

Cretaceous karst phenomena of the Central Western Carpathians

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Abstract. Cretaceous, Paleoalpine karst phenomena occurs in different positions in several tectonic units (Tatric/Fatric, Hronic, Silicic) of Central Western Carpathians. Paleokarst ediments and morphological forms provide an important record of the little known history of periods of uplift and erosion, mainly during the pre-Gosau period.

Key words: Karst, Tatric/Fatric, Hronic, Silicic

Introduction

The sedimentary record of the Central Western Carpathians (CWC) is dominated by marine sediments. A common feature of the CWC paleogeographical syntheses is that they are usually concerned with the paleogeography of basins. A proportionate place in the paleogeographical syntheses is not given to the neighbouring dry land, the source areas for the basins sedimentation. Among the wrongly neglected problems of the CWC paleoland, the problem of paleokarst is one of the most neglected. Looking for the paleotectonic roots of the Cretaceous karst in the CWC, the disintegration of Triassic carbonate platform complexes by rifting in Early Jurassic and the Cretaceous contraction and establishment of Paleoalpine tectonic units (cf. Plašienka, 1999) should be taken into account. Cretaceous karst phenomena is mainly developed in the carbonate complex of Middle/Upper Triassic age of the Hronic and Silicic cover nappe systems. In the western part of the CWC are predominant carbonate complexes belonging mainly to the Hronic and Fatric. In the eastern part, extensive areas of carbonate complexes of the Silicic predominate. Cretaceous paleokarst is notably developed mainly on Wetterstein and Gutenstein Limestones and Dolomites, Hauptdolomites and Steinalm, Tisovec, and Furmanec Limestones. Numerous present-day karst landforms and sediments are believed to have developed during the Cretaceous (Činčura, 1993, 1997, 1998). The lower boundary of the Cretaceous, Paleoalpine karst period is age-determined by the gradual emergence and termination of the marine deposition in the main tectonic units of the CWC (Činčura & Köhler, 1995). The karstification started in the southern paleogeographic zones of the CWC already in Early Cretaceous (in Silicic partly in Late Jurassic) and operated also during the extensive surface overthrusting, emplacement of the superficial nappes. In the northern paleogeographic zones prevailed the marine sedimentation with shorter breaks longer.

Cretaceous karst phenomena of the Tatric/Fatric

The Tatric and Fatric (Andrusov et al., 1973, Plašienka, 1999), belong to the northern superunits of the CWC. Pelagic sedimentation in CWC units was interrupted several times by deformations, uplift and emergence. On the top of the Urgonian limestones of the short living Urgonian carbonate platforms (northern Fatric-southern Tatric domains), traces of syngenetic karstification (Andrusov, 1959, Glazek, 1989) and hardgrounds (Rakús, 1997) - in our opinion microkarst (northern Fatric) - are known. Carbonate buildups grew on elevated parts of tilted blocks (Plašienka 1999). Immediately after its deposition and the syngenetic karstification, in the Albian times, the Urgonian carbonate platform was drowned and covered with pelagic sediments. The Praznov Formation overlies the Urgonian limestones with an unconformity which is represented by a phase of karstification (Činčura, in press) and a hardground (Rakús, 1997).

Cretaceous karst phenomena of the Hronic

The Hronic (Andrusov et al., 1973) belongs to the southern superunits of the CWC and represents a possible lateral paleogeographical analouge of the Silicic (Plašienka, 1999). The Hronic is characterised by a thick pile of marine carbonates of Middle/Upper Triassic age and only rudimentary preserved Jurassic-Early Cretaceous carbonate sequences. Paleokarst sediments repeatedly unconformably overly Triassic carbonates. Therefore it can be expected, that Jurassic and Early Cretaceous carbonate sequences were destroyed by the following Paleoalpine karst solution. This idea is supported, for example, by the occurrence of spicules of sponges and radiolarians in red clayey or silty matrix of the Valchov Conglomerates. Cretaceous karst developed on Middle/Upper Triassic carbonate complexes (mainly Gutenstein, Reifling, Wetterstein Limestones, Wetterstein Dolomite and Hauptdolomite). The lower boundary of the Creta

ceous (Paleoalpine karst period) karst is age-determined by the gradual emergence and termination of the marine deposition in the main tectonic units of the CWC - in the Hronic in ?Aptian (Činčura & Köhler, 1995). The uneven surface of the „quasi-platform„ basement, on many places made by carbonate complexes of the Hronic, was strongly corroded and karstified. Doline- and canyon-like depressions of the Cretaceous karst are rarely filled by bauxite. In Strážovské vrchy Mts. yellow, red and brown bauxites of Turonian age consist of hydrargillite, kaolinite, boehmite and colloidal hydrogoethite (Číčel, 1958, Borza & Martiny, 1964). In Malé (Brezovské) Karpaty Mts. red, lens-shaped, boehmite-kaolinite bauxite with chlorite is rather rare, red ferruginous silty clays are more frequent. Shallow karst depressions are often filled with red ferruginous clays. The clay fraction consists of chlorite, kaolinite, illite and illite/smectite (Činčura, 1997). Coarse breccias in Malé Karpaty (Kržľa Breccia, Michalík, 1984) are the products of the collapse of karstic cavities (Činčura, 1990). The clasts are mostly angular, their size varies from 0,1 up to 300 m³. Speleothems formed by coarse columnar or laminar calcite and lenticular beds of laminated marl with a horizon of weakly rounded gravel (sediments of a subterranean stream) in the breccia complex indicate a cave origin of the breccias. The areal and spacial extent of the breccia complex, indicates that an important cave system existed in the central part of Malé Karpaty Mts. before the transgression of the Paleogene sea (Činčura, 1992). Occurrences of longitudinal bodies of freshwater limestones have been known in the Brezovské Karpaty Mts. (Pustá Ves Formation, Michalík et al., 1993). Pebbles of such freshwater limestones were found in the Valchov Conglomerates. We regard the limestones as paleokarst sediments deposited in lacustrine basins (pre-Upper Cretaceous uvala-like depressions) developed especially on the surface of karstified carbonate complexes. The bottoms were flooded during heavy precipitation. Intermittent lakes originated with the growth of freshwater algae which contributed to the deposition of limestones. The end of the Cretaceous Paleoalpine karst period in the Hronic is connected with two transgressions. In the northern part of Malé Karpaty Mts. (Brezovské Karpaty) the upper boundary of the karstification if determined by the transgression of the Gosau (Valchov Conglomerates, Brezová Group) in Coniacian. In the middle part of the Malé Karpaty Mts. (Lower Eocene), in Strážovské vrchy Mts. (Lower Eocene), Liptov Basin (Middle-Late Eocene) were the karst forms and sediments sealed by the transgression of the Paleogene sea – Borové Formation (Činčura & Köhler, 1995).

Cretaceous karst phenomena of the Silicic

The Silicic belongs to the southern superunits of the WC and represents a possible lateral paleogeographical analouge of the Hronic (Plašienka, 1997). The Silicic is characterised by a more thousand metres thick pile of marine carbonates of Middle/Upper Tiassic age and only rudimentary preserved Jurassic carbonate sequences. Pa-

leokarst sediments of Cretaceous age unconformably overly Triassic carbonates.

Plateau paleokarst is a typical feature of Middle and Upper Triassic carbonate sequences of the Slovak Karst, Slovenský Raj and Muránska Planina. On the surface of paleokarst plateaux, a wide range of karst forms are present, especially different types of grikes and sinkholes, and sometimes valley sinks and inselbergs. Depressions filled with freshwater chalk rocks, or of banded series of light coloured graded siltstones and black mudstones are known (Mello & Snopková, 1973, Marschalko & Mello, 1992, Číček & Bednářová, 1994 Číček & Svobodová, 1999) in different quarries (Gombasek, Host'ovce, Včeláre) of paleokarst plateaux. According to plant pollen and spores the filling is of Upper Cretaceous (Santonian-Campanian) age. The depression near the Dobšiná Ice Cave represents a fallen block in a paleokarst plateau system - probably a Middle Cretaceous polje - which was later, during Upper Cretaceous filled by conglomerates of continental origin. From the bottom of this depression rises the Steinalm limestone mogot/hum of Ostrá Skala hill, which is surrounded by remnants of the fill of the depression: conglomerates of continental origin and freshwater limestones of Upper Cretaceous age (cf. Bystrický, 1978, Tulis & Novotný, 1989, Hovorka et al., 1990). The polje-like depression and the mogot/hum of Ostrá skala hill represent exhumed forms. The karst is clearly older than the fill of conglomerates of continental origin and freshwater limestones of Upper Cretaceous age. The exhumation of this paleokarst practically finished in Lower Miocene and new karst forms of the Miocene karst period started to develop in changed climatic conditions.

The deeply corroded carbonate „quasi-platform“ base-ment is partly covered by lateritic crusts and red ferruginous silt/clays. Boehmite-gibbsite bauxite fills a small canyon-like depression at Drienovec (Grečula et al., 1995). Occurrences of bauxite are known from the contact zone of the Silicic and the Hornád Basin at Markušovce (Zorkovský, 1952). Residual bauxitic iron ores occur locally on the surface of the Silica Plateau (Borza & Martiny, 1964). Red clays fill different karst depressions in Middle/Upper Triassic limestones.

The start of the Cretaceous karstification in the Silicic is indicated by the termination of marine deposition during the Tithonian. The end of the Paleoalpine karst period is connected in the northern part with the transgression of the Paleogene sea. In the Medvedia jaskyňa cave, which lies bellow the surface of the Glac paleokarst plateau remnants of sediments of the basal transgressive lithofacies are found. In the southern part the transgression progressed on the karstified surface to the north from Upper Cretaceous until Egerian.

Conclusions

1. Cretaceous karst phenomena of the Tatic/Fatric is represented by traces of syngenetic karstification and hardgrounds/microkarst on the top of the Urgonian limestones.

2. Doline- and canyon-like depressions, filled by red ferruginous clay and rarely bauxite, coarse collapse breccias, fresh water limestones deposited in uvala-like depressions are characteristic features of the Cretaceous karst of the Hronic.

3. Wide paleokarst plateaux, a Middle Cretaceous ?polje and a mogot belong to the most typical karst phenomena of the Silicic.

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