidence curves.

A collision between the Arabia and the Europe took place in the Middle Miocene-Quaternary. This continent-continent collision has led to collision tectonics and orogeny in the Caucasus-south-Crimea region, and to syncompressional subsidence of the Black Sea and Southern Caspian basins. The collision was irregular with five main phases of shortening: 16.5-15, 12.4-9.7, 7-5, 3.7-1.8 and 1.6-0 Ma ago. Each compressional event was accompanied by rapid subsidence of molasse basins followed usually by clinoform sedimentation. The syncompresional bulge to the North of the Scythian Platform molasse basins suffered uplifting since the Early Miocene. The greatest compressional events took place in the Sarmatian (13.6-9.7 Ma ago) and pre-Akchagylian-Akchagylian (3.7-1.8 Ma ago). The syncollisional shortening of the Great Caucasus was nearly 150-200 km.

The subsidence history of the different tectonic units was different. The Terek-Caspian, Indol-Kuban, Transcaucasus, and Fore-Crimea molasse basins suffered polyphase subsidence, The Sravropol High began to subside which was followed by plateau-like uplifting up to 500-900 meters. To the North of the Terek-Caspian-Kuban molasse basins a peripheral Karpinsky (or Salsk-Manych) bulge began to uplift since the Miocene. The amplitude of the peripheral bulge uplifting was up to 500-1000 meters. The distance between the Great Caucasus axes and the Salsk-Manych peripheral bulge axes is close to 400-475 km. Peri-Caspian basin suffered uplifting in the Miocene which was dramatically changed by rapid subsidence up to 600 meter during the last 3.4 Ma. The Eastern Black Sea basin had a decrease of the subsidence rate 17-3.4 Ma ago changed by rapid subsidence till the recent time. Inside the southern part of the East-European Platform a system of whole(?)-lithospheric very gentle anticlines and synclines originated with the amplitude of vertical movements up to 200-300 meters. These deformations took place together with local intracratonic thrusting/folding events mainly to the West and North of the Peri-Caspian basin. The maximum of intracratonic deformations took place nearly 13.6-9.7 Ma ago. The region of compressional Alpine deformations spreads more than 1200 to the North of the Creat Caucasus (Fig. 1).

Two main driving mechanisms took place during the Caucasus-related molasse basins origin: horizontal compressional stress and vertical loading of the orogen. The horizontal stress-related structures spread very far from the region of the orogen loading influence.

The seismic profile we choose for 2D modelling crossed out all tectonic provinces of the Eastern Fore-Caucasus: Karpinsky swell, Kuma highs, Nogaiskaya step, Terek-Caspian depression. The position of this profile is close to the position of deep seismic sounding profile Volgograd-Nahichevan we use for dynamic modelling.

On the base of the detailed geological cross-sections with clinoforms dating accuracy 0.1 MA we made the two-dimensional restoration with decompaction. The special algorithm allow us to restore paleobathymetry from the shape of the clinoforms. Since the end of Pontian (Messinian) stage the sea was closed and the regional sea level variation differs from the world eustatic changes. The results of this restoration were used in dynamical modelling. Knowledge of the basin shape through the time allow us to obtain stress and loading history through the time.

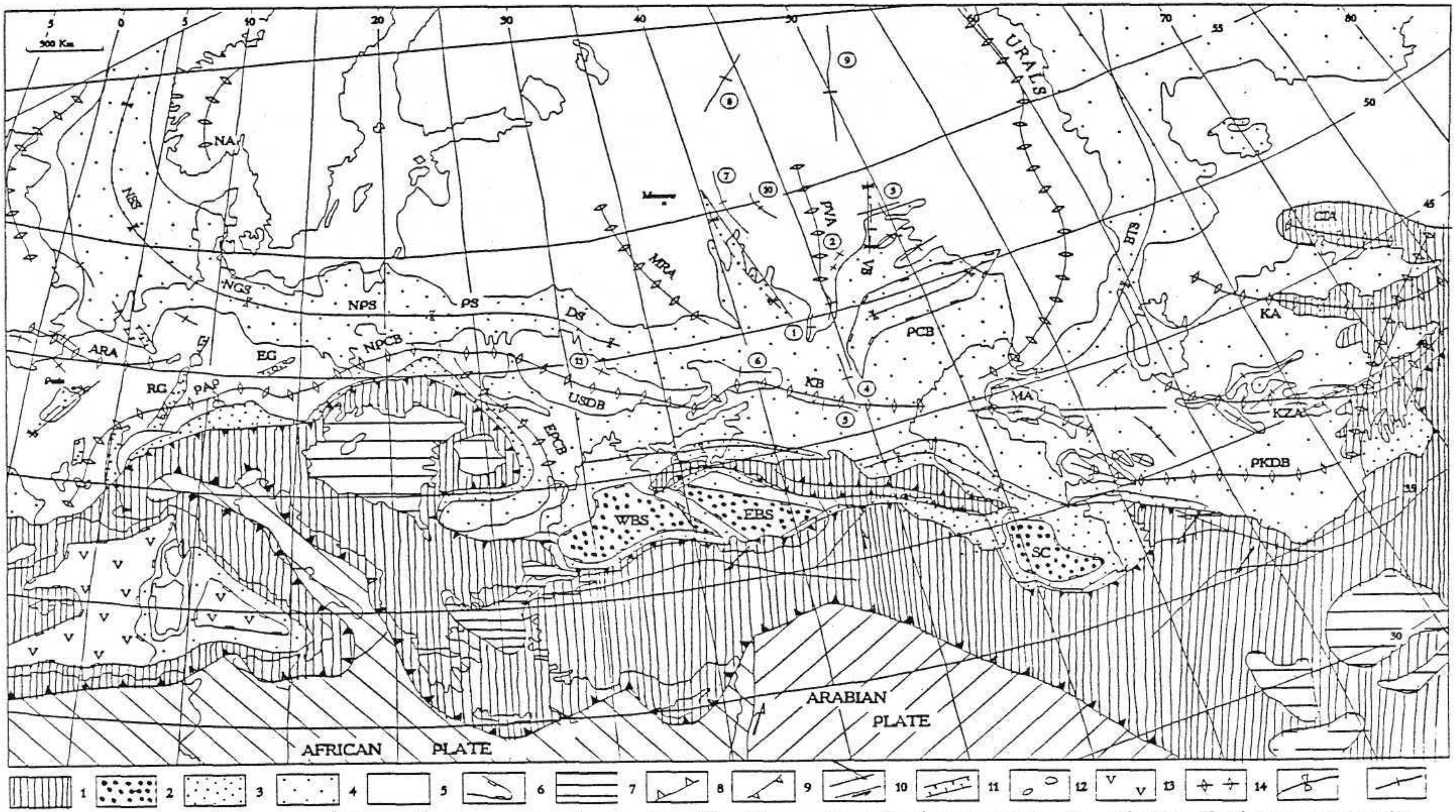


Figure 1. Main features of the Alpine tectonics in the Northern Peri-Tethyan areas. 1 - Alpine Tethyan orogenic collisional belt undivided; 2 - very deep molasse basin on the oceanic-like crust; 3 - molasse basin; 4 - region with Oligocene-Neogene sediments in the Northern Peri-Tethyan area; 5 - region of the Oligocene-Neogene uplift; 6 - basin with oceanic-like crust; 7 - some intramountains basins; 8- subduction zone; 9 - thrust; 10 - strike-slip faults; 11 - graben; 12 - Neogene volcanites; 13 - Neogene back-arc basins with oceanic-like crust; 14 - axes of the proposed whole-lithospheric gentle anticline; 15 - axes of the proposed whole-lithospheric gentle syncline; 16 - intracratonic

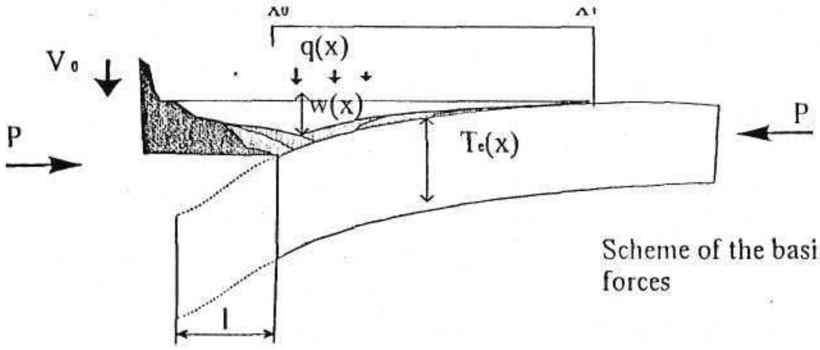
The geometry of the molasse basin is defined by the flexural properties of the lithosphere, intraplate stresses and loading of the mountains and sediments. It has a characteristic shape with deepening toward the orogen and flexural bulge on the lithosphere half-wave distance in opposite direction.

The flexural properties of the lithosphere is defined by the thermal state of the lithosphere, thicness and constitution of the crust. Our estimation give us the value near 50 km for average effective elastic thickness. Some deviations is presented in the areas of former rifts and continetal margin.

The knowledge of the basin geometry allow us to estimate the intraplate stress and loading force. Knowledge of the basin shape through the time allow us to obtain stress and loading history through the time.

The principle of the regional isostasy consider that due to the flexural stresses the subsidence is distributed over the more broad area than loading. If we know the geometry of the basin we can evaluate the excess of the subsidence over loading in the framework of local isostasy. This "local excess subsidence" is appeared due to the redistribution of orogen support forces. So, it is possible to evaluate the loading of the orogen supported by the lithosphere of the basin.

We are carriyng out the modelling of the stress/loading history based on the detailed kinematical 2D restoration. Changing the intraplate stress and loading force values we fit the geometry of the basin for each time slice. As a result we have the time slices of the modelled best-fitted flexural shapes of the basin and stress-time, loading-time plots.



Scheme of the basin geometry and main diving forces

KINEMATICS OF THE BLACK SEA BASIN OPENING

V.G.Kazmin,
P.P.Shirshov Institute of Oceanology RAS, Moscow.

The Black Sea basin consists of 3 sub-basins: Moesian, Western (WBS) and Eastern (EBS). The Moesian sub-basin was formed due to rifting of the Moesian platform in Aptian or Barremian and was limited on the east by an extension of Tornquist line. The Western and Eastern sub-basins originated in the Albian (probably Late Albian) when the back-arc rifting followed the collision of Pontides with the Scythian platform and re-organization of the subduction system (Fig.1). This is evidenced by rifting and subsidence on the northern shelf of the Black Sea (the passive margin of WBS) and by development of a back-arc basin on the eastern extension of the EBS (Rioni depression). Both sub-basins (WBS and EBS) opened as conjugated rifts joined by a massive crustal block of the Andrusov rise which rotated clockwise - a kinematics typical for a number of continental rifts (e.g. Baikal, southern Red Sea etc.)

The second important stage of extension was in the Paleocene directly after the Late Cretaceous collisions in Pontides and southward displacement of the Tethyain subduction zone. Data on Adjaro-Trialetia and reconstruction of the subduction zone in Transcaucasus (Adamia et al., 1974; Zonenshain, Savostin, 1979) show that EBS was opening in the Paleocene - Mid-Eocene time. Subsidence along several normal faults or flexures is also reported on the northern periphery of the Great Caucasus basin (GCB) (Shcherba, 1994). Coeval extension in EBS and GCB is well explained by a kinematic scheme described above and thus implies simultaneous opening of WBS (Fig.2). The latter is in accord with existing interpredictions (Tugolesov et al., 1985; Finetti et al., 1988) suggesting that the Cenozoic sediments rest directly on the basaltic basement in the central part of WBS.

A phase of weak compression affected the Black Sea margins in the Pre-Oligocene time and was followed by development of deep uncompresated Maikopian basins in WBS, EBS and GCB. Though there is an evidence of step-faulting and subsidence in GCB (Shcherba, 1994) the general tectonic situation of the Maikopian stage remains unclear. In any case, development of deep basins at the background of a

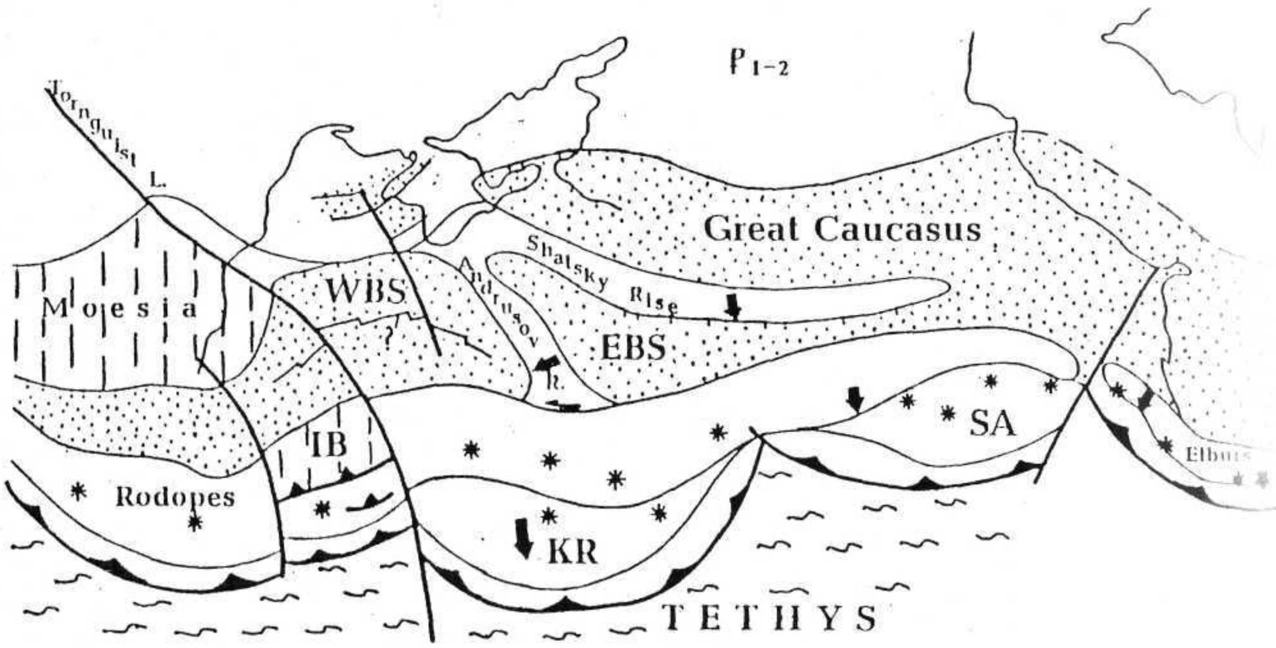
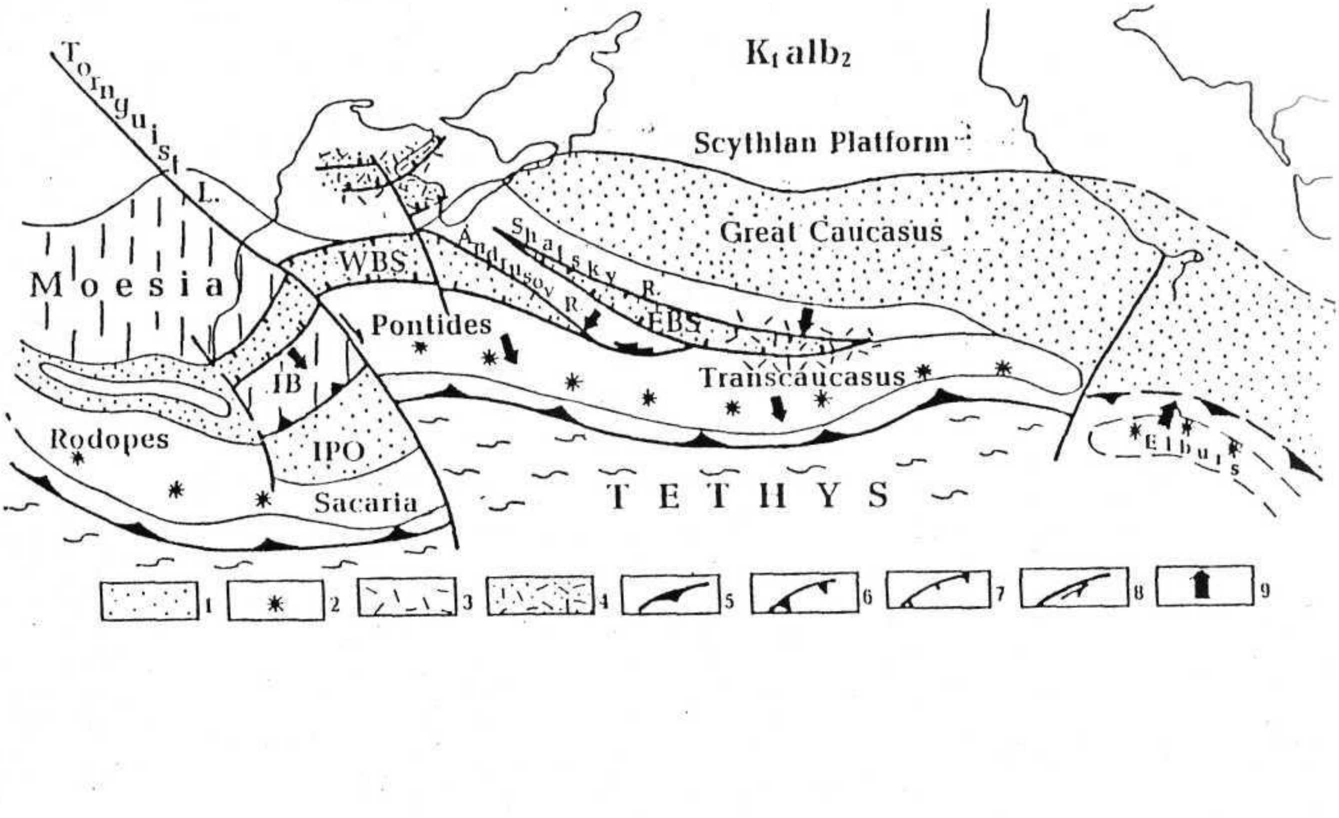

P 1-2
Tornguist L.
Moesia
WBS
Andrusov R.
Spatsky Rise
Great Caucasus
EBS
IB
Rodopes
KR
SA
Elburs
TETHYS

Fig. 2


K1 alb2
Tornguist L.
Scythian Platform
Great Caucasus
Moesia
WBS
Andrusov R.
Spatsky R.
EBS
Pontides
IB
Transcaucasus
Rodopes
IPO
Sacaria
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major drop of the sea level (Haq et al., 1987) must have had a tectonic cause. Some regional extension was probably induced by re-organization of the subduction system and block expulsion in the course of progressing Arabia/Eurasia collision.

Fig.1. Paleotectonic map for the Late Albian. 1 - back-arc basins; 2 - volcanic arc; 3 - volcanism in the back-arc basin; 4 - volcano-sedimentary sequence; 5 - subduction zone; 6 - reverse fault; 7 - normal fault; 8 - strike-slip fault; 9 - plate motion, relative to Eurasia. IB - Istanbul block; IPO - Intrapontide ocean. KR - Kirshechir massif; SA - South Armenia; WBS - Western Black Sea; EBS - Eastern Black Sea.
Fig.2. Paleotectonic map for the Paleocene-Eocene.

GEOKINEMATIC MAP OF THE AREA OF DYNAMIC INFLUENCE OF THE ALPINE-MEDITERRANEAN COLLISION BELT ON THE EURASIAN AND GONDWANIAN PLATFORM FRAMING (LATE CENOZOIC), SCALE 1:10,000,000

M.L.Kopp, V.S.Burtman,Yu.G.Leonov,L.M.Rastsvetajev

The orogenic geokinematics of the Peri-Arabian collisional area and the entire Alpine-Mediterranean belt has not received an adequate study. Research groups which adhered the mobilisms concept, concentrated their efforts on the pre-collision history of horisontal movements. However, the horisontal movements of the orogenic stage have determined the modern appearance of folded belts. It is important for the "Peri-Tethys" Programme goals that the intense collisional horizontal compression involves both a folded zone itself and colliding plates over the great distances, thus resulting in intraplate deformations. It has been clearly demonstrated for Western Europe [Bergerat, 1983; Hippolyte et al., 1993; Jllies, 1975; Letouzey, Trimolieres, 1980; Zoback et al., 1993]. Although the appropriate researches have been just started in respect of the platform framing the Anatolian-Iranian segment of the collisional zone the preliminary results are very promising [Gushchenko, 1990; Kopp, 1991; Kopp et al., 1994; Korchemagin, Emets, 1987; Leonov, 1995; Rastsvetaev, 1987, 1995].

This investigation is aimed to filling up to some extent these gaps in our knowledge. It was carried out along the following lines: (1) reconstruction of the Late Cenozoic kinematics of the Peri-Arabian collisional area on the basis of analysis of strike-slip-related structural patterns (the available estimates of neotectonic structural ensembles age were reanalysed and partly reinterpreted and (2) studies geodynamic and kinematic environments of Late Cenozoic intraplate structures and the spatial-age relationships between these structures and domains and blocks moving in different directions within the Anatolian-Iranian segment of the collisional zone.

We compile our own version of the age deformation map, which based on the principle of "the age of separate structure" but not "the age of sone". Such a way made possible to emphasize the features important for the geokinematic analysis, such as northward propagation of the Dead Sea transform, difference in age between left and right strike-slips of Kopetdagh and between compression and extension structures of the southern Caspian region, eastward migration of the Caucasian compression in late Miocene - Quaternary, inversion fault kinematic sign in eastern Iran at the end of Pliocene, and so on. A comparison of the Late Cretaceous and Paleogene paleomagnetic data from the Scythian and Arabian platforms and Lesser Caucasus shows a convergence between the northern border of the Arabian plate and the Eurasia at 16±4°. A half of it took place between Lesser Caucasus and Eurasia. Paleomagneti decenations show a secondary origin of the Trabson and Lesser Caucasus structural arcs.

Geokinematic evolution of the region on study may be subdivided into 4 stages:

1) *Late Eocene-Oligocene* - an initial Afroarabia-Eurasia collision; change of the direction of Afro Arabian motion from north to north-west; the Pyrenean and Savic orogenies in Turkey and South-Western Europe;

2) *Early-Middle Miocene* - blocking of the Afroarabian north-west motion as a result of consolidation south-western Europe and Turkey; engagement of the Arabian promontary with Turkey and creation of a rotational moment to turn Arabia counterclockwise and to close the Zagros relic basin continental break-up and formation of the Red Sea - Aden rift system; counterclockwise rotation of the newly-formed Arabia plate around a pole situated in the Sinai peninsula (a position of the pole was determined from an arcuate configuration of the Mangyshlak-Aden dextral shear zone distinguished by authors), Savic-Styrian compression of the Iran - Kopetdaghian block; intraplate deformation of the western Turanian plate (Mangyshlak and a.o.);

3) *Late Miocene - Early Pliocene* - a reorganisation the spreading - transform fault system to close the Caucasian relic basin; transference of the Arabia - Africa pole from Sinai to Libya; beginnings of the Dead Sea fault in its recent configuration; approximately north Arabia motion; directed mainly to the west lateral extrusion of blocks out of two major deformational necks namely the Erzerum and Alborz ones sublatitudional extension in the South Caspian depression and coeval compression in the Caucasus buckling of Lesser Caucasian structural arc; collision of the Lesser Caucasus with the Scythian platform accompanied by squashing of the Caucasian relic basin; intraplate deformation of the Scythian platform and beginnings of the Greater Caucasus in its modern appearance;

4) *Upper Pliocene - Recent* - cessation of an outflow of rock masses from under the South Caspian basin and transformation of it from an area of tectonic denudation to that of tectonic accumulation; lateral extrusion of blocks out of Caucasian and Kopetdaghian syntaxes directed into the South Caspian geodynamic asylum; intense eastward motion of the Lesser Caucasus structural arc; directed eastward lateral extrusion of the East Iranian block; continuing since Early Miocene lateral extrusion of the Anatolian block westward; intense intraplate deformation of the Arabian plate.

MODELLING OF THE PRI-CASPIAN AND CASPIAN SEA BASINS USING TRADITIONAL AND NEW MECHANISMS OF TECTONIC SUBSIDENCE

L.I.Lobkovsky, I.A.Garagash, Yu.A.Volozh, A.T.Ismail-zadeh (*CSBR*), M.-F.Brunet (UPMC)

The important task of the present proposal is to establish main mechanisms which determine evolution of the Pri-Caspian and Caspian Sea sedimentary basins. Analysis of geological and geophysical data shows that traditional mechanisms of lithosphere subsidence during sedimentary basin evolution are often incapable of adequately describing some peculiarities of this evolution.

We suggest three new mechanisms of lithosphere subsidence having a claim on explanation of sedimentary basin's evolution for PriCaspian and Caspian Sea region: 1) subsidence of the crust due to eclogite lens formation on the bottom of the thinned lithosphere; 2) subsidence of thermally inhomogeneous lithosphere due to its conformed bending during extension; 3) oscillation regime of lithosphere subsidence.

First mechanism results from lithosphere thinning due to its extension or owing to hot plume in the mantle. The melt, a light component of the asthenosphere material, moves upward and accumulates in the asthenospheric bulge. Magmatic lens is formed there if the roof of the bulge is impenetrable to the melt. The material of the lens gradually transforms into denser eclogite body. The flow induced by subsidence of heavy eclogite body results in depression of the surface.

Second mechanism of the surface lithosphere subsidence is connected with conformed bending of thermally inhomogeneous elastic lithosphere under extension forces. Testing calculations show that both mechanisms of lithosphere subsidence can explain formation of additional sedimentary thicknesses up to 5-7km.

Third mechanism deals with oscillatory movements of the lithosphere surface which are often observed during sedimentary basin's history. For example, it is necessary to understand the observed Pliocene damped oscillations of the sea level in the Caspian Sea: in Akchigin time - uplift on 1000m relatively Balakhansk period; in Hazar time - uplift on 200m relatively Tyurkan time; in Holocene - uplift on 100m relatively Mangyshlak regression. Similar problems arise in explanation of uplifts of the basement in Devonian-Permian time for the Pri-Caspian basin. To explain these phenomena it is suggested to use new model of oscillation regime of the crust subsidence which takes into account the velocity difference between displacement of the lithosphere-asthenosphere phase boundary and vertical movement of the lithosphere block under loading. As a result movement of a lithosphere block to a new level of isostatic balance is accompanied by damped oscillations. Evaluations of characteristic values of activation energy, heat of conversion, densities and thicknesses of asthenosphere and lithosphere, viscosity of the asthenosphere show that periods of oscillations can vary from thousands to tens of millions of years.

DEVELOPMENT PECULIARITIES OF THE VOLGA-URAL, BLACK SEA AND CASPIAN PALEOBASINS REFLECTED IN SCALAR MAGNETIC CHARACTERISTICS, AND PALEOMAGNETISM OF THE MESOZOIC-CENOZOIC FORMATIONS.

E.A.Molostovsky *(Geological Institute of Saratov University, Moskovskaya, 161, Saratov, Russia, 410750; Tel: 7-8452-243-279; E-mail: kae@shart.ssu.runnet.ru)*

Magnetic properties of sedimentary complexes are functionally associated with sedimentation settings, and reflect many important peculiarities in baleobasin development: sedimentation rhythms, source-rock compositions in source regions, geochemical settings of sediment formation, etc. /1/. The paleogeographic potentials of petromagnetism are illustrated with the materials on the Upper Permian from the South Cis-Urals, Lower Cretaceous from the North Caucasus and the Plio-Pleistocene from the Black Sea and Caspian regions.

The Upper Permian from the South Cis-Urals.

The Upper Permian formations from the region are extremely diverse in their magnetic parameters. The petromagnetic differentiation of these sequences is determined by their spatial-structural positions, ages and sedimentation settings. Most important in this respect, were tectonic activations of the folded Urals and erosion of heavily magnetized volcanites from the greenstone band in its eastern slope.

The Upper Permian formation from the south-eastern part of the Russian Plate and the western zone of the Cis-Ural Trough, is peculiar for low magnetism (magnetic susceptibility, k = 0.0001-0.0002 SI units, natural remanent magnetization, Jn = 0.005-0.008 a/m). The central and the eastern zones of the Trough are filled with a thick sequence of highly magnetic red beds)k=0.002-0.01 SI units, Jn=0.04-0.3 A/m).

The highly magnetic intervals of the section: the Ufimian stage, the Upper Kazanian and Upper Tatarian substages. The Lower Kazanian and the Lower Tatarian substages are characterized by lower magnetism.

It follows from the above petromagnetic relations, that:

- In the Late Permian, the Cis-Ural Trough used to be a deep depressional morphostructure; the bulk of the terrigenous magnetic material used to settle there;
- In the Late Permian, the western zone of the Trough was closely associated with the Russian Plate in the structural-facies respect, while the piedmont depression existed only within the present central and eastern parts of the Trough;
- Judging from the variations in the petromagnetic section,

active erosion of the Ural greenstone band occurred in the Ufimian, Late Kazanian and Late Tatarian. During the Early Tatarian and Early Kazanian sedimentation cycles, preferential wash-out of the low magnetic sequences from the Central and Western Urals was taking place.

The Lower Cretaceous from the North Caucasus.

Two Early Cretaceous sedimentation stages are traditionally recognized: the Berriasian-Valanginian (carbonate-terrigenous) and the Hauterivian-Albian (terrigenous) ones /2/. More detailed paleogeographic reconstructions were performed by means of petromagnetic data. The Lower Cretaceous terrigenous complex is divided into two parts according to petromagnetic properties. The lower, the Hauterivian-Barremian one, is peculiar for high magnetism (k up to 0.0006 SI units, Jn up to 0.003 A/m), the Aptian-Albian one is of the low magnetic rank (k=0.00001-0.0001 SI units, Jn=0.00005-0.0009 A/m).

The only possible source of magnetic materials arriving in the Cis-Caucasian basin, could lie in the Great Caucasus highs with their highly magnetic Upper Paleozoic and Jurassic intrusions.

Within the low-magnetic Aptian-Albian complex, thermomagnetic analyses have revealed substantial intervals saturated with finely dispersed pyrite, absent from the Hauterivian and Barremian deposits.

It follows from the above:

- The Hauterivian and Barremian were the periods of the Great Caucasus tectonic activation accompanied with transportation of magnetic materials to the Cis-Caucasian basin;
- The most important drifting and accumulation of terrigenous materials are recorded in the Central Cis-Caucasia;
- Starting from the Aptian, the Great Caucasus was no longer important as a providing province, which was recorded by drastic decrease in rock magnetism;
- In the Aptian and in the Albian especially, significant paleogeochemical changes took place in the basin: the regime of hydrogen sulfide contamination was established in many areas. That might be associated with global unoxidic events at the Early/Late Cretaceous boundary.

The Plio-Pleistocene from the Black Sea and Caspian regions.

Magnetism of the Ponto-Caspian sedimentary complexes reflects the dynamics of the tectonic events in the Eastern Para-Tethys. The Pliocene activation is recorded by increased rock magnetism in the Middle Kimmerian and in the Surukhan suite /3/. Judging from the high magnetism (k=0.001-0.008 SI units) of the Pliocene complex from Western Georgia, the Adjar-Trialet region with its Middle Eocene blanket basalts, was the center of upheaval and erosion, most stable through time. Intensive denudation started there in the Gilbert epoch and went on for over 4 million years, up to the present.

In the Eastern Caucasus, the upheaval and denudation maximum falls on the end of the Gilbert - start of the Gauss epochs. This period of tectonic activation was less than one million years long.

In the Upper Pliocene and Pleistocene beds from the Caspian region, the magnetic properties variations were caused by authigenic magnetic sulfides. The distributions of the latter ones within stratigraphic sections, were determined by climatic conditions and paleobasin transgressive-regressive rhythms. The dependence of petromagnetic variations upon paleoclimatic factors has allowed the detailed correlation between the marine Lower Pleistocene from Kalmykia and the covering sequences from the Samara Trans-Volga region.

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VOLGIAN PALEOGEOGRAPY OF THE PECHORA AND VOLGA-KAMA DOMANIKOID-BEARING BASINS

Sedaeva K.M.*, Vishnevskaya V.S.**

**Moscow State University, Russia **Institute of the Lithosphere, Russian Academy of Sciences, Staromonetny per.,22, Moscow 109180, Russia*

The Jurassic marine deposits have a thickness of 1-3m to 80-150m. The lowest values are reported for the Central part of the Russian platform (0 - 50), whilst the thickest deposits are found north-east in the Pechora Syneclise (over 150m). Wide lithological diversity is characteristic of the Jurassic marine deposits. There could be found within small areas clastic and clayay deposits, various siliceous sediments, glaukonite, phosphorite, bituminous blake shale, combustible shale and marl with limestone. In these deposits fossils remnants of various bionomic shelf zones (coastal, neritic-pelagic-benthos and benthos-pelagic) have been found. Besides, in certain sections there exist faunal communities, belonging to other paleozoogeographic (West-European, Boreal-Atlantic, West-Siberian and Tethyan). In all, these deposits contain fossil representatives more then 130 genera of 15 classes.

The Jurassic stratigraphic sequences in the Timan-Pechora Basin show a clearly transgressive depositional system starting with Early-Middle Jurassic sands and deepening upward to the accumulation of the higher grade source rocks in the Volgian time. The mass extinction, observed here and especially in the Gorodische section of the Volga-Urals Basin (only about 40 species of ammonites, 20 species of aucellids, 22 species of benthic and 20 species of planktonic foraminiferas, 10 species of belemnites, 5-40 taxa of calcareous nannofossils, 20 species of radiolarians and several species of algae were recognized within Dorsoplanites panderi Zone), probably resulted from the cumulative effects of a constant ranges of transgressive-regressive episodes. The schematic paleogeographic map of the Volgian time indicates the eastern rim of shallow coastal sea with the excellent environments for oil and fuel organic source rocks. Similar to recent seas the maximal concentrations of phytoplankton, siliceous plankton and benthos, carbonaceous plankton, nekton and benthos were found in the water immediately bordering the continent (land). The relative increasing in the bottom sediments in proportion of lipid rich organic matter and good preservation of it overtime took place owing to preservative character of phosphorus.

It is well-known that in the Tethyan Realm Genus Parvicingula has very rare distribution, whereas the content of this genus in the Boreal (Khydjaev, 1931; Sedaeva, Vishnevskaya, 1995) and Australian provinces (Vishnevskaya, 1996) reaches up to maximum. Owing to these data we can assume the cold water environments for the Jurassic domanikoid-bearing basin. Besides, the preponderance of parvicingulides can indicate an upwelling conditions which could exist along offshore.

For example, the paleogeographic map of Early Volgian time is demonstrated.

MAGNETIC ANOMALY FIELD AND ITS BEARING ON TECTONICS OF THE BLACK SEA.

Schreider A.A., Bulichev A.A., Kislitsina O.I., Luigin V.E., Melichov V.R., Soloviev V.D.

The Black Sea area is covered by more then 100000 km of shipborn magnetic profiles. Such data allows us to construct very detailed distribution of magnetic anomalies.

Magnetic anomaly field of the Black Sea area is not uniform. In particular the Eastern basin is characterised by various shape

anomalies with 50-200 nT intensity. The most remarkable quasilinear anomaly 200 nT and more intensity is coinside with footstep, northwestern slope and sometime top of the Shatsky Ridge. Total anomaly length exeeds 500 km with width of about 50 km and more.

Quantitative computations,based on stable downward continuation of magnetic anomaly field show that anomaly is coused by some sublinear bodies lay on 10 km depth in the basaltic section of crust. The bulks of bodies are laterally shifted on distance of some kilometrs. If basaltic crust is of oceanic

The Paleocene- early Eocene time differs from the subsequent period by the dominance of th regime on the entire territory under study. The major part of the sediments is composed of fine elutri basin-type shales, and the flysch is represented by mainly distal varietes. All sediments of that time h higher carbonate. We assumed 4 km as the initial maximal depth for the Paleocene with a reservation it characterizes only individual and the deepest basins. However, according to seismoacoustic lithofacies data, rather shallow zones, often without sediments, were located in close proximity with d depressions. Moreover, the dissection of the Paleocene-Early Eocene was maximal during the entire Oligocene time.

In the **Eocene time** the filling of the basins was very intensive, but the character of evolution essentially different in the Lutetian, Ypresian and Early Bartonian (Late Lutetian).Regressive condit and highly intensive sedimentation on the whole dominated in the *Lutetian. The Ypresian and E Bartonian*, however was characterized by accumulation of carcareous shales in the transgress environment (Georgievskaya and Keresta suites).

The Oligocene was the time of another period of greater differentiation of the basin's floor. Some the previous subaquatic ridges became dry land; e.g., the Somkheto-Agdam ridge turned into mountain land. The troughs, on the contrary, deepenedm the fine basin clays were deposited in them. The isolat of the basin from the southern parts of the Tethys took place. This process was reflected in an alm overall setting of anaerobic sedimentation environment and in the deposit of faunless shales with jaro (the Maikop series). In the Oligocene, the sedimentation rate sharply increased, which resulted in filling of the depressions particularly those confined to the Mesozoic island arc.

The edge of the continental slope moved much further north.

In the Eastern and North-western Caucasus, the depressions appeared south of the newly form edge of the continental slope, which in later periods became the Terek and Indolo-Kuban Foredeeps.

In the Western Caucasus and on the Kerch Peninsula, the local geologists revealed the ang unconformities at the base of the Miocene, which were referred to the appearance of consedimenta Styrian folding phase - the initial stage in the closing of the *marginal sea of the Greater Caucasus* in t western part.

The axial part of the *uplifts of the Shatsky and Kyurdamir ridges* was on the whole much deeper th in the Paleocene and Eocene. However, it also experienced a noticable transversal uplift in the area of t modern Dzirula massif.

Regularities of development of the Caucasian Basin in the Paleogene

1) The morphology of transverse profiles of dips and rises is markedly asymmetrical. The southe slope of the latter are steep and in many places are devoid of sediments. Thus,all sedimentation occurs their northern slopes. This situation as well as the peculiarities of rock texture and granulometry are favor of the southern, Gondwana source of drift in the major part of the basin. In our opinion, there a no signs of drift from the Greater Caucasus.

The only region, in which materials in extensively large amounts arrive from the north, is t northern foothills of the Greater Caucasus.

2) According to the seismoacoustic and facies data, the areas of initial absense of sediments with the Greater Caucasus (the Goitkh anticlinorium in the Western Caucasus, the Tengin-Bashbarma anticlinorium, and the Kusar-Divichinsky Neogene foredeep in the Eastern Caucasus) are not the to parts of the cordilleras, as it was believed previously, but the steep segments without sediments of t Eurasian continental slope. In this respect they are analogs to the steep southern flanks of the Shatsky a Kyurdamir ridges.

The Caucasian dissected paleogene relief may be regarded as a result of a extension and subsidence processes, characteristic of development of back-arc system. In the Paleogene it was levwll down. the most intensive sedimentation occured in eocene and Late oligocene. In the Orogenic staget active role belonged to the rises. Afterwards some of them , e.g. the Samkheto-Agdam one , turned in megaanticlinoria

3) Two sedimentation cycles are identified in the development of the Paleogene basin in t Caucasus - the Paleogene-Late Eocene and the Oligocene-early Miocene cycles. Each started with t phase of strong tectonic dissection of the Paleogene basin (Paleocene, early Oligocene) and ended with t period of tectonic flattening and filling of the basin with sediments (Eocene, late Oligocene-ear Miocene). During the first tectonic dissection phase, the Mesozoic island arc was crushed, and the secon phase affected the Eurasian shelf.

system that was formed on the Euro-Asian margin of the complicatedly built northern periphery of the Tethys.

- The deltaic model of the Upper Albian terrigenous-clayey succession of the northern part part of Crimea is established. Paleorelief was complicated by volcanoes. The model stipulates a new search direction.

- It has been revealed that Maikopian deposits of Kerch peninsula compose two parts of the distal avandelta ,the significant part of wich is situated in the Black and Azov Seas.

- The paleogeographical pucture of Carpathian foredeep Bilche - Volitsa zone in time of upper molassa accumulation (Badenian-Sarmatian) becomes more clear if the deep-water origin of Tyrassian gypsum is taken into consideration.

PALEOGEOGRAPHY AND TECTONICS OF THE CAUCASUS PALEOGENE BASIN

I.J.Sherba, M.I.Kopp

The Paleogene evolution of the Caucasus was studied by many researchers, and yet it still abounds with unsolved problems.

Unlike the previous paleogeographic reconstructions, our scheme emphasizes a more detailed study of the morphology and paleobathymetry of the basin

We have drawn our paleogeographic maps on the present-day topographic basis. The palinspastic recovery of the layers to their initial bedding was applied only in paleogeographical profiles.

The sharp tectonic differentiation of the relief in the end of the Cretaceous dissected the Caucasian basin into several foredeeps and rises, which developed throughout the Paleogene.

The following paleogeographical zones are identified from the north to the south :

1. The shelf of the Eurasian continent. During the entire Paleogene, this was the place of accumulation of the carbonate deposits of a moderate (0,5-1,5 km) thickness containing mainly the nannoplankton foraminifers and benthic mollusks. The southern parts of the Indolo-Kuban and Terek foredeeps have well-preserved continental scarps characterized by flysch clinoforms, slumps, and erosion canyons. The shelf sediments in the modern structure form the box-like folds of simple construction and a gently sloping northward monocline of the northern limb of the Greater Caucasus.

The basin of the marginal sea of the Greater Caucasus with the Lazarev-Kobystanian deep-water through in the axial part corresponds to the modern southern slope of the Greater Caucasus. The Paleogene sediments in the through form extremely thin beds of the basin-type shales (not more than 1 km thick) with rare plankton foraminifers; on the slopes, these beds are replaced by flysch clinoforms. The deep-water sediments participate in the complicated fold-overthrust structure of the southern slope of the Greater Caucasus.

3. The zone of the submarine rizes of the Shatsky and Kyurdamir ridges corresponds to the northern part of the Mesozoic island arc. and contains a chain of Tertiary basins

The deposits in this soze are thin and sometimes wedge out; their shallow-water character is evident from the abundant mollusk fauna. At the top of the ridges, the sediments remain only as slightly inclined structural terraces.

4. In the zone of the Adjzro-Trialetian and Talysh volcanogenic-flysch troughs, the Paleogene deposits are represented by the andesite-basalts of the island-arc type and by tephroid flysch with the total thickness of the propagational lenses up to 8 km. These depressions open towards the Eastern Black Sea and the Southern Caspian basins, where the clinoform complexes are replaced by shales. The latter differ from those of the Lazarev-Kobystanian trough by their greater thickness reaching 3 km. Along the clinoform boundaries with deep-water sediments, the Neogene overthrusts developed and crumpled the volcanogenic-flysch deposits into large box-shaped folds.

5. The Somkheto-Agdam submarine ridge (now the meganticlinorium of the Lesser Caucasus) belongs to the southern part of the Mesozoic island arc. The Paleogene deposits still intact on the slopes of the ridge are composed of the shelf carbonates and andesite-basalts of the Paleocene-Eocene. In combination with the Mesozoic deposits, they form a sharply asymmetric meganticline with gently inclined (10°) northern limb and a greatly deformed southern limb cut off by the zone of the major overthrust of the Lesser Caucasus.

6. The Yerevan-Ordubad basin corresponds to the modern intermountain depression. In the pre-Oligocene time, this depression with Adjaro-Trialetia and Talysh covered the area of one Paleogene island arc, whose axis passed south of the Mesozoic arc axis. In the Oligocene, the zone became the region of orogenic volcanism

RECENT MECHANISM OF ARABIAN SYNTAXIS DEFORMING ON THE BASE SEISMOLOGYCAL DATA AND RESULT OF MATHEMATICAL MODELLING

J.Angelier, Yr.Rebetski, Ye.Nikitina

The reconstruction of the modern regional stress field of the Arabian syntaxis on the base seismological data about 980 crustal earthquake focal mechanisms was aimed at receptions data about a longer periodic stress tensor components - average for whole supervision tool period.

Analysis of reconstruction results allowed to define as well know the submeridianal orientation of maximum pressure stress axis, as deviation this stress axes from submeridional to practically sublatitude within the limits of western and yest coast of South Caspian sea. The particular nature of tectonic structures and anomalies of the recent stress field in area of the South Caspian sea basin has been related to the presence of two major sources of regional deforming forces. One source is the northward motion of Arabian plate relative Eurasia, while the other lies in the active downwarping of the lithosphere crust in the South Caspian deep-water depression. The data about stress state and the geologycal-geophysical data about tectonic structures for this region are the base for 2D numerical modelling. The result of 2D modelling allowed to research the influence of undercrust unhomogeneous on the South Caspean sea and is the base for creation 3D modelling.

SEDIMENTOLOGICAL MODELS OF THE PERSPECTIVE SUCCESSIONS OF HTE OIL-AND-GAS - BEARING BASINS OF UKRAINE.

Olena V. Samarska, Bogdan M. Polukhtovich.

Because of exhausting of the traditional anticline traps the exploration works in oil and gas regions,and all the Ukrainian ones are like that, need subtle and careful investigations. In this connection paleogeographical reconstructions of small, up to the single bed, stratigraphic units are becoming more and more important. So it is necessary to analise the material accumulated on productive and perspective complexes in the light of the modern doctrine of sedimentary basins. The presented paper is dedicated exactly to this problem and makes a contribution into its solving.

Carbonate complexes

- The material accumulated allowed to systematize the organogenic buildups that formed sliding in time and space lower Carboniferous formation of Dnieper-Donets depression. By the way of forming there are distinguished three types of constructions timed to the certain intervals: Tournesian - Lower Visean micritic knolls (analogous to the Waulsortian reefs), Lower Visean algaic biogerms and banks; Upper Visean - Serpukhovian bryozoan-algal reefs. In all the three types of buildups the collector properties can be connected with fissuring and dolomitization of rocks, here and there with the primary porosity of the organogenic varieties. The rocks that compose the Upper Visean - Serpukhovian reefs have the the best primary collector character.

- Upper Jurassic reefogenic formations situated in western and southern regions of Ukraine and being the part of the Jurassic reef belt of the Tethys northern margin are of interest. There are Opara reef and Lopushna knolls (Tithonian) and Rudki biogerms (Oxfordian) in Carpathian foredeep, reefs Predobrogea and South-Western Crimea.

Upper Jurassic carbonates became the subject of special interest after the discovery of the Lopushna field whose collectors are questionable. We typify the Lopushna carbonates as an organogenic buildup.

- The Ugronian facies of Plain Crimea can also be of interest. It is identified for present as that of terrigeneous type, enriched with orbitolinas, formed during the Late Barremian - Early Aptian transgression.

- New type of reservoirs that is Upper Cretaceous pelagic carbonates of the Black Sea north-western shelf can be regarded as perspective too. Collectors can be connected with fissuring and also with the horisons of "organogenic rains".

Terrigenous complexes

- The detailed tracing of the Upper Visean productive horisons V-15 and V-18 all over Dnieper-Donets depression allowed to present paleogeographical picture , to show that the best granular collectors are connected with silty-sandy alluvial, proximal and partially distal deltaic facies, and to project perspectives.

- Studying Jurassic deposits in Predobrogea revealed one fan of Middle - Upper Jurassic deltaic buildup, the bigger part of wich is covered now by the Lower Prut allochtone. This delta is a part of deltaic

Scherba I.G. is tectonic curator Chondkarian S.O., Ph.D. Pinchasov are curators on Transcaspian stratigraphy and maping.

Two Gisiness meetings were carried out during 95-96: The first one took place in Moscow and deal with the

paleogeographic problems of the Great Caucasus. And the second one - in gasthouse "Lesnaja skazka", Adygea, North Caucasus, during the International field Symposium "Paleontology and stratigraphy of the Eocene - Miocene sections of the Western Pre-Caucasia" (August 1-9, 1995).

We worked out legend for the basic maps, cartographic base and began all maps of our set. Now we finished the first author's versions of the 4 basic maps: for the late Eocene (Priabonian); the early Oligocene (Rupelian, early Kishelian, Pschechian), beginning of the Middle Miocene (Early Badenian, Chokrakian) and the terminal Middle Miocene (Sarmatian). One of these maps - Early Badenian - Chokrakian one - are preparing now for publication in Belgrad GeoInst (Jugoslavia).

Beside maps of our set, the same autor's team was preparing all the Eastern Paratethys territory for the first version of final Peri-Tethys maps: 5 maps (N18 - Late Rupelian; additional map - Early Burdigalian; N19 - Early Langhian; N20 - Late Tortonian; N21 - Early Piacentian). These maps were presented at the Bratislava meeting, February 1-3, 1996.

Paleogeographic essays was written for the Early Badenian - Chokrakian maps, prepared for publication in the English version and for the Priabonian, Rupelian, Sarmatian maps - in Russian.

Quality of the paleogeographical drafts is determined by precision of the stratigraphical base first of all.

Biostratigraphy of the Oligocene - Neogene Paratethys basins has a specific difficults, connected with inland hemiclosed character of the basins. These difficults brought to light at the last Bratislava meeting, when participantes from the different countries driwed different time-slices for first versions of the final PTP maps. The main difficults are the next:

- Precise biostratigraphical zonations of the Oligocene - Early Miocene (Majkopian) which presented by terrigeneous, non carboniferous deposits;

- Absence in the Eastern Paratethys of the Preorbulina marker-level, which would permit to distinguish Early and Middle Miocene;

- Age determination and correlation of the Maeot-Pontian succession with high-endemic fauna.

Recently we have begun a serie of the International field works, concerned with these biostratigraphic and some paleogeographic problems.

Last yearfield works were carried out on the Pre-Caucasian upper Eocene - Miocene sections (Belaja river basin, 12-25 June, 5). All the upper Eocene, Oligocene and lowermost Miocene nannoplanctonic and dynocist standart zones were identified for the first time from the Majkop deposits of the main Belaja river section (dataof J.Krhovsky, Geol. Inst. Prague; Dr. M.A. Akhmetiev, N.I. Zaporozhec,Geol. Inst. Moscow) along with the diatome, foraminifers, molluscs and fish associations, plant's remains and palinological complexes. The results were demonstrated during International Excursion (August 1-9, see Excursion Guidebook, 1995), presented in Moscow PTP Session (January 27-28, 1996) and prepared as material for Database - Validation Point records.

Besides field works deal with the Tethys - Paratethys connections carried out on the sections of the Aegean region (Greece, March, April, 1996). New material on the terminal Miocene history was recieved and results were presented on MIOMAR project meeting (April 29, Crite) and will be presented too on Kerch - Taman International meeting (June 7-14, 1996). These material will be prepared for Database after faunistic determinations (molluscs, foraminifers, nannoplankton) and paleomagnetic research.

In Bratislava meeting February, 96 we organized an International group on the Middle Miocene biostratigraphic problems and planed to work on the Tarkhan - Tschokrakian hypostratotipic section at June 7-15. The second task of this year field works will be deal with paleogeographic history of the Oligocene - Middle Miocene Great Caucasus.

Next 97 year eulenkamp group is about to work on the Middle Miocene - Pliocene Kerch - Taman sections.

8) Aalenian history. During the Aalenian and at the Aalenian/Bajocian boundary compressional tectonics took place: orogeny in the Crimea, orogeny and uplifting in the Pontides, and proposed weak compressional deformations in the Great Caucasus trough.

9) Bajocian-Bathonian history. During the Bajocian a major subductional magmatic belt was active in the Transcaucasus-Pontides area. Intra-Bajocian inversion tectonics took place along the Great Caucasus-Southern-Crimea basins. This inversion tectonics continued to Bathonian times and culminated at the end of Bathonian-beginning of the Callovian as an orogeny along the Great Caucasus-Southern-Crimea belt. Regional subsidence of the Scythian Platform and southern half of the Russian Platform was initiated since the Late Aalenian and especially since the Late Bajocian. It was simultaneously with the maximum of the Late Bajocian subduction related volcanism in the Transcaucasus-Pontides belt and inversion tectonics inside the Great Caucasus trough.

10) Callovian-Mid-Berriasian history. A new rifting phase took place in the Callovian-Tithonian along the Great Caucasus-Southern Crimea belt, in the Dobrogea area and along the eastern and southern margin of the Moesian Platform; rift volcanism also occurred in Dobrogea and southern part of the Great Caucasus. The Transcaucasus-Pontides volcanic belt was active in this time, so the back-arc dynamics of the rifting is proposed.

11) Berriasian orogenic event. During the Berriasian time or at the Jurassic/Cretaceous boundary an orogenic event and associated thrusting took place in the Southern Crimea basin; in the Dobrogea(?), and in the western Pre-Caucasus area of the Scythian Platform.

12) Late Berriasian-Barremian history. During this time a new configuration of sedimentary basins was formed in the Scythian platform; possibly in response to a new weak tensional phase.

13) Aptian-Late Cretaceous history. Major subductional volcanic arcs were active in this time along the Srednegorie-Western Pontides-Eastern Pontides-Transcaucasus-Alborz belt. A system of back-arc rifted basins originated 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, on the base of radiolaria in Paleocene three zones : *Buryella tetradica, Tripodiscinus sengilensis* a *Petalospyris foveolata* of Kozlova (1994) were established. On the base of diatoms *Hemiaulus peripter H.incurvus* Zones of Fourtanier (1991) and on the base of silicoflagellates *Cobrisema hastata, Cobrise dissimetrica communis* Zones were distinguished. Paleocene sediments of the Middle Volga Region w related by us to the Middle Zelandian -Lower Tanethian time (*CP4-CP8* nannoplankton Zones) on t base of radiolarian and diatom species discribed from Atlantic and South Ocean (Fig.2)

Judging by the stratigraphic data obtained on the base of diatoms and radiolarians, at least thr basins with the intensive biogenic siliceous accumulation existed in Paleocene on the north of Europe the Middle Volga region and in West Siberia. Very similar taxonomic composition of the Midc Paleocene (Zelandian) diatom and radiolarian assemblages testify to the connection between the Eocene sediments in the Middle Volga Region are eroded as a rule, Lower Eocene is exposed south between Volgograd town and Saratov town, and Middle Eocene sediments appear only to the south Volgograd, i.e. in the area of carbonate sedimentation.

On the contrary, in Dnieper-Donets depression Paleocene sediments are usually absent or a represented by sands of a little thickness. Early-Middle Eocene deposits lie uncorformingly on t Maastrichtian marls. Early Eocene sediments contain no microfossils. Lower part of the Middle Eoce (Fig.1) succession contains planktonic and benthic foraminifera, nannoplankton of the *CP13* standa Zone, and radiolaria of the boundary Lutethian/Bartonian beds. Radiolarian assemblage is very simil to the one of the well-known Kuma Formation from the southern regions of the FSU. Upsection thr regional Zones based on radioalria: *Cyrtophormis* alta, *Ethmosphaera polysiphonia* and *Theocyri andriashevi* of Bartonian age are distinguished. Diatoms and silicoflagellates determine Bartonian age c sediments. Taxonomic composition of the assemblages is close to co-eval associations of the Norway Se and in a less degree to that of the Pre-Caspian depression and differs from the assemblages of souther type very much. The belt of Uppermost Lutetian-Bartonian biogenic siliceous accumulation included th vast area from the Norway Sea to PreCaucasus, PreCaspian basin and East regions of the Middle Asia.

SOUTHERN PART OF THE EASTERN EUROPE: LATE PALEOZOIC-MESOZOIC-CENOZOIC HISTORY.

A. Nikishin, E. Baraboshkin, S. Bolotov, A. Fokin, A. Furne, V. Il'ina, L. Kopaevich, M. Korotaev, B. Nazarevich, D. Panov, I. Shalimov, M.-F. Brunet, S. Cloetingh, R. Stephenson and P. Ziegler

The work is based on new series of palaeogeographical/palaeotectonical maps for the East European and Scythian platform area and results of burial history modelling.

During the Early Devonian East-European Platform was an uplifted area mainly. We ca recognize the following stages of the post-Early Devonian history of the southern part of the Easter Europe:

1) Eifelian: regional marine transgression.

2) Givetian-Mid Famennian: five rift events, origin of the Dnieper-Donets, Peri-Caspian and Peri Uralian rift systems, structural pattern of rifting changed in time; rifting took place due to regiona extension phases and possibly was controlled by back-arc environments.

3) Carboniferous-Permian: collisional orogeny in the Uralian and Scythian belts, accretion of nev terranes to Europe, postrift subsidence of the Devonian rifted basins modulated by compressiona deformations, development of broad foreland basins.

4) End of the Late Permian:collapse of the orogens.

5) Early Triassic-early Carnian: origin of a major continental rift system in the Scythiar Dobrogea-Moesian region, possibly in a back-arc tectonic environments, rifting inside the East-Europea Platform, intraplate magmatism.

6) Carnian/Norian boundary-Hettangian: collisional tectonics along the eastern Moesia-Scythiar Crimea-Great Caucasus-Alborz region. The collision took place between the Eurasia and some continenta terranes (possibly Transcaucasus terrane, Alborz terrane, Western and Eastern Pontides terranes). Hig stand of the East-European Platform.

7) Sinemurian-Toarcian. The Transcaucasus-Pontides subductional magmatic belt originate (may be close to position of the former Triassic magmatic belt) possibly in the Sinemurian-Toarcian wit north-dipping subduction. A major back-arc rifting phase took place and deep-water rifted basin wa formed along the belt Great Caucasus-Southern Crimea-recent margin between Moesian Platform an Western Black-Sea basin-southern margin of the Moesian Platform; rift events took place in the Scythia Platform and Dobrogea. High stand of the East-European Platform

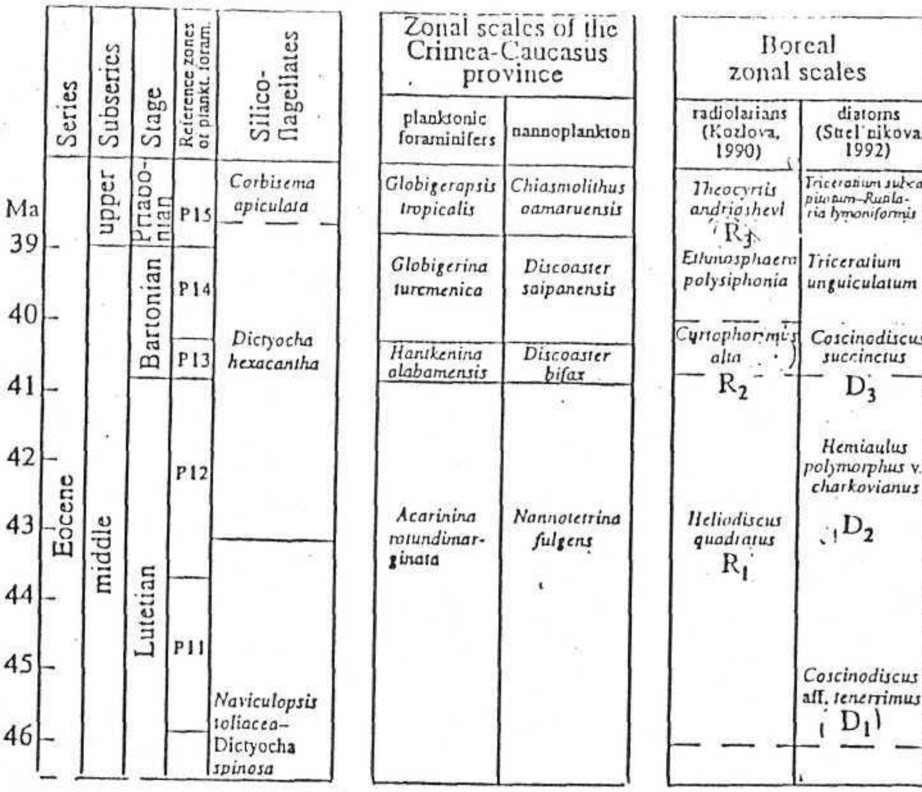
Series
Subseries
Stage
Reference zones of plankt. foram.
Silico-flagellates
Zonal scales of the Crimea-Caucasus province
planktonic foraminifers
nannoplankton
Boreal zonal scales
radiolarians (Kozlova, 1990)
diatoms (Strel'nikova, 1992)
Ma
39
40
41
42
43
44
45
46
Eocene
upper
middle
Bartonian
Lutetian
P15
P14
P13
P12
P11
Corbisema apiculata
Dictyocha hexacantha
Naviculopsis foliacea–Dictyocha spinosa
Globigeropsis tropicalis
Globigerina turcmenica
Hantkenina alabamensis
Acarinina rotundimarginata
Chiasmolithus oamaruensis
Discoaster saipanensis
Discoaster bifax
Nannotetrina fulgens
Theocyrtis andriashevi
R3
Ethmosphaera polysiphonia
Cyrtophormis alta
R2
Heliodiscus quadratus
R1
Triceratium unguiculatum
Coscinodiscus succinctus
D3
Hemiaulus polymorphus v. charkovianus
D2
Coscinodiscus aff. tenerrimus
D1

Fig. 1

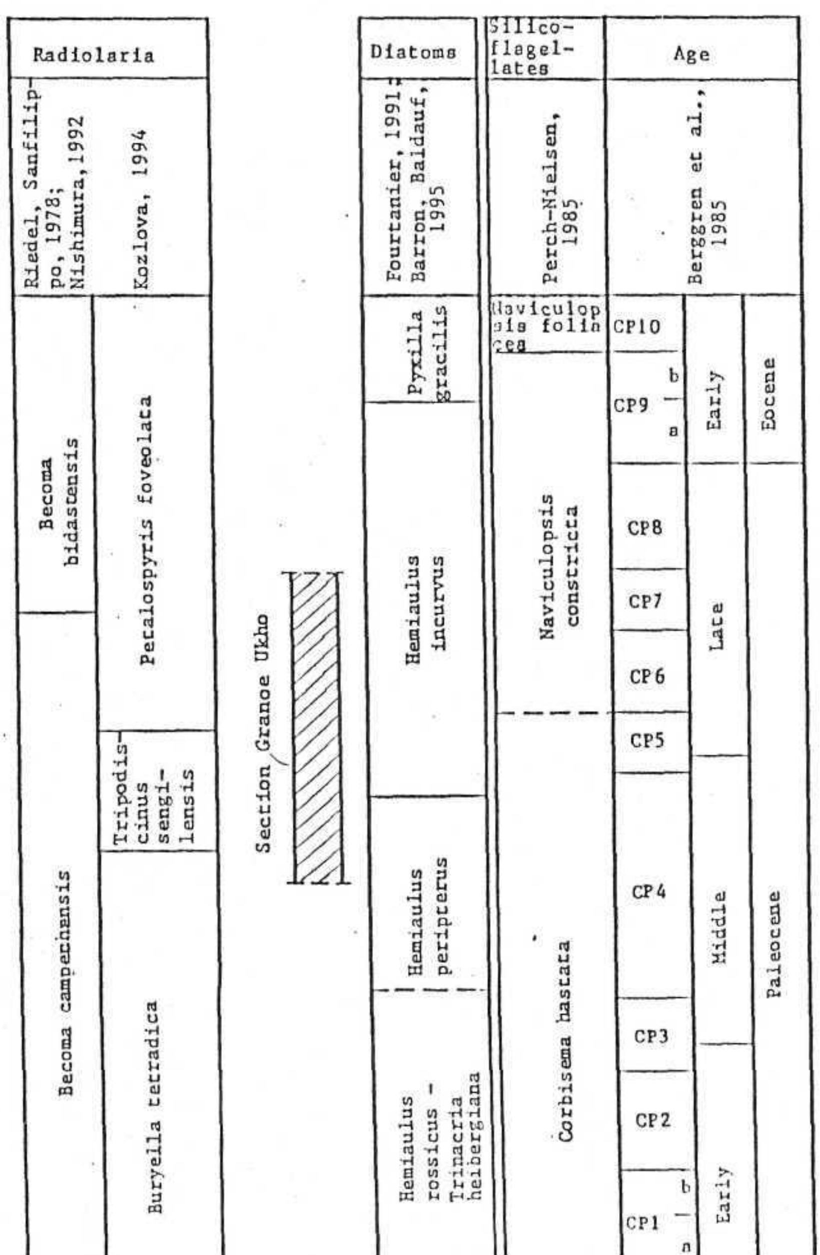
Radiolaria
Riedel, Sanfilippo, 1978; Nishimura, 1992
Kozlova, 1994
Becoma bidastensis
Becoma campechensis
Petalospyris foveolata
Tripodiscinus sengilensis
Buryella tetradica
Section Granoe Ukho
Diatoms
Fourtanier, 1991; Barron, Baldauf, 1995
Pyxilla gracilis
Hemiaulus incurvus
Hemiaulus peripterus
Hemiaulus rossicus – Trinacria heibergiana
Silicoflagellates
Perch-Nielsen, 1985
Naviculopsis foliacea
Naviculopsis constricta
Corbisema hastata
Age
Berggren et al., 1985
CP10
CP9
CP8
CP7
CP6
CP5
CP4
CP3
CP2
CP1
Early
Late
Middle
Eocene
Paleocene

Fig. 2

CORRELATIONS BETWEEN MARINE AND CONTINENTAL DOMAINS IN SOUTH URAL AND NORTH PERI-CASPIAN DEPRESSION FROM UPPER PERMIAN TO TRIASSIC.

Molostovskaya I.I., Molostovsky E.A., Minikh M.G., Minikh A.V., Crasquin S. *(Unive P.&.M.Kurie, Paris). (All from Geological Institute of Saratov University, Moskovskaya, 161, Sar Russia, 410750; Tel: 7-8452-508-624; E-mail: kae@shart.ssu.runnet.ru).*

Facies variability of the red-bed sequences from Upper Permian to Triassic makes it difficul correlate them according to lithologic features, which are of local importance. Regional and re correlations are usually carried out according to the index fossil complexes; the most accurate resul some stratigraphic intervals are available by means of combined paleomagnetic and paleontol definitions.

Ostracodes make the leading stratigraphic group for the Upper Permian red-bed formation; allow to divide and correlate the sequences at the stage and horizon levels. Terrestrial vertebrates ma possible to recognize only the Upper Tatarian substage, characterized by the Pareiasaur-Theriodont fa The more ancient, Dinocephalian fauna is common for the Ufimian and Kazanian stages, and for Lower Tatarian substage as well.

Tetrapods and lungfish are of guiding stratigraphic importance for the Lower and Middle Tria palynoflora is important for the upper section.

The paleomagnetic data become stratigraphically important in the Upper Tatarian substage of Permian and in the Triassic, where repeated changes of magnetic zonality are recorded. The Ufim Kazanian and Lower Tatarian beds were formed during the stable period of reverse field (R-Kiama) are not divisible according to paleomagnetic characteristics.

The Permo-Triassic red bed complex comprises two marine formations: these are the L Kazanian substage from the Cis-Urals and the Middle Triassic from the Cis-Caspian. These seque may

The materials available show that the stratigraphic boundaries of practically all the regional of the Upper Permian and Triassic from the Volga-Ural and Cis-Caspian regions, are of event nature.

Of principle importance in such research is the choice of reference correlation levels, marked coincidence of geodynamic, paleogeographic, biotic, formational and geomagnetic boundaries.

In the Permo-Triassic part of the scale, the following boundaries meet this condition: those bet the Lower and the Upper Tatarian substages, between the Permian and Triassic, and the Lower Middle Triassic. The rank and geologic importance of the last two boundaries are well-known. boundary between the Lower and Upper Tatarian substages has not been assessed properly.

This boundary is marked by large-scale changes in tetrapod fauna, ostracods and ichthyofaun paleomagnetism evolution, the regime of stable reverse polarity field was replaced by the epoch of freq reversals. The above data offer profound grounds for recognizing the Upper Tatarian substage a independent stage.

DETAILED PALEOGENE STRATIGRAPHY OF THE SOUTH RUSSIAN PLATFORM ON THE BASE OF FOUR MICROPLANKTONIC GROUPS.

Muzylov N.G., Khokhlova I.E., Geological Institute, RAS, Moscow

Microfossils from eight Paleogene sections from the two key regions of the Russian Plat were studied during the second year of the Project to solve the problem of precise age determina detailed stratigraphy, correlation and paleogeographic connections.

The Middle Volga Region is a typical area of Paleocene deposits' distribution, and the Dni Donets depression and Voronezh anrteclise can be considered as classical area containing Eocene dep of the northern type. These predominantly noncarbonate terrigenous and siliceous sediments co usually siliceous microfossils: radiolarians and diatoms while calcareous microfossills are absent in cases.

Distribution of Paleocene deposits depends on the tectonic structure of the region very muc the Volga Region they are distributed meridionally following the direction of main depressions. O north of the Region they fill the Ulyanovsk-Saratov syneclise and very often have a considerable thic about 100 m and more. Due to mainly nerithic type of assemblages it became possible to subdi Paleogene deposits of the Volga Region and South Russian platform according to regional zonal shem nature,sublinear bodies can be interpreted in terms of oceanic inversional magnetic layer. Tentative comparison of the inversion bodies distribution with magnetic time scale shows that oceanic crust is not younger than Paleocene age.

In the Western basin another elongated anomaly exists near the northeast slope of basin.Its intensity exceed 150 nT,width is about 30-40 km.Its character shows that it can be coused by laterally shifted bulks of magnetic bodies.

Quantitative estimations show the possibility to interpret the bodies in terms of inversional magnetic layer of established by seismic data oceanic crust. Crust underline the sediments on depth more then 10 km. The estimation of age of this portion of oceanic crust is in progress now.

One more separated anomaly of 100 nT intensity is situated near the western limit of deep part of the Black Sea,possibly related to the another one small basin with old oceanic crust.

In the present time the detailed magnetic anomaly chart is constructed for northwestern part of the Black Sea and surrounding continental areas. The interpretation of this chart with available continental geological data allowed to establish the seaward continuation of some faults in the crystalline fundament and to do some conclusions about their age relationship with Scythian plate and Moesian platform.

The main task of our near future interpretation is datailed stable 3-D downward continuation of anomaly magnetic field down to acustic basement for establishing of transcurrent fault in the basement structure,possible age of oceanic crust creation and geometry of the Black Sea opening. The results of such study shall be a key points for constructing prnicipally updated geological history of the Black Sea area.

POST -RIFT EVOLUTION OF THE DNIEPER-DONETS BASIN .

S.M. Stovba, R.A. Stephenson, E.S. Dvorjanin

The ivestlgations were grounded on complex Interpretation profiles, well data and numeric modelling. The main stage of the rifting In the DD basin lasted 7- 1 0 My during the Frasnian and Famenian stages of the Late Devonlan. Post Carboniferous, Permian and Mesosoic sediments cover the rift flanks and increase In thickness towards the rift axis. Their total thickness reaches 15 km. Major post-rift tectonic events took place at the end of Early Visean , in the middleof Serpukhovian, In Early Permian, and between Mesozoic and Cenozoic. The deformational style reveals that extension forces were prevailing during the entire Calferous and Early Permian time.Structural reactivatings during at the end of the Cretaceous were compressional In nature.The duration of the tectonic events did not exceed 2-3 My. Tectntic reactivatings during the post-rift history were most pronounced In the south-east part of the DD basin and in the Donbas while they were least pronounced in the north-west part of the basin merging in the Pripyat Trough where they are barely observed. All the tectonic events during the Carboniferous and Permian were accompanied by faulting and halokinesis. After Early Permian extensional tectonics, a rapid uplift of the Donbas, with the southern shoulders, the southern pre-flank zone of the southeastern part of the DD basin, and aparently a major part of the Ukrainian Shield occurred. Thick successions (in places more than 2 km in the study area, and up to 6-8 km in the Donbas) of Upper and Middle Carboniferous were uplifted above an erosion base-line where they roded during the ensuing dominant phase.

The results of the forward modelling indicate that the observed spatial and temporal variations of tectonic subsidence In the Dnieper-Donets Basin, specifically the increasing ratio of Carboniferous to Late Devonian subsidence from north-west to south-east, cannot be explained by a either a uniform or depth-dependent stretching model adopting only a single Frasnian-Famenian phase.A tvo-phase model, however, m which a significant part of Carboniferous tectonic subsidence is related to early Vlsean rift activity strongly dominated by sub-crustal lithospheric stretching, provides a satisfactory fit to the data, 3D compilations of the forward modelling calculations, adopting polyphase two-layered stretching approach, allows the quantification of intrabasinal variations in terms of timing and magnitude of rifting

The peculiar features of the basin evolution, including results of the numeric modelling, allowed to predict the basin area, which was influenced by intensive extension and fault during either the rifting period and post-rift tectonic events. On the south-west of the basin the much larger than it was previously predicted from the data about the area of the Devonian synrift succession occurrence. Post-rift tectonic events were the primary structural control on the majority of known hydrocarbon traps.

NEW STRATIGRAPHIC AND PALEONTOLOGICAL DATA ON VOLGIAN TO CRETACEOUS OF ULJANOVSK, VOLGA RIVER BASIN

V.Vishnevskaya *, N.Bogdanov *, E.Baraboshkin **, N.Bragin*, L.Bragina ***, E.Lamber P.De Wever******

**Institute of the Lithosphere, Russian Academy of Science, Moscow, Russia; ** Moscow State University, Moscow, Russia; ***Geological Institute of Russian Academy of Science, Moscow, Russia; ****Universite Pierre et Marie Curie, Paris, France*

During our investigations in 1995-1996, the new data on the stratigraphy and paleontol Mesozoic succession of Simbirsk Syneclise were obtained.

The first section is the lectotype of Volgian Stage, Gorodische section. The Jurassic macr microfauna of the section attracted our attention due to co-occurrence of boreal and Mediterrane of radiolarians and exclusevely boreal ammonites in the same strata.

Rocks of ammonite Dorsoplanites panderi Zone, Zarajskites zarajskensis subzone (layers have sharp rhythmical structure. Rhythms are usually begin with the horizons of reworked and di fauna. They are build up by carbonate clays and are finished by the oil shale. The quantity of matter grows in it a direction from 1-1,5 up to almost 22% at decrease of carbonate. Accorc rhythmicity, changes in benthic assemblage are occurs: from prevalence of a benthos up to a incr quantity of necton. In the oil shales young populations of lost Loripes fischerianus and Scurria mae usually prevailed, as well as nepionic ammonites. It shows strong anoxic impulse during the oi formation. It was determined the following cephalopod fauna assemblage from that interval: amn Zaraiskites cf.scythicus, Z. pilicensis, Z. quenstedtii, Z. stchukinensis, Dorsoplanites panderi; bele Lagonibelus (L.) magnifica, L. (Holcobeloides) volgensis, L. (L.) cf. rosanovi.

The interval belongs to the uppermost part of nannofossil Watznaueria communis Zo contain radiolarians Orbiculiforma ex gr. mclaughlini Pessagno, Stichocapsa ? devorata Phormocampe favosa Khudyaev, Parvicingula hexagonata (Heitzer), P. cristata Kozlova, P. (Khabakov), P. aff. alata Kozlova, P. multipora (Khudyaev), P. aff. haeckeli (Pantanelli), P. aff. s (Grill & Kozur), Plathycryphalus ? pumilus Rust, Lithocampe cf. terniseriata Rust.

Higher in the section (layers 22-20) the thin member of quartz - glauconitic sands and sanc builds up the succession. It contains horizons with reworked phosphorites. Findings of fauna are predominary in rewashed pebbles. So, in a layer 20 the remains of strongly reworked zonal Virgatites gerassimovi was found together with Loripes sp. and dissolved rostrums of Lagonibel volgensis. There are a lot of reworked radiolarians from Z. zarajskensis subzone in the phos pebbles.

Ammonites from the overlayed zone Virgatites virgatus were not met, however it is establis stratigraphic position in a section between layers 18 and 20.

The section is build up by the dense thin member of a carbonate sandstones with the large an ammonites Epivirgatites bipliciformis and E. nikitini (layers 17-12) from E. nikitini zone of Volgian.

Above it, with the erosional surface in the bottom, lays sandstones of the Upper Kachpurites fulgens zone. They contain Craspedites nekrassovi, C. sp. and Kachpurites fulg assemblage with Buchia piochii, B. sp., belemnites Acroteuthis (A.) russiensis and A. (A.) mosq which were found in situ (layers 11-10).

Overlapping layers 9 - 7 also lays with erosion and are characterized by reworked Crasped okensis, being typical form of zone Craspedites subditus of Upper Volgian. Together wit ammonites the belemnites Acroteuthis (A.) mosquensis and bivalve Buchia piochii and B. tenuicoll met. Radiolarian species P. cristata Kozlova, P. alata Kozlova, P. blowi (Pessagno) and Stich devorata are characteristic within these strata. Here parvicingulides content is 50-60%.

In layers 6 - 5 ammonite fauna was not found, but on a literary data it is known, that t correspond to the zones Craspedites nodiger of Upper Volgian and zone Temnoptychites syzranicu Lower Valanginian. Among the radiolarian microfauna an appearance of the Mediterranean sp boesii (Parona) is fixed in the uppermost part of Volgian Stage.

JURASSIC TO CRETACEOUS RADIOLARIAN ASSEMBLAGES OF THE RUSSIAN PLATFORM AND THEIR POSSIBLE CORRELATION WITH MICRO- AND MACROFAUNAS

Age			Radiolarian zonation	Nannoplankton Zone (Nikiforova, 1987)	Foraminiferal Zone (Amon, De Wever, 1994) (Kuznetsova, 1984)	Buchia zone (Sey, Kalacheva, 1994)	Ammonite Zone (Mesezhnikov, 1984)
K 2	Maastrichtian		Amphipyndax tylotus-Amphibrachium sibiricum (Bragina, in press)				
	Campanian				Cibicidoides voltzianus		
	Santonian		Orbiculiforma quadrata-Lithostrobus rostovzevi		Gavelinella stelligera		
			Euchitonia santonica-Alievium praegallowayi		Gavelinella infrasantonica		
	Coniacian		Archaeospongoprunum bipartitum - A. triplum		Gavelinella praeinfrasantonica		
	Turonian		Spongotripus aculeatus-Alievium superbum				
	Cenomanian		Pseudodictyomitra pseudomacrocephala		Gavelinella cenomanica		
K 1	Albian		Crolanium cuneatum				
	Aptian						
	Barremian						
	Hauterivian						
	Valanginian		Parvicingula khabakovi-Williriedellum salumicum				
	Berriasian= Ryasanian		Parvicingula blowi-Pseudocrolanium planocephala			okensis	mesezh-nikowi
J 3	Volgian	Upper		Parhabdolithus embergeri	Lenticulina muesteri	piochii-terebratuloides	nodiger
					A.aquilonicus-M.impropria		subditus
					Placopsilina-A.polyhimnius		fulgens
		Middle	Parvicingula haeckeli P. papulata Kozlova, 1994		L.ponderosa-S.pravoslavievi	mosquensis-russiensis	nikitini
							virgatus
							panderi
		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	
	Oxfordian		Parvicingula jonesi			lata	alternans
J 2	Callovian						
	Bathonian						

The determined radiolarian assemblages are dominantly Boreal in character. These types of radiolarian zonations have not been described previously. The proposed Middle Volgian Parvicingula haeckeli Zone is correlated as closely as possible with the Parvicingula papulata Zone of Kozlova (1994) and belongs to the ammonite Dorsoplanites panderi Zone which can be correlated with the Evolutinella emeljanzevi - Trachammina septentrionalis or Saracenaria pravoslavlevi foraminiferal Zone (Kozlova 1994) in Pechora Basin and Lenticulina biexcavata Zone (Ljurov, 1995) in Sysola hydrocarbon Basin and Parhabdolithus embergeri nannoplankton Zone in Middle Volga hydrocarbon Basin. We can trace last Zone in Southern England and North France. Due to presence of index species it is possible to correlate this interval with buchizones B. mosquensis - B. russiensis of the Russian platform (Sey, Kalacheva, 1993).

The proposed Upper Volgian Parvicingula blowi - Pseudocrolanium planocephala Assemblage can be correlated with Buchia piochii - B. terebratuloides Zone of the Russian platform (Sey, Kalacheva 1993).

The section is terminated by black clays (layers 4-1) with siderite and limonite concretions containing large weathered ammonites Speetoniceras (S.) versicolor and S. (S.) subinversum, describing by the zone Speetoniceras inversum of the top Hauterivian.

The Upper Cretaceous of Uljanovsk Volga Basin is also predominantly represented by boreal radiolarians (Bragina, 1987), which sometimes occur together with planktonic foraminifera or in the sections where foraminiferal zones are well established (Kopaevich, in press). Cretaceous sections were investigated south of Uljanovsk. The Santonian radiolarian assemblage includes Crucella irwini Pessagno, Histiastrum aster Lipman, H. membraniferum Lipman, Rhopalastrum tumidum Lipman, Prunobrachium crassum Lipman, Pseudoaulophacus aff. praefloresensis Pessagno, Dictyomitra densicostata Pessagno, whereas the Campanian is characterized by Amphibrachium mucronatum Lipman, Spongoprunum angustum Lipman, Cromyodruppa concentrica Lipman, Pentinastrum aff. subbotinae Lipman, Amphipyndax stocki (Campbell and Clark).

Upper Cretaceous radiolarian assemblages similar to boreal associations of Russian and West Siberian platforms and have not analogues in the Tethyan scales, but include some Tethyan taxa. In the Volgograd Volga Basin they supported by foraminiferal ones (Bragina & Beniamovsky, in press), which have affinity with European ones. The direct correlation with Tethyan is impossible owing to provincialism.

MESOZOIC RADIOLARIAN SCHEME OF THE RUSSIAN PLATFORM AND ITS CALIBRATION WITH FORAMINIFERAL, NANNOPLANKTON, AMMONITE AND BUCHIAS BIOSTRATIGRAPHIC SCALES

Vishnevskaya V.S., *Institute of the Lithosphere, Russian Academy of Science, Moscow, Russia.*

Biostratigraphic correlations using microfossils (radiolarians, foraminiferas, nannoplankton) and macrofossils groups (ammonites, buchias) is of first order interest for establishing synchronicity of events and consequently of more general geological processes.

The epoch of the Middle to Late Jurassic sedimentation in the Russian platform was a period when after prolonged continental erosion marine activity took effect.

The sediments were being amassed with diverse lithological composition and mixed orichtocenosis of transient and endemic forms of faunas. The latest of Early Cretaceous to Late Cretaceous was a time of predominantly siliceous-carbonate marine accumulation.

The diverse lithological composition and polyfacial character of sediments led to problem in stratigraphical correlation of sections.

The co-existence within all these deposits of ammonites, buchias, inoceramides and other fauna groups either belonging to other paleozoogeographic provinces or not characteristic of the West-European or never found there led to hypotheses of "sea straits" between boreal and tethyan provinces and the existance of "cold streams".

The version of possible correlation of the radiolarian assemblages with different biozonations is proposed.

SEISMOSTRATIGRAPHY OF SEDIMENTARY BASINS OF SOUTH EASTERN PART OF THE NORTHERN PERI-TETHYS.

Yu.A. Volozh,A.L Voznesensky , G. Kazmin

During the past period the number of scientific goals was achieved. Among them are: I) Analysis of the geological data for the selected basic sections (with outcrops, wells etc.) of Triassic, Jurassic and Cretaceous on the territory of Scythian and Turanian plates as well as on North Caucasus, Copetdag and Crimea. 2) Compilation of the lithological-stratigraphical sections for the North Caucasus, Scythian and Turanian plates. 3) Compilation of the paleogeographic schemes for Triasslc (Low, Mid and Upper), Jurassic (Sinemurian, Toarelan, CaUovlan, Kimmeridgian), Cretaceous (Hauterivian, Aptian, Cenomanian.Campanian, Maastrichtian). 4) Seismostratigraphic analysis on the regional profiles crossing the Scythian and Turanian plates. Determination of the sequence units of first, second and third orders for Mesa-Cenozoic section (tracts of low and high standing, transgression, regressions). Compilation of seismostratigraphlc schemes.

Seismostratigraphy of the platform cover The foot of the platform cover of the Scythian and Turanian plates is determined by seismic refraction data. The structure of the platform cover Is shown In regional records of the seismic common depth point method .There are four large megabasins within southern East European plate margin. These are Moesul, Scythian, PriCasplan and Turan. They are distinguished by time Intervals of sedimentary cover and Its structures. The object of this investigations is three last megabasins The PreCasplan sedimentary cover are underlaid by Archean -Lower Proterozolc rocks in the north .Riphean - In the south-east and high velocities rock in the center part (probably suboceanic crust type). Tile folded basement of Scythian and Turan MB Is Riphean complexes consolidated during Precambrian.

Sedimentary cover of the PriCasplan megabasin consist of four platform's structural-tectonical units divided by angular and erosional unconformities: Rlphean, Lower Paleozoic (VD2), Upper Devonian - Trlassic and Jurassic-Cenozoic. Three upper units form plate stage and lower one - preplate structural stage. Turanian megabasin are infilled Devonian - Cenozoic sediments subdivided Into three structural stages: Devonian -Lower Permian; Upper Permian - Triassic (Including Artian and Kungurian),forming preplate complex ; and Jurassic - Cenozolc - plate complex Age interval of the folded complex combines the Devonian - Triassic sediments, prePlate one - Triassic and Plate one Jurassic - Cenozoic. Thus Jurassic - Cenozoic sediments are distributed within all megabasins. These sediments reflect the Alpine stage of Tethys evolution. They accumulated within shelf basins of the northern Peritethys periphery separated from active margin by a chain of deep seas.

Mesozoic - Cenozoic history of sedimentary basins of this region may be subdivided into some stages: I) closure of the Urals Tjan Shan ocean and the junction Kazakhstan with East-European continents 2) collision of Mesa-Tethys and origination of intracontinental folded structures in Donbass-Tuarkur zone during Late Permian - Early Triassic, followed by accumulation of continental and shallow marine terrigeneous and volcanogeneous complexes; 3) Early -Middle Jurassic rifting with formation of Caucasus-Kopetdag margin basins, MurgabAral and Middle Jurassic Turgaj rift systems ;4) the formation of vast troughs with an epicontinental carbonate-terrigeneous sedimentation during Late Jurassic - Cretaceuos; 5) complex transgressive-regressive polycyclic evolution of margin basins during Late Mesozoic - Cenozoic within shelf seas, mostly with terrigenous-carbonate and evaporite strata. Mesozoic sequences in the centlal parts of depressions known at the depth of 5-6 km may locally be in excess of 10 kM. There are three structural-tectonical stages: folded, pre-plate and plate sedimentary complexes in Scythian and Turanian plates. The last one includes sedimentary sequences of five orders showing the detail evolution of Mesozoic - Cenozolc megabasins and basins. Mesa-Cenozoic sediments were subdivided on some main seismic sequences using the main seismic region reflectors. They ale systems of tracts (or some body of this tract) of the first order sequences (megacomplexes). There are three megacomplexes within Jurassic -Cenozoic section: Jurassic, Cretaceous- Eocene (including Rupeiiq, Oligocene - Quaternary. The first and second ones are complete cycles and the third Is non-complete cycle with only tract of low stand Besides the first order sequences we can distinguish the sequences of second order (mesocomplexes) and their tract systems within foredeep basin of the Scythian and Turanian Plates.

PALEOGEOGRAPHY The detailed lithological-facial analysis of the deposits under discussion was done on the basis of reference sections, lltholo go-facial and seismoprofiles, and served as a basis for paleogeographical maps. They illustrate critical points in the evolution of paleolandforms in the history of sedimentary basins formation in platform borders: I - the end of the Late Triassic (Norian-Rhaetic), 2 - the end of the Early Jurassic (Pliensbachian-Toarcian), 3 - the end of the Middle Jurassic (Bathonian-early

Callovian), 4 - the beginning of the Late Jurassic (Oxfordian), 5 - the end of the late Jurassic (late Kimmeridgian-early Tithonian), 6 - the middle of the Early Cretaceous (Barremian), 7 - the beginning of the Late Cretaceous (Senomanian), 8 - the middle of the Late Cretaceous (Companion).

In the southern periphery of the platforms, early Mesozoic structures were inherited from Late Permian time, which was the critical period In the tectonic development of the region. It related to the consolidation of Paleozoic structural elements and emplacement and formation of pre-Mesozoic structures and basins. The following Early-Middle Triassic epoch inherited the major paleogeographic settings within synsedimentary troughs from the Late Permian. Terrigenous-carbonate sediments accumulated in shallow basins, developed along the periphery of the Scythian and Turanian plates. Peneplanation and the crust of weathering formation widely occurred in elevated blocks in the Middle Triassic. These processes affected vast continental areas in the Turanian and Scythian plates and in the Tiyan-Shan epiplatform.

The Late Triassic. At the beginning of the Late Triassic the Scythian plate was a continental margin, dissected by alluvial valleys, opening to the south-west in the form of deltas in the direction of the North Caucasian marine basin.

Since the Carnian, the southern port of the Scythian has preserved its appearance. Alluvial-delta sea-side plains, at tunes overflown by the sea, formed at its marginal parts.

The eastern border of the Scythian plate was an island or peninsula-like land separated from the Usturt paleoelevations by a shallow-marine basin at the place of North CaspianMangyshlak. A slightly dissected constructional plain of the Turanian plate extended to the east, with separate low-mountain areas of denudation (Karabogaz, Amudaria and Central Karakum areas).

By the end of the Late Triassic, the Ustyurt elevation came Into contact with the Central Turkmenian and Hindukush ones, separating the vast Amudaria alluvial plains from the south Caspian-Kopetdagh marine basins .

The Early Jurassic. At the beginning of the Early Jurassic, the shallow marine basin occupied the southernmost part of the region. It penetrated into the North and Central Caspian by coves. The rest area of the Scythian and Turanian plates was a lowland dissected area of denudation with isolated ridges in the west of the Turanian plate. Two vast submeridional river systems are distinguished here, occasionally overflowed by the sea. One is confined to the northern part of the present-day Caspian region, and the other one extends from the south-eastern part of Turianenistan through Uzbekistan to the northern Aral region.

At the end of the Early Jurassic, transgression caused the marine basin deepening and its extending northward to the Caspian depression, also occupying the Scythian plate margins.

Vast alluvial delta plains formed In the periphery of the epicontinental basins. In the west they faced the Kuban' trough, and in the center of the region they occupied nearly the entire western part of the Turanian plate. At the eastern part of the region these plains occupied the Amudaria and Afghan-Tadjik depressions. Locally In these valleys coastal (paralic) coal formation areas (Daghestan) or ultracontinental (Illume) ones (the northern and southern parts of the Afghan-Tadjik depression) were developed. Hie central Karakum, Karabogaz upwarpings and other denudation areas, situated further to the east, served as provenances.

At the outset of the Middle Jurassic, the areas of shallow marine terrigenous carbonate sedimentation significantly increased by extending to vast south Turianenlan troughs and the Central and northern Caspian territory, and embraced nearly the entire CIS-Caucasus. In the south these seas joined the open marginal Mesotethys seas, 'tile northern active Mesotethys margin formed within the Lesser Caucasus. As a result, the areas of the coastal terrigenous alluvial-delta sedimentation reduced. The dimensions of the dissected denudation surface of the Turanian plate also decreased. In the Amudaria depression and in all southern piedmont foredeeps of the present-day Tiyan Shan, It was surrounded by wide alluvial and proluvial fans of coarse elastics . Local zones of coal formation of the delta and alluvial-limnic-bog types were assigned to the interchannel zones with delta and mouthpiece alluvium.

At the end of the Middle Jurassic (end of the Bajocian- Bathonian) sedimentation became rhythmical. The maximum sea advancement occurred In the second half of the Bathonian. The whole eastern Caspian area presented a submeridional zone with alternated shallow marine coastal and continental settings with elevations at the places of the present-day Mangyshlak, Karabogaz, and In the south of the Caspian region. Local zones of the paralic coal formation were confined to their margins. The vast marine alluvial plains of the Turanian plate margin extended further to the east. Clastic material arrived here from the dissected elevations of Northern and Southern Tyan-Shan.

The Bajocian-Bathoman tune Is characterized by most Intensive (island are ?) volcanism of the Intermediate-basic composition in the Lesser Caucasus. The marine basin, transgressed from the south, got into the eastern part of the region having occupied the major part of the Afghan-Tadjik depression.

Late Jurassic After a short-term regression at the end of the Bathonian-beginning of the Callovian, occurred mostly It the Scythian plate, the Late Jurassic was marked by the wide marine basin transgression.

A sublatitudal basin zone with shallow marine carbonate sedimentation formed In the Callovian-Oxfordian In the southern part of the Scythian and Turanian plates.

Continental sediments were formed In the north-east part of the Turanian plate (coastal alluvial-limnic plain). Since the beginning of the Oxfordian, large reef massifs appeared in elevated areas at the territory southern border (western and eastern Caucasus, Bolshoy Balkhan, Amudarla depression). At the Scythian plate they separated carbonate platforms and slopes from the southerly situated Mesotethys deepwater marginal seas. In which a thick complex of terrigenous turbidite pledmont cone deposits was formed.

The arid climatic regime In the Kimmeridgian , rather dissected relief of the carbonate platforms, being mature by the end of the Kimmeridgian, regular eustatic fluctuations of sea level resulted In the accumulation of thick sulphate-haloid strata at the end of the Late Jurassic (Labinsk, Terek, Amudaria depressions).

The Late Jurassic stage ended at the Scythian and In the west of the Turanian plate by transgression in the southern part of the shallow shelf sea with carbonate sedimentation (late Tithonian-Valanginian) and by northerly migration of the cove-lagoon zone with evaporite sedimentation. At the end of the Jurassic, the central and eastern parts of the Turanian plate underwent uplifting, and the evaporite sequence was partly washed out.

Early Cretaceous. A wide sea regression (occured In the Neocomian-Aptian. The marine conditions are preserved only at the Scythian and In the west of the Turanian plates. Four paleogeographic zones have been outlined:

I) The first embraced the Mesotethys marginal seas and was marked by an accumulated thick strata of flysch rhythmic terrigenous and, along the northern and south-eastern borders of the Transcaucasian massif, by volcanic-terrigenous deposits;

2) The second represents a rattler deep outer shelf, extending in the form of sublatitudinal strip along the southern border of the plates (Kopetdagh, Bolshoy Balkhan, the Greater Caucasus northern slope). In the Berriasian-Valanginian the carbonate sedimentation type prevailed here, and In the Hauterivtian-Aptian the terrigenous, locally carbonateterrigenous dominated;

3) The third zone lied further to the north (rather shallow Internal shelf), embracing the western part of the Turanian plate (Tuarkyr, Mangyshlak) and the Cis-Caucasian central sublatitudal part. Shallow marine and coastal terrigenous sandy-clayey and carbonate sediments mostly accumulated here, on some occasions giving way to variegated covelagoon deposits;

4) The fourth zone was an site of terrigenous material drift with the framing alluvial-proluvial plain with periodically formed coves and lagoons (the eastern part of the Turanian plate, Stavropol dome, the north-western part of the Terek trough, the north of the Labinsk and Kuban depression).

Late Cretaceous The marine transgression Incipient In the Aptian continued In the Albian and Cenomanian. A deep exterior shelf was recorded In the north of the Scythian and in the west of the Turanian plates. Shallow marine, cove-lagoon sediment accumulations and areas of continental terrigenous sediments were observed In the east of the Turanian plate. Elongated progradation bodies (clinoforms) were formed (according to geophysical evidence) In the exterior shelf zone. Tile large sublatitudal rifting trough (the Adzharo-Trialetian trough) with intensive volcanic activity was emplaced at the end of the Early Cretaceous in the Transcaucasia. The Albian-Senonamian terrigenous turbidites of the Caucasian marginal basin are the only rocks, containing pyroclastic and siliceous material. The continuing Turanian-Danish transgression stimulated extension of the sedimentation area . The shallow marine setting with carbonate sedimentation prevailed at the Scythian and in the west part of the Turanian plates. In the east the sedimentation became terrigenous-carbonate. And in the Maastrichtian, the carbonate sedimentation spread over the entire territory of the legion. Turbidite (flysch and flyschoid) deposits accumulated in depressions of the Caucasian marginal basin during the entire Late Cretaceous. From the beginning to the end of the Mesozoic the width of this marine basin progressively decreased, reaching at the maximum no less than 1000 km. Thus, six well correlated sedimentary complexes have been established in the Mesozoic sections of the Scythian and Turanian plates southern margin .

I . Lower - Middle Triassic terrigenouse complex;

2. Upper Triassic terrigenous-carbonate complex;

3. Lower-Upper Jurassic terrigenous (occassionally coal-bearing) complex;

4. Upper Jurassic - Valanginian carbonate (in place, evaporite) complex;

5 . Hauterivian - Albian terrigenous complex (red-coloured in the cost);

6. Upper Cretaceous carbonate complex.

The complexes show different lithological composition, and geneses, and filtration properties. At the sedimentary basins margins, Mesozoic have a reduced thickness and are chiefly composed with continental deposits.

PALEOGENE OF NORTH-EASTERN PERI-CASPIAN AND CIS-URALS (LITOSTRATIGRAPHY, BIOSTRATIGRAPHY, GEOLOGICAL CORRELATION, PALEOGEOGRAPHY)

V.I.Zhelezko

The Paleogene sediments of this region is widespread on the junction of three platforms: Russian, Turanian and Western Sibirian. There are we see the different paleogeographic subregions, the different facies. Therefore this region is very important for sovle the theoretical and practical tasks of Paleogene stratigraphy.

Great successes achieved for the last decades in biostratigraphy of Paleogene deposits this domane are connected with the usage of planctonic microorganisms: foraminifera, calcareous nannoplankton, dinoflagellates, radiolaries and othes groups. In our work we used the remains of sharks, theirs teeth, inasmuch as the teeth of sharks very frequent fossils of paleogene rock-masses, aspecially of sea shore shallow water deposits.

There is presented the new Paleogene chronostratigraphic scale on selachian fishes. While its development it has been also taken into consideretion the data by L.S.Glickman (1964). The Paleogene scale on sharks for this territory is based upon the evolution of the tooth devides of genera: Palaeohypotodus, Jekelotodus, Striatolamia, Otodus, Carcharocles, Isurolamna and others.The stages of impruvement of teeth apparates in continuous series this genera made it possible to distinguich 19 biozones (in direction from down to up): zone E1 - Cretolamna tethysae (danian), zone E2 - Otodus naidini (danian), zone E3 - O. minor mediavus (selandian), zone E4 - O. minor minor (thanetian), zone E5 - O. ajatensis (thanetian), zone E6 - O. obliquus obliquus (ypresian), zone E7 - O. obliquus mugodzharicus (ypresian), zone E8 - Carcharocles toliapicus (ypresian), zone E9 - C. disauris (ypresian), zone E10 - C. auriculatus (lutetian), zone E11 - C. poseidoni ustyurtensis (bartonian), zone E12 - C.poseidoni poseidoni (bartonian), zone E13 - C. poseidoni turanensis (bartonian), zone E14 - C. sokolovi caspiensis (priabonian), zone E15 - C. sololovi sokolovi (priabonian), zone E16 - C. angustidens angustidens (priabonian), zone E17 - C. angustidens turgidus (rupelian), zone E18 - Lamiostoma gracilis crenata (rupelian), zone E19 - Lamiostoma stolarovi (chattian).

Zonal scale on sharks is correlated with zonal schemes of other groups of fossils. Sharks zones have a wide horizontal spreading, with their help it will be possible to make correct paleogeographical maps.