

**TERRESTRIAL AND SHALLOW-MARINE DEPOSITS OF CENTRAL-  
CARPATHIAN PALEOGENE BASIN:  
EXAMPLE FROM EASTERN SLOVAKIA**

J. JANOČKO

*Geological Survey of Slovak Republic, Jesenského 8, 040 11 Košice, Slovakia*

**Abstract:** Deposits of Upper Eocene - Lower Oligocene Borové Formation are well-exposed along the southern margin of the Central-Carpathian Paleogene Basin between Spišská Nová Ves and Margecany. Facies associations suggests that they are part of a facies tract representing gradual transition from alluvial fan and fluvial environments to deltaic and shallow marine realms. The mutual relationship among individual depositional environments is delicate and mainly depends on coastal morphology and tectonics in source areas.

**Key words:** Central-Carpathian Paleogene Basin, Borové Formation, alluvial fan, fluvial, delta, shallow-marine

### **Introduction**

Borové Formation, belonging to the Subtatric Group, was defined by Gross et al. (1984) as shallow-water, transgressive facies deposited in the Lutetian and Bartonian. The division is of great use for mapping purpose because it lumps together more lithologically and stratigraphically similar deposits. However, for detail paleoenvironmental studies the deposits belonging to the formation may be divided into more details (e.g. Marschalko, 1966, Baráth and Kováč, 1995) resulting in definition of Tomášovce, Hornád and Chrást' Beds and Vítkovce Breccias (Filo and Siráňová, 1996, 1998). The deposits comprising the defined lithostratigraphic units originated in wide variety of environments from alluvial fan and fluvial environments to deltaic and shallow marine ones.

The main objective of the paper is to describe sediments belonging to Borové deposited on- and offshore at the south-eastern part of the Central-Carpathian Paleogene

Basin between Spišská Nová Ves and Margecany. Well exposed sediments in the narrow belt fringing the pre-Tertiary units render excellent natural archive elucidating type of deposition during the first stage of the basin evolution. The spatial distribution of deposits points to delicate transitions among various type of environments suggesting important role of coastal morphology and morphology of adjacent source areas.

### **Geological setting**

The Central-Carpathian Paleogene Basin belongs to the largest Tertiary basins of the Slovakian Western Carpathians. To the north the basin is separated by the Pieniny Klippen belt from the Outer Flysch zone. To the west and south the basin is bounded to the pre-Tertiary, Mesozoic and Paleozoic units of the Central Western Carpathians. To the east the basin is tectonically bounded to the East-Slovakian Basin.

The opening of the basin commenced in the Paleocene with the maximum subsidence during the Late Eocene and Oligocene. During the initial stage of development major subsidence occurred along its northern part, which hugs the Pieniny Klippen belt today. The depocenters gradually shifted southward during the Late Eocene and Early Oligocene while during the Late Oligocene the main depocenters were again localized close to the Pieniny Klippen belt.

The basin fill is divided into four formations of Subtatric Group defined by Gross et al. (1984). The lowermost one, which mostly comprises shallow-marine deposits, is Borové Formation. It is overlain by Huty Formation represented by mudstones and minor sandstones and conglomerates. It is, in turn, overlain by Zuberec Formation consisting of alternating mudstones and sandstones. The entire sedimentary succession is capped by sandstones of Biely Potok Formation. The stratigraphic span of the basin fill ranges from the Middle Eocene to the Lower Miocene (e.g. Soták et al., 1996, Janočko et al., 1999).

### **Marginal facies of CCP Basin between Spišská Nová Ves and Margecany**

The gradual shift of basin depocenters during the evolution of the basin resulted in diachroneity of basal deposits. The age of numullite sandstones occurring close to the Pieniny Klippen belt is of Middle and Upper Eocene age (e.g. K hler in Janočko, 2000)

while the basal deposits flanking the southern margin of the basin are of Upper Eocene - Lower Oligocene age.

The "basal" deposits of the CCP Basin fill represent both terrestrial and marine environments in the study area. The terrestrial deposits belongs to fluvial and alluvial fan systems. Transition between these deposits is comprised by deltaic and fan deltaic deposits. Marine realm is represented by inner and outer shelf deposits. All these deposits are closely related comprising a facies tract and they may laterally pass into each other mostly depending on coastal morphology and morphology of hinterland. The described succession represents a composed profile from the area between Spišská Nová Ves and Margecany (Fig. 1).

Terrestrial part of the facies tract may be defined by Hornád Beds (Filo and Siráňová, 1998) well exposed in Markušovce village. The coarse-grained deposits filling deeply incised valley in the Mesozoic carbonates have been defined as alluvial fan (Marschalko, 1970) and as alluvial fan, fluvial and shallow-marine deposits (Baráth and Kováč, 1995; Filo and Siráňová, 1998).

The sedimentary succession starts with clast-supported conglomerates prevailingly composed of crystalline clasts. The conglomerates are massive and comprise sharply-based very thick beds. This is overlain by erosively-based bimodal conglomerates with clast diameter up to 40 cm. The conglomerates passes into monomic carbonate, normally-graded conglomerates pinching out laterally. This is, in turn, overlain by thick beds of conglomerates with fining upward trend. The whole succession is capped by parallelly-laminated sandstone.

The uppermost part of the succession again consists of conglomerates and sandstones, however, sandstone beds are most frequent and have better internal organization. The character of valley fill suggests that depositional processes only used older inherited valley for accumulation of sediments. Thick-bedded, clast-supported and massive conglomerates are indicative for debris flows which usually do not have significant erosional ability. Such debris flows often occur in alluvial fan environments. Facies associations in the upper part of the profile consist of better organized sediments showing prevailing deposition in fluvial environment.

Deltaic deposits are recorded by borehole RHV-22 located west of Matejovce village. The borehole revealed almost 159 m of basal Paleogene deposits. The sedimentary succession starts with alternating intervals of normally graded massive sandstones passing into mudstones at the top of beds. This is overlain by black mudstones and coal layers. The mudstones are parallel and ripple-cross laminated. These facies extends up to 111 m below surface. The sandstone is locally bioturbated. From 111 m upward normally-graded conglomerate passing into massive sandstone is predominant.

The lower part of the succession probably represents delta plain deposits with local swamps filled by coal and organic-rich fines. The upper part of the succession from 111 m upward suggests deltaic front with prevailing coarse-grained sedimentation. The interpretation implies retrogradation of studied delta. The Upper Eocene and Lower Oligocene age of transgressive marine deposits suggests slightly older age of deltaic deposits (Upper Eocene?).

Fan-deltaic deposits are well-preserved at right bank of Hornád river near Štefanská Huta village. The sedimentary succession starts with massive, medium-sized sandstone containing clusters of pebbles. Upward erosive-based conglomerate bodies prevail representing conglomeratic fill of channels. Conglomerates are usually clast-supported, however, matrix-supported conglomerates are also locally developed. The conglomerates alternate with massive and parallel-laminated sandstone. The overall trend of the sediments is fining upward suggesting deepening of environment and progressive reworking of deltaic deposits by waves. Lateral development of this facies succession may be followed in quarry Vítáz some 5 km eastward. The conglomerates are much less present and the succession is basically sandy. Massive, parallel laminated and trough-cross laminated sandstone prevails. These sediments are already interpreted as inner shelf deposits.

Shoreface deposits are well exposed in Chrást nad Hornádom village. The deposits are prevalingly composed of sandstone and minor conglomerates. The sandstone are arranged into sharply based beds showing trough-cross stratification. Conglomerate patches or clusters are common. The deposits are thought to be developed in shoreface environment by reworking deltaic material.

## Conclusion

Examples from several localities between Spišská Nová Ves and Margecany, located at the southern margin of the CCP Basin show complex depositional history during the first stages of basin evolution. It is possible to assume a continuous transition from terrestrial alluvial fan and fluvial deposits to deltas and shoreface deposits. All the dispersional system was unstable and depended on coastal morphology and tectonics of hinterland.

## References:

- Baráth, I. and Kováč, M. 1995: Systematics of gravity-flow deposits in the marginal Paleogene formations between Markušovce and Kluknava villages (Hornád Depression). *Mineralia Slovaca*, 27, 1, 6 (Geovestník, Košice).
- Filo, I. and Siráňová, Z. 1996: The Tomášovce Member - a new lithostratigraphic unit of the Subtatric Group. *Geol. Práce, Spr.* 102, 41-49.
- Filo, I. and Siráňová, Z. 1998: Hornád and Chrást' Members - new regional lithostratigraphic units of the Subtatric Group. *Geol. Práce, Spr.*, 103, 35-51.
- Gross, P., K hler, E. and Samuel, O. 1984: A new lithostratigraphic subdivision of the Central Carpathian Paleogene. *Geol. Práce, Spr.*, 81, 103-117.
- Janočko, J. Hamršíd, B., Siráňová, Z. and Jacko, St. Jr. 1998: Suprafan and channel-and-levee deposits near Tichý Potok, Levoča Mts.; Central-Carpathian Paleogene Basin, Slovakia. *Slovak Geol. Mag.*, 4, 1, 3-15.
- Marschalko, R. 1966: Geology and sedimentology of marginal lithofacies (Šarišská hornatina Mts.). *Zbor. geol. Vied, Západné Karpaty*, v. 5, 1-102.
- Marschalko, R. 1970: Research of sedimentary structures, textures and paleoflow analysis of basal formations (Paleogene of Central Western Carpathians N of Spišsko-Gemerské Rudohorie Mts.). *Acta Geol. Geogr. Univ. Comen., Geol.*, Bratislava, 19, 139-163.
- Soták, J., Bebej, J. and Biroň, A. 1996: Detrital analysis of the Paleogene flysch deposits of the Levoča Mts.; evidence for sources and paleogeography. *Slovak Geol. Mag.*, 3-4, 345-349.