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Fig. 1. Photo of the quarry near Krásna Hôrka village exposing the Jurassic and Lower Cretaceous sediments of the Nižná Unit.

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Detection of chrome spinels of harzburgitic provenance in the Kimmeridgian of the central Northern Calcareous evidenced Late Jurassic erosion of an obducted Neotethyan ophiolites in the southern Eastern Alps

HANS-JÜRGEN GAWLICK[1], ROMAN AUBRECHT[2], FELIX SCHLAGINTWEIT[3], SIGRID MISSONI[1] and DUŠAN PLAŠIENKA[2]

[1] *Department of Applied Geosciences and Geophysics, Petroleum Geology, Montanuniversität Leoben, Peter Tunner Str. 5, 8700 Leoben, Austria; Gawlick@unileoben.ac.at*

[2] *Department of Geology and Paleontology, Faculty of Natural Sciences, Comenius University, Ilkovičova 6, 842 15 Bratislava, Slovakia; aubrecht@fns.uniba.sk; plasienka@fns.uniba.sk*

[3] *Lerchenauer Str. 167, 80935 Munich, Germany; Felix.Schlagintweit@gmx.de*

The causes for the Middle to Late Jurassic tectonic processes in the Northern Calcareous Alps are still controversially discussed (see Gawlick et al. 2009 for a review). There are several contrasting models for these processes, formerly invented as "Jurassic gravitational tectonics".

Whereas in the Dinarides or the Western Carpathians Jurassic ophiolite obduction and a Jurassic mountain building process with nappe thrusting is widely accepted equivalent processes are still questioned for the Eastern Alps. For the Northern Calcareous Alps an Early Cretaceous nappe thrusting process is widely favoured instead of a Jurassic one, obviously all other Jurassic features are nearly identical in the Northern Calcareous Alps, the Western Carpathians or the Dinarides. In contrast, the Jurassic basin evolution processes as best documented in the Northern Calcareous Alps were in recent times adopted to explain the Jurassic tectonic processes in the Carpathians and Dinarides. Whereas in the Western Carpathians Neotethys oceanic material is incorporated in the mélanges and in the Dinarides huge ophiolite nappes are preserved above the Jurassic basin fills and mélanges, Jurassic ophiolites or ophiolitic remains are not clearly documented in the Northern Calcareous Alps.

Here we present chrome spinel analyses of ophiolitic detritic material from Kimmeridgian allodapic limestones in the central Northern Calcareous Alps. The geochemical composition points to a harzburgite provenance as known from the Jurassic suprasubduction ophiolites well known from the Dinarides/Albanides. These data clearly evidence Late Jurassic erosion of obducted ophiolites before their final sealing by the Late Jurassic – earliest Cretaceous carbonate platform pattern.

The new data of detrital chrome spinel grains in the western central Northern Calcareous Alps result in the following conclusions (Gawlick et al. 2015):

1. Erosion of the obducted ophiolite stack started in the Kimmeridgian and not in the Early Cretaceous as previously assumed (Faupl & Pober 1991). This clearly indicates that the first thrusting event related to ophiolite obduction (upper plate) in the Northern Calcareous Alps is of Jurassic age. Additionally, in a Jurassic strike-slip tectonic environment redeposition of eroded oceanic crust cannot be expected (Frank & Schlager 2006).
2. Geochemical composition of the detrital chrome spinels points to a harzburgite provenance. The (Jurassic SSZ) ophiolites occur in a higher nappe position as the (mainly) lherzolitic (Triassic) ophiolites, as proven in the ophiolite nappe stack e.g. in Albania (Mirdita ophiolites).
3. The southern Northern Calcareous Alps underwent the same Jurassic to Early Cretaceous geodynamic history as the Western Carpathians, the Dinarides, and the Albanides/Hellenides with Middle to early Late Jurassic ophiolite obduction and the onset of erosion of the ophiolitic nappe pile in the Kimmeridgian (compare Gawlick et al. 2008, Missoni & Gawlick 2011). A Kimmeridgian to earliest Cretaceous carbonate platform evolved on top of the nappe stack including the obducted ophiolites (Schlagintweit et al. 2008). Erosion of the obducted ophiolite nappe stack started in the Kimmeridgian and lasted until the late Early Cretaceous (Aptian) (Krische et al. 2014), but interrupted by the (Late) Kimmeridgian to earliest Cretaceous platform evolution, which protected the ophiolite nappe stack against erosion during that time span (Gawlick et al. 2009). In the Early Cretaceous also this platform was widespread eroded and can only be reconstructed by pebble analysis from mass flows in the Lower-Upper Cretaceous sedimentary successions.

The Northern Calcareous Alps are therefore part of the mountain building process in the northwestern Tethyan realm. As this orogen resulted from the closure of the western part of the Neotethys Ocean, but this orogenesis do not belong to the Cimmerides (as defined as a result of the closure of the Palaeo-Tethys: e.g. Sengör 2005). Therefore Missoni & Gawlick (2011) invented the term Neotethyan Belt as part of the Tethysides for this orogen.

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Tithonian–Berriasian magnetostratigraphy in the Northern Calcareous Alps (Leube quarry, Northern Calcareous Alps, Austria) – first results

JACEK GRABOWSKI[1], HANS-JÜRGEN GAWLICK[2], JOLANTA IWAŃCZUK[1], OLIVER KRISCHE[2], DANIELA REHÁKOVÁ[3] and KRYSTIAN WÓJCIK[1]

[1]*Polish Geological Institute – National Research Institute, Rakowiecka 4, 00-975 Warszawa, Poland; jacek.grabowski@pgi.gov.pl; jolanta.iwanczuk@pgi.gov.pl; krystian.wojcik@pgi.gov.pl*
[2]*Department of Applied Geosciences and Geophysics, Montan Universitaet Leoben, Austria; gawlick@unileoben.ac.at; oliver_krische@gmx.at*
[3]*Dept. of Geology and Palaeontology, Faculty of Science, Comenius University Bratislava, Slovakia; rehakova@fns.uniba.sk;*

Unlike the Western Carpathians, Tithonian and Berriasian magnetic stratigraphy has been never applied so far in the Northern Calcareous Alps. All formerly investigated sections are localized in the Tirolic units and they reveal multiphase, syntectonic remagnetization (Pueyo et al., 2007). The only locality investigated outside the Tirolic Unit is the Nutzhof section in the Gresten Klippen Belt, near Wien, where J/K boundary was magnetostratigraphically documented (Lukeneder et al. 2010).

We present the first magnetostratigraphic and magnetic susceptibility results from the Tithonian – Berriasian succession of the Leube section (central Northern Calcareous Alps, Austria). The Leube section (Tirolicum) is very well accessible and outcropped in an active quarry. It comprises succession of the Tithonian to Valanginian hemipelagic limestones and marls of 340 m thickness. Its age was estimated on the basis of calpionellids and ammonites from the Upper Tithonian (Crassicollaria intermedia Subzone) to lowermost Valanginian (boundary between Calpionellopsis and Calpionellites Zones) (Krische et al., 2013; Bujtor et al., 2013). The succession contains in several levels mass-flow deposits, especially frequent in the Upper Tithonian with decreasing intensity up to the the Tithonian/Berriasian boundary interval (Oberalm Formation + Barmstein Limestone). The upper part of the Oberalm Formation is represented by well bedded greenish marly limestones interbedded with marls. The Schrambach Formation starts in the upper part of the Lower Berriasian with marls intercalated with cherty limestones and – scarce – polymictic turbidites. A peculiar lithological feature is the presence of red carbonate beds in the upper part of the Lower Berriasian (Gutratberg beds), between Remaniella and Elliptica Subzones (Krische et al., 2013). Important to note is the decrease in the sedimentation rate and the