

Petrographic and geochemical analysis for determination of provenance of the Slovenj Gradec Miocene Basin fill (Western Central Paratethys)

Kristina Ivančič (1), Mirka Trajanova (1), Dragomir Skaberne (1), and Andrej Šmuc (2)

(1) Geological survey of Slovenia, Regional geology, Ljubljana, Slovenia (kristina.ivancic@geo-zs.si), (2) Department of Geology, Faculty of Natural Sciences and Engineering, Ljubljana, Slovenia

The Slovenj Gradec Basin (SGB) is located in northern Slovenia between eastern margin of the Northern Karavanke and the western Pohorje Mts. Structurally, it belongs to Eastern Alps. It is filled with Miocene clastic sediments.

Modal composition of sandstones was determined on thin sections by point-counter and presented with the QFL and QmFLt diagrams. Their geochemical composition was determined by classical method and by Inductively Coupled Plasma-Mass Spectrometry.

Based on petrography, sedimentary fill of the SGB consists mostly of lithic grains and quartz, derived from metamorphic and carbonate rocks. Locally, fragments of granitoids occur. Binder consists of carbonate, subordinately quartz cement, and carbonate matrix.

Recycled orogen (lithic and transitional recycled) provenance of the grains was determined.

Geochemical composition shows that:

- Sandstones from the SGB belong to the fields of shale, wacke, litharenite, arkose and subarkose (Pettijohn, 1972).
- In the ternary diagram of weathering trends (cf. Nesbitt & Young 1984), the samples group near the $\text{CaO}+\text{Na}_2\text{O}+\text{Al}_2\text{O}_3$ conjunctive. Calculated minimum CIA (Fedo et al., 1995) is 40.06, indicating that the source rocks were not subjected to considerable weathering.
- According to discriminant function (cf. Roser & Korsch, 1988) all samples from SGB originate from quartzose sedimentary rocks.
- For determination of tectonic setting of source rocks (Verma & Armstrong-Altrin, 2013) the studied samples plot in the field of collision zone.
- In the multidimensional discriminant function diagram for the discrimination of active and passive margin after Verma and Armstrong (2016), the samples plot into the field of passive margin.

The data indicate that source rocks of the SGB sedimentary fill were derived from Eastern Alps and Southern Alps. It is suggested that SGB was detached from the Styrian and Mura-Zala Basins in the course of the Pohorje Mts. oblique transpressive uplift during the late Miocene to Pliocene (Trajanova, 2013). Consequently, the area of the wider SGB was still an integral part of the Central Paratethys until late Miocene.

References

- Fedo, C.M., Nesbitt, H.W. & Young, G.M., 1995. Unravelling the effects of potassium metasomatism in sedimentary rocks and paleosols, with implications for paleoweathering conditions and provenance. *Geology*, 23(10), pp.921–924.
- Nesbitt, H. W., & Young, G. M., 1984. Prediction of some weathering trends of plutonic and volcanic rocks based on thermodynamic and kinetic considerations. *Geochimica et Cosmochimica Acta*, 48 (7), 1523–1534.
- Pettijohn, F.J., Potter, P.E., Siever, R., 1972. *Sand and Sandstone*, second ed., Springer, New York, Heidelberg, Berlin 618, pp.
- Roser, B.P. & Korsch, R.J., 1988. Provenance signatures of sandstone-mudstone suites determined using discriminant function of major-element data. *Chemical Geology*, 67(1–2), pp.119–139.
- Trajanova, M. 2013: Starost pohorskega magmatizma; nov pogled na nastanek pohorskega tektonskega bloka (Age of the Pohorje Mountains magmatism; new view on the origin of the Pohorje tectonic block). PhD thesis. 183 pp., Ljubljana.
- Verma, S.P. & Armstrong-Altrin, J.S., 2013. New multi-dimensional diagrams for tectonic discrimination of siliciclastic sediments and their application to Precambrian basins. *Chemical Geology*, 355, pp.117–133.
- Verma, S. P., & Armstrong-Altrin, J. S. (2016). Geochemical discrimination of siliciclastic sediments from active and passive margin settings. *Sedimentary Geology*, 332, 1–12.