Geodynamic Evolution of the Subsilesian Realm

Jan GOLONKA[1], Marek CIESZKOWSKI[2] and Anna WAŚKOWSKA-OLIWA[1]

[1] Faculty of Geology, Geophysics and Environmental Protection-University of Science and Technology-AGH, 30-059 Krakow, al. Mickiewicza 30, Poland
[2] Institute of Geological Sciences, Jagiellonian University, Oleandry 2A, 30-063 Kraków, Poland

Subsilesian nappe in Poland and Czech Republic

Present-day Subsilesian Nappe extends between Moravia in Czech Republic and Eastern Part of the Polish Outer Carpathians. Westward it extends into Ždanice zone in Moravia, across Lanckorona-Żegocina zone in Beskid Mts., the eastward extension is unknown. It underlies tectonically the Silesian Nappe. In the western sector of the West Carpathians both nappes are thrust over the Miocene molasse of Carpathian Foredeep and in the eastern sector they are thrust over the Skole Nappe.

The Subsilesian unit has also been drilled in many boreholes between Bielsko, Cieszyn and Ustroń, and in the adjacent apart of Moravia beneath the Silesian Nappe (Picha et al. 2005, Ślączka et al. 2005 and references therein). This unit also appears in the Żywiec window (Geroch and Gradziński 1955). The intensely folded, and arranged in scales mostly lying in an N-S direction and steeply dipping to the west Subsilesian Unit rocks form the diapiric anticlinal uplift (Książkiewicz 1977). Eastwards, several tectonic windows under Silesian and Skole nappes occur. The Subsilesian Unit rocks are exposed in these windows. In the frontal part of the Silesian Nappe, north of the town Krosno the Subsilesian Nappe is exposed in the Węglówka tectonic half window. Deep wells connected with the Węglówka oil field show that the tectonic window is built of refolded thrust-faulted anticline. The Subsilesian Nappe is steeply overthrust onto the Skole Nappe. Further to the east the Subsilesian Nappe forms once more a narrow zone in front of the Silesian Nappe. Near the town of Ustrzyki Dolne the Subsilesian Nappe disappears from the surface, and the frontal part of the Silesian Nappe becomes a thrust-faulted fold and eventually joins with the Skole Nappe. There is also a possibility that tectonic prolongation of Subsilesian Nappe is the Rosluch scale in Ukraine.

In the western part of the Outer Carpathians near of Andrychów, along the Silesian Nappe there are several huge blocks built mainly by Jurassic limestones. They were regarded as tectonic klippen that were sheared off during the movements of the Silesian nappe (Książkiewicz 1977), however a new data suggest that they are olistolites in uppermost part of the Krosno beds of the Subsilesian nappe (Ślączka et al. 2005). It is possible that Andrychów and Subsilesian Upper Cretaceous and Paleogene rocks were deposited within the same ridge area. The Andrychów facies represent the central, partially emerged part of the ridge, while the Subsilesian much broader slope area.

Geodynamic evolution and sedimentation

The Silesian basin and Subsilesian sedimentary area have been connected during their early sedimentation period. In the Ždanice Unit shallow-water carbonate facies represent the oldest Jurassic-lower Cretaceous deposits (Picha et al. 2005 and references therein). They equivalent in Northern Moravia are known as Baška facies, which now is regarded as belonging to the Silesian Nappe. Similar rocks are also known from the North European Platform. They were drilled under the Carpathian Overthrust in the area south of Rzeszów. The more basinal slope facies are represented by Maiolica-type Upper Jurassic-Lower Cretaceous cherty limestones known from Targanice and Roczyny in the Andrychów area. It looks like during the Late Jurassic large carbonate platform existed uplifted part of European plate and Tethyan Penninic realm. The Maiolica deposits represent the deepest part of this platform. They were rimmed by shallower carbonate facies with carbonate buildups. As result of the fragmentation of European platform the Outer Carpathian rift had developed with the beginning of the Uppermost Jurassic-Lower Cretaceous calcareous flysch sedimentation. This Proto-Silesian basin was formed during the synrift process with a strong strike-slip component (Golonka et al. 2005). It included the oldest deposits of the future Subsilesian realm as well as the future Skole basin.

During Cretaceous time several ridges have been uplifted as an effect of the orogenic process (Golonka et al. 2005). This process started in Albian and was concluded in Paleocene. The Subsilesian Ridge originated between Silesian and Skole basin. Westward it extends into the shelf and slope of the European Platform. During the orogenic, mainly transpressional process the inversion of the proto-Silesian basin happened. The deepest part of the old basin became part of the newly formed ridge. New carbonate platform developed within the ridge and its slope area. The shallow-water Paleocene organogenic limestones are known from the Andrychów area (Książkiewicz 1951, Olszewska and Wieczorek 2001, Gasiński 1998). The Andrychów facies represent the central, partially emerged part of the ridge, while the Subsilesian facies much broader slope areas. These facies were deposited also in the deeper part of Silesian and Skole basins. The Subsilesian Late Cretaceous-Paleogene realm in Poland includes different deposits located between the central axes of the surrounding basins.

Variegated shales of the Cenomanian-Turonian age which pass upwards into a thick complex (about 700 meters) of red and green marls (Węglówka-type marls) which are Senonian to Mid Eocene (Ślączka et al 2005). During the Late Senonian grey marls (Frydek-type marls) often with exotic rocks (Książkiewicz 1977) developed at the same time with Węglówka-type marls in this area. Frydek-type marls represented submarine slumps from boundary of the shelf and bathial zones (Morgiel and Olszewska 1981). In the western part of the Subsilesian Unit sandy and conglomeratic complexes of the Upper Senonian and/or Paleocene were deposited. At the end of the Cretaceous an intensive activity of density currents started in the Subsilesian sedimentation zone, as a result of that a fine-grained sedimentation was interrupted by a sandy-shaly deposition. The Rybie sandstones, the Szydłowiec sandstones, the Gorzeń beds and the Czerwin sandstones are the effect of this sedimentation. At the end of Paleocene sedimentary conditions changes and are deposited muddy sediments called as green or variegated shales, which pass in to in marly shales with the Middle Eocene. The marly complex passes upwards into Globigerina Marls representing uppermost part of the Eocene.

The movement of Inner Carpathian terranes during Eocene-Oligocene led to the development of Outer Carpathian accretionary prism. This prism overrode the ridges, including the Sub-Silesian ridge. The ridge basement rocks and part of its depositional cover from olistostroms and exotic pebbles within Menilitic-Krosno flysch. The Oligocene begins in the Sub-Silesian realm with brown, bituminous shales (Menilite Beds) which grades upward into a complex of thick and medium bedded, calcareous sandstones and marly shales (Krosno Beds).

Finally, during the Miocene time the Outer Carpathian nappes were detached from the basement and thrust northward onto North European platform with its Miocene cover. The Subsilesian realm forms the present-day Subsilesian Nappe. The Outer Carpathian allochtonous rocks have been Overthrust onto the platform for a distance of 50 to more than 100 km.

Acknowledgements

This research has been supported financially by KBN grant 4T12B 025 28 and AGH grant No. 11.11.140.159.

References

GASIŃSKI M.A., 1998. Campanian-Maastrichtian Paleoecology and Paleobiogeography of the Andrychów Klippes, Outer Carpathians, Poland. Uniwersytet Jagielloński, Rozprawy Habilitacyjne 333, Kraków, 1-90.

GEROCH S. and GRADZIŃSKI R., 1955. Stratygrafia serii podśląskiej żywieckiego okna tektonicznego. *Rocz. Pol.o Tow,a Geol.*, 24: 3-62.

GOLONKA J., KROBICKI M., MATYSZKIEWICZ J., OLSZEWSKA B., ŚLĄCZKA A. and SŁOMKA T., 2005. Geodynamics of ridges and development of carbonate platform within the Carpathian realm in Poland. *Slovak Geol. Mag.*, 11: 5-16.

KSIĄŻKIEWICZ M., 1951. Ogólna Mapa Geologiczna Polski w skali 1:50 000. Arkusz Wadowice. Państwowy Instytut Geologiczny Warszawa + objaśnienia.

KSIĄŻKIEWICZ M., 1977. The tectonics of the Carpathians. In: W. POŻARSKI (Editor), Geology of Poland, Vol. IV, Tectonics, Wydawnictwa Geologiczne, Warszawa, 476–620.

MORGIEL OLSZEWSKA, 1981. Biostratigraphy of the Polish External Carpathians. *Micropaleontology*, 27: 1-30.

OLSZEWSKA B. and WIECZOREK J., 2001. Jurassic sediments and microfossils of the Andrychów Klippens (Outer Western Carpathians). *Geol. Carpath.*, 52 (4): 217–228.

PICHA F.J., STRANIK Z. and KREJCI O., 2005. Geology and Hydrocarbon Resources of the Outer Western Carpathians and their Foreland, Czech Republic. In: F.J. PICHA and J. GOLONKA J. (Editors), The Carpathians and their foreland: *Geology and hydrocarbon resources: AAPG Mem.*, 84: 49-175.

ŚLĄCZKA A., KRUGLOW S., GOLONKA J., OSZCZYPKO N. and POPADYUK I., 2005. The General Geology of the Outer Carpathians, Poland, Slovakia, and Ukraine. In: F.J. PICHA and J. GOLONKA (Editors), The Carpathians and their foreland: *Geology and hydrocarbon resources: AAPG Mem.*, 84: 221-258.

Phanerozoic Palaeogeography of Southeast Asia

Jan GOLONKA[1], Michał KROBICKI[1], Jakub PAJĄK[1], Nguyen Van GIANG[2] and Witold ZUCHIEWICZ[3]

[1] Faculty of Geology, Geophysics and Environmental Protection-University of Science and Technology-AGH, 30-059 Krakow, al. Mickiewicza 30, Poland
[2] Institute of Geophysics, Vietnamese Academy of Science and Technology, Nha A8-18 Hoang Quoc Viet - Cau Giay - Hanoi-Vietnam
[3] Institute of Geological Sciences, Jagiellonian University, Oleandry 2A, 30-063 Kraków, Poland

Methodology

Thirty two time interval maps have been presented, which depict the global plate tectonic configuration as well as palaeogeography and lithofacies for South-East Asia region (Fig. 1) from Cambrian to Neogene. The presented maps were primarily generated as Intergraph™ design files and CorelDraw™ files using computer software and databases. The plate tectonic model used to create palaeocontinental base maps is based on Plates and PALEOMAP tectonic reconstruction programs. These programs take tectonic features in the form of digitised data files and assemble those features in accordance with user specified rotation criteria. The detail information about the database, including the palaeopoles used can be found in the Plates homepage:

- http://www.ig.utexas.edu/research/projects/plates/plates.htm.

Plates maintains an up-to-date oceanic magnetic and tectonic database, continuously adding new palaeomagnetic, hot spot, geological, and geophysical data to extend the span and accuracy of global plate reconstructions. Plates' reconstructions are built around a comprehensive database of finite-difference poles of rotation, derived both from extensive plate motion research at UTIG, using the Plates interactive plate modeling software, and from published studies. Updated plate motion models are in turn