

Integrated stratigraphy of the Silurian of the Carnic Alps

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The Carnic Alps are located across the Italian-Austrian border. Here, one of the best exposed and most complete Palaeozoic successions in the world, ranging from the Middle Ordovician to the Upper Permian, occurs. Even if Silurian outcrops are irregularly distributed in the region, some reference sections for Silurian global studies (e.g., Cella, Rauchkofel Boden, Oberbuchach, Graptolithengraben, etc.) are here located. Main types of exposed rocks include shallow water bioclastic limestones, nautiloid-bearing limestones, limestones interbedded with shales, and black graptolitic shales and cherts (“lydites”). The overall thickness of Silurian strata does not exceed 60 m. The Silurian transgression in the region started at the beginning of the Llandovery. The duration of the gap separating the Ordovician and Silurian successions is highly variable, and embracing several conodont zones of Llandovery up to early Wenlock age. Depositional features suggest an overall transgressional regime acting from Llandovery to Ludlow times. Uniform calcareous deposits in the Prídoli indicate the establishment of a more stable condition in the Carnic region at the end of the Silurian. In terms of lithostratigraphy, three formations follow each other in the succession in the proximal (calcareous) parts of the basin: the Kok Fm. (Telychian-lower Ludfordian), the Cardiola Fm. (Ludfordian) and the Alticola Fm. (upper Ludfordian-lowermost Lochkovian). The last unit corresponds to the former Alticola Limestone and Megaerella Limestone. All the three units are mainly represented by bioclastic cephalopod-rich limestones, whose colour turns gradually from dark red and black in the lower Silurian to light grey-ochre in the Prídoli. Nautiloid cephalopods are very abundant; trilobites, bivalves and conodonts are common; crinoids, gastropods and rarer ostracods, brachiopods, and chitinozoans are present as well. Starting from the middle of Prídoli, in the shallower parts of the basin the Seekopf Fm. (Prídoli-Pragian) deposited; it consists of a mostly grayish lithoclastic limestone with abundant fossil debris. In the deeper part of the basin, the Silurian corresponds to the up to 80 m thick Bischofalm Fm. It consists of black siliceous shales with interbeds of chert and clayish alum slate, mainly deposited in an euxinic environment. Graptolites are generally abundant in these rocks. Alternating black graptolitic shales, marls and limestones of the Nölbling Fm. were deposited in intermediate conditions between calcareous and shaley facies. Both the Bischofalm Fm. and the Nölbling Fm. range from the Rhuddanian to the Lochkovian. A precise biostratigraphy of these units has been mainly obtained thanks to rich conodont and graptolite faunas.