Miocene and Pliocene palaeogeography of the West European Platform

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Based on stratigraphic and palaeoenvironmental analyses of its numerous Tertiary basins, palaeogeographic maps of the West European Platform have been compiled for the Chattian-Aquitanian, Burdigalian, Langhian-Tortonian, Messinian and Zanclean-Piacenzian time intervals. The sequence stratigraphic records of the basins indicate that Neogene tectonic activity related to intra–plate stresses and plate motions generated by the continuing collision of Apulia and Europe played an important role in basin development, as during the Paleogene. Eustatic changes in sea level induced major changes in the palaeoenvironmental evolution of the West European Platform, for instance by terminating the occurrence of saline passages between basins. In general, minor changes in relative sea level and restricted tectonic events had great impacts on the environmental and depositional development of the generally shallow-water, filled to overfilled basins. These effects are illustrated for the Rhenish Triple Junction, which structure comprises the Upper Rhine Graben, Hessen Depression, Neuwied Basin, and Lower Rhine Embayment. In particular, the episodic existence of saline communication of the Upper Rhine Graben with the external marine realms is evidenced by the immigration of different species of fish from the north (North Sea Basin), the south (Mediterranean Basin) or the east (Paratethys).

Stratigraphy and paleogeography of the Eastern Paratethys

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Stratigraphy

"Gold nails" for Paratethyan stratigraphy are several brackish levels in the basin evolution and their related occurrence of endemic biota. An explosive evolution of ancestral marine euryhaline forms and rapid extinction in unstable environments of semi-closed basins are observed among molluscs, ostracods, diatoms, and dinocysts. They provide a possibility for precise stratigraphic correlations. The best studied and most useful group are the molluscs.

The first appearance of specific Paratethyan short-lived endemics took place as a result of the Solenovian brackish event during the Rupelian (BALDI 1984, VORONINA & POPOV 1984, MERKLIN 1974, RUSU 1988, NAGYMAROSY & VORONINA 1993). This event distinctly influenced the mollusc, ostracod (*Disopontocypris oligocaenica* - Association), calcareous nannoplankton (bloom of *Reticulofenestra ornata*, *Transversopontis fibula*), and dinocyst composition as well as the sediments. It is recognized from the Alps to Lake Aral and Kopet-Dagh and reflected in the stratigraphic scheme of Fig. 1 as Level 1. The Solenovian mollusc fauna possibly originated in the Transcaucasian area (South Georgia, Akhaltsikhe).

The second event occurs in the Upper Ottnangian – Kozakhurian (Level 2 in Fig. 1). This brackish level is based on molluscan and foraminiferan data and can be observed from the Swiss Molasse Basin to the northern Lake Aral area and the western Kopet-Dagh (POPOV & VORONINA 1983). Transitional forms from euryhaline ancestral *Cerastoderma* to endemic *Limnopagetia* and *Limnopappia* are observed in material from Bavaria (SCHLICKUM 1962,

1963, 1971). Later, this molluscan fauna inhabited the Eastern Paratethys (known from Georgia and Kopet-Dagh) without the transitional forms.

The third level (Fig. 1), important for interregional correlation, is observed at the base of the Sarmatian and is marked by a pronounced impoverishment of marina biota and the appearance of more than 20 endemic species (3 species of *Inaequicostata*, *Mactra eichwaldi*, and *Obsoletiforma lithopodolica* were widespread in the Eastern and Central Paratethys). A second wave of appearance and spreading of endemic species occurred in the Middle Sarmatian s. l. (Bessarabian) among molluscs (*Mactra vitaliana*, *Obsoletiforma praefischeriana, Venerupis ponderosa*), ostracods, and foraminifera (Level 4 in Fig. 1).

The last level of short-lived, widespread endemics is observed in the basal Pontian - Late Messinian, which is marked by several molluscan genera (*Limnocardium, Pseudocatillus, Eupatorina*), the ostracod *Loxoconcha djaffarovi* – Association, and endemic dinocyst species (Level 5 in Fig. 1). An ancestral association of Pontian molluscs occurs in the Late Messinian (POPOV & NEVESSKAYA, 2000). A second wave of widespread Paratethyan endemics can be observed at the base of the Upper Pontian (Portaferian). All paleomagnetic data from the Eastern Paratethyan Pontian, basal layers excluded, are characterized by reverse polarity which is correlated with Chron C3r (TRUBICHIN, 1989). Consequently, the Upper Maeotian, which is dominated by normal polarity, has to be correlated with Chron C3An, and the Lower Maeotian, predominantly of reverse polarity, with C3Ar - C3Br. Generally, the Maeotian corresponds with the Lower Messinian (TRUBICHIN 1989, MOLOSTOVSKII & KHRAMOV 1997). The Middle Sarmatian s. l. corresponds to Chron C5n in the upper part based on a long-term normal polarity interval (TRUBICHIN 1989), nannofossils of Zones NN8-NN9 (MARUNTEANU 1993), and mammals of Zone MN10.

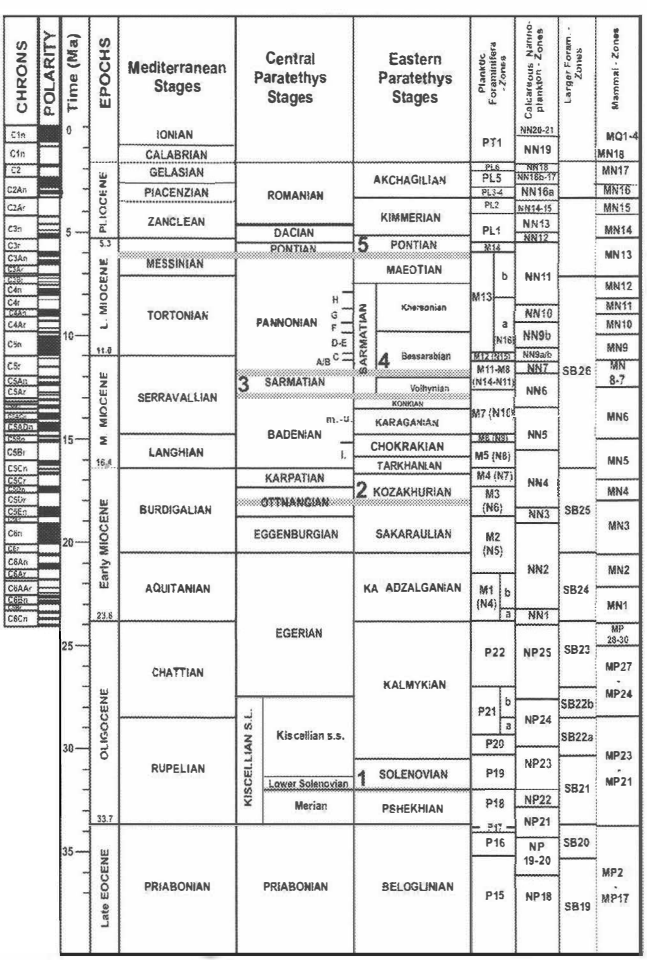

Fig. 1: Stratigraphic scheme of parts of the Cenozoic Mediterranien and Paratethys and main levels of appearance of brackishwater endemics:
Level 1 (Solenovian): first appearance of *Ergenia, Urbnisia, Korobkoviella, Merklinicardium*; Level 2 (Upper Ottnangian-Kozakhurian): appearance of *Rzehakia dubiosa, Limnopagetia, Eoprosodacna*; Level 3 (Lower Sarmatian): widespread of *Obsoletiforma, Plicatiforma, Inaequicostata, Abra reflexa, Mactra eichwaldi*; Level 4 (Middle Sarmatian s.l.): wide spreading of *Mactra vitaliana, M. podolica, Venerupis ponderosa, Obsoleti-forma praefisheriana, Inaequicostata barboti*; Level 5 (Pontian-Upper Messinian): first appearance of *Lymnocardium, Pseudocatillus, Eupatorina*).

Paleogeography

Within the framework of the Peri-Tethys Programme, a set of 10 paleogeographic maps of the Paratethys (scale 1:7,500.000) were worked out for the following time slices:
1) Late Eocene (Priabonian), 2) Early Rupelian (before Solenovian), 3) Chattian (Egerian – Kalmykian), 4) Early Burdigalian (Eggenburgian – Sakaraulian), 5) Langhian (Early Badenian – Chokrakian), 6) Middle Serravallian (Late Badenian – Konkian), 7) Late Serravallian (Sarmatian), 8) Late Tortonian – Early Messinian (Early Maeotian), 9) Late Messinian (Pontian), and 10) Piacenzian – Gelasian (Akchagilian).

Palinspastic maps (1:20,000.000) were reconstructed after finishing the Peri-Tethys Programme. For the older time intervals they are presented in Maps 1–4. Five maps for the 3 high-resolution intervals (HRI 1 – 3) are currently worked out. Within the EEDEN Programme they can act as a base for terrestrial and marine biogeography as well as for water and wind circulation models.

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Map 1

Lithological-Paleogeographic maps of Paratethys: Late Eocene

Compiled by S.V. Popov, I.G. Shcherba, A.S. Stolyarov

Co-authors:
B.I.Pinkhasov (Turan area),
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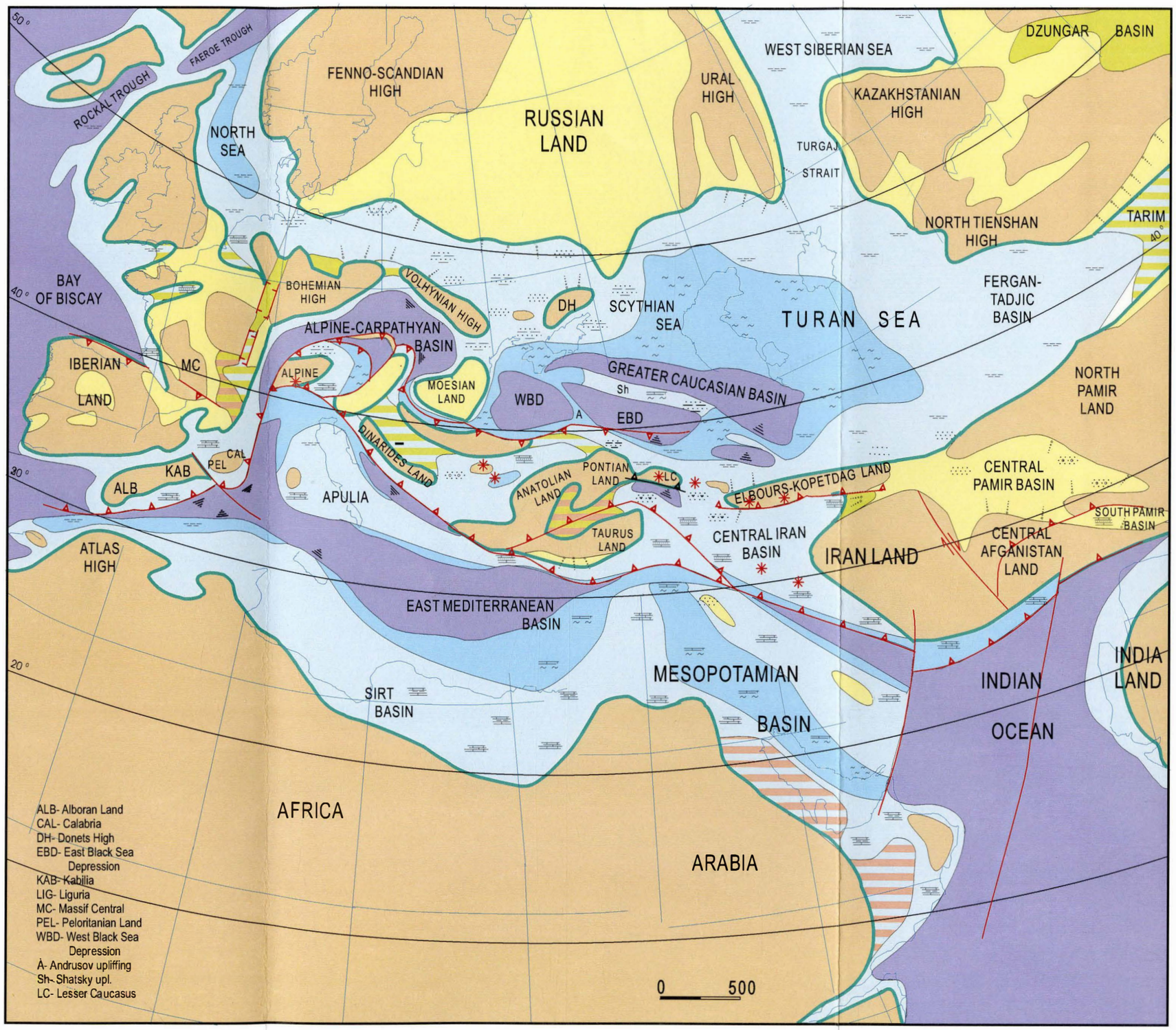

Map 2

Lithological-Paleogeographic maps of Paratethys: Early Oligocene

Compiled by S.V. Popov, I.G. Shcherba, A.S. Stolyarov

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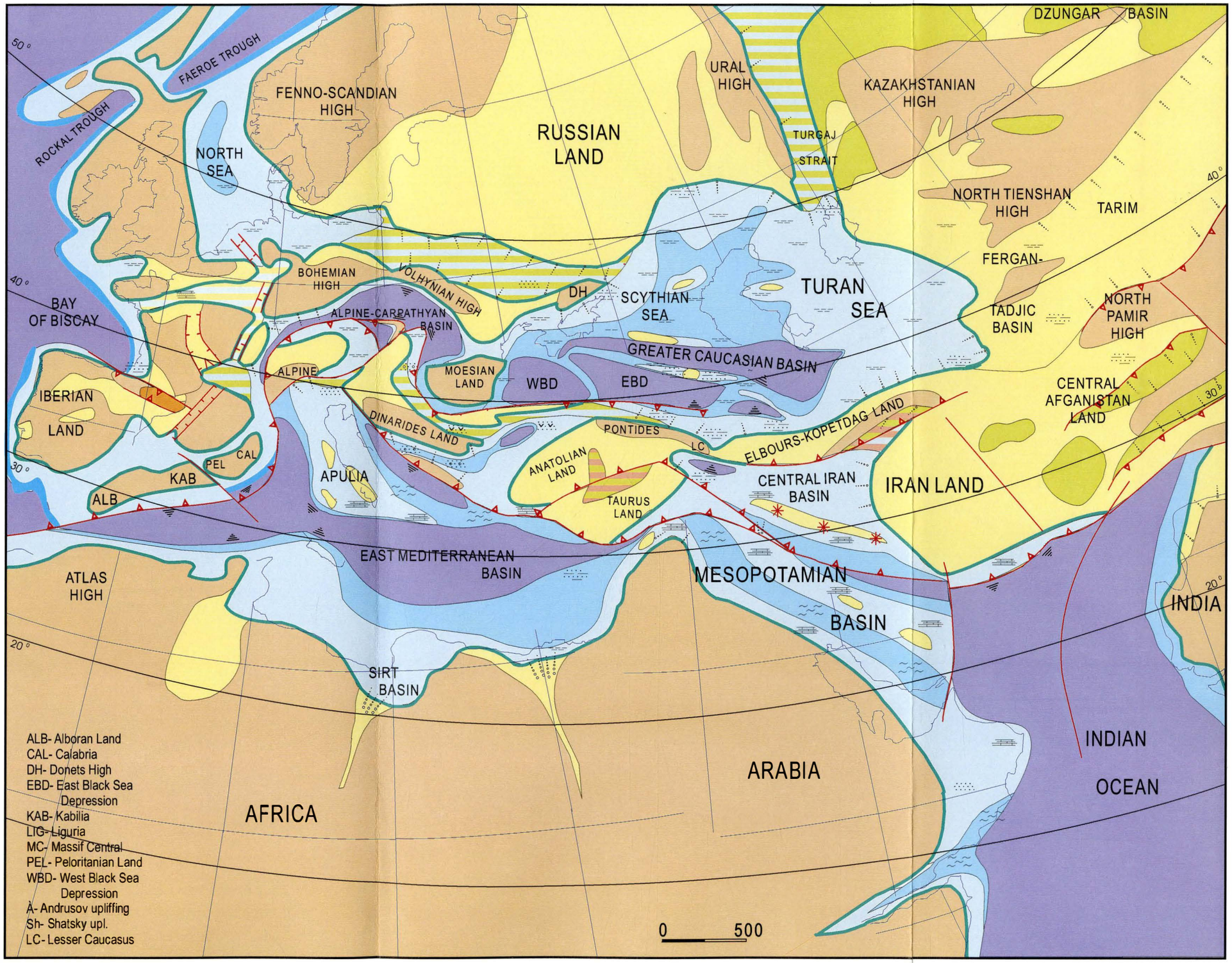

Map 3

Lithological-Paleogeographic maps of Paratethys: Late Oligocene

Compiled by S.V. Popov, I.G. Shcherba, A.S. Stolyarov

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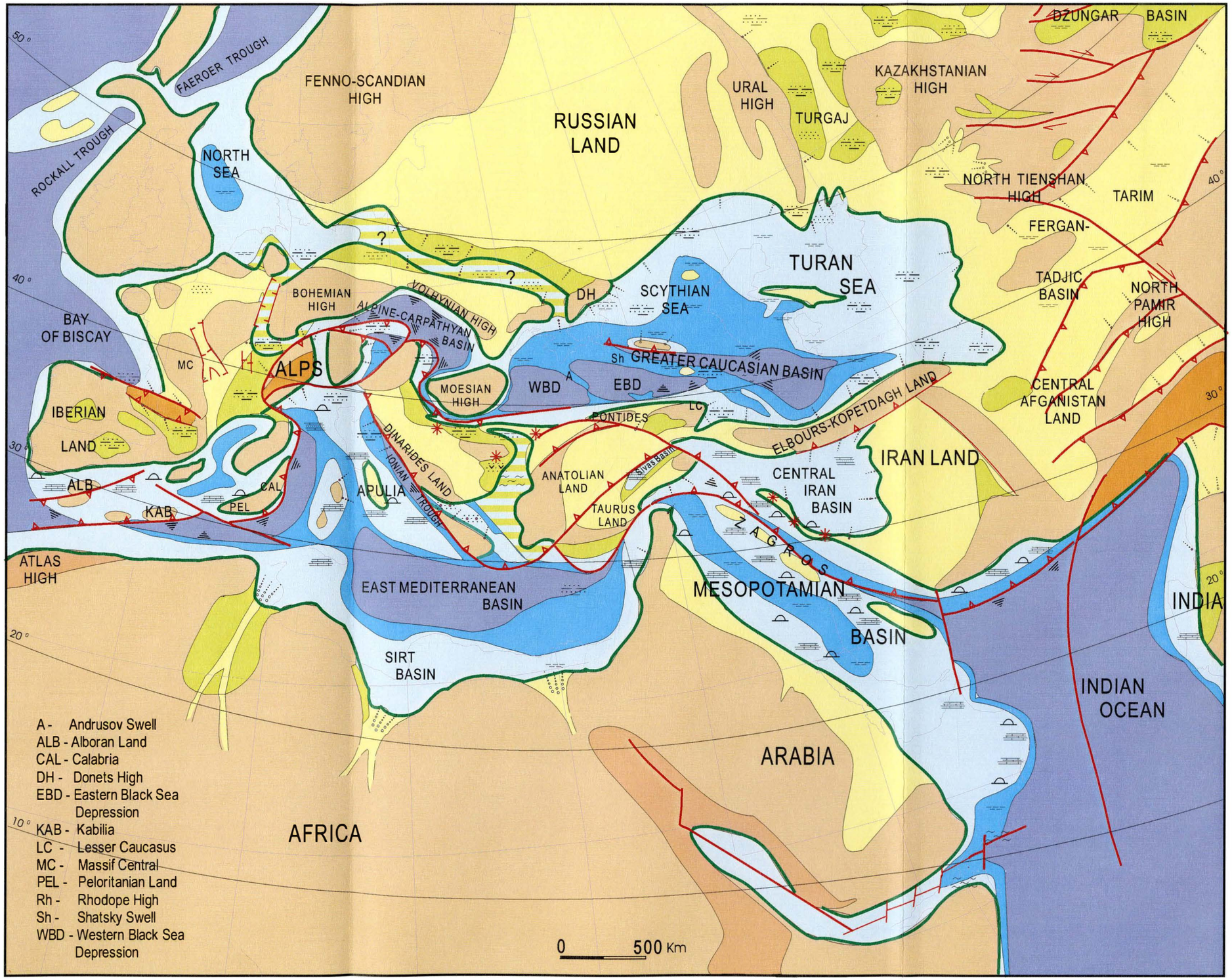

Map 4

Lithological-Paleogeographic maps of Paratethys: Early Miocene

Compiled by S.V. Popov, I.G. Shcherba, A.S. Stolyarov

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