

# Plöcken Formation

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Österreichische Karte 1:50.000  
Blatt BMN 197 Kötschach  
Blatt BMN 198 Weißbriach  
Blatt BMN 199 Hermagor

Carta Topografica d'Italia 1:50.000  
Foglio 018 Passo di Monte Croce Carnico  
Foglio 032 Tolmezzo

Blatt UTM 3109 Oberdrauburg  
Blatt UTM 3110 Kötschach-Mauthen  
Blatt UTM 3116 Sonnenalpe Naßfeld  
Blatt UTM 3117 Nötsch im Gailtal

## Definition

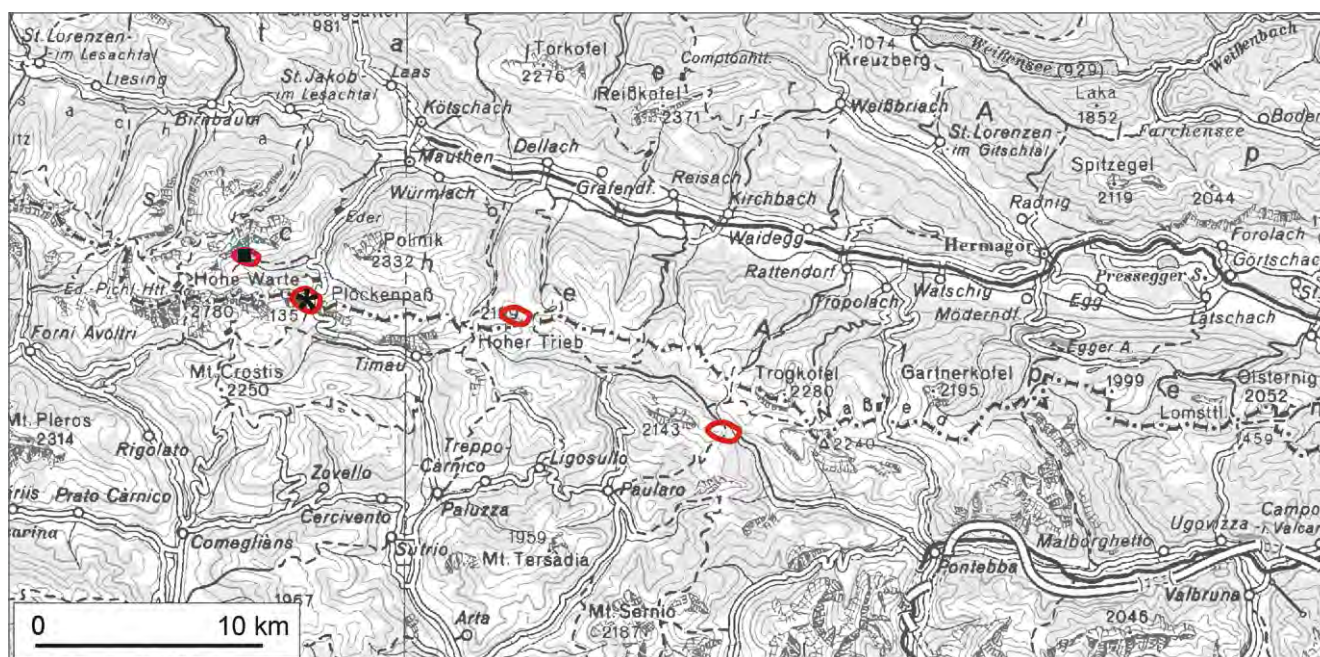
Coarse-grained indistinctly bedded impure grayish to blackish limestones, which grade into calcareous pyritiferous sandstones.

## Description

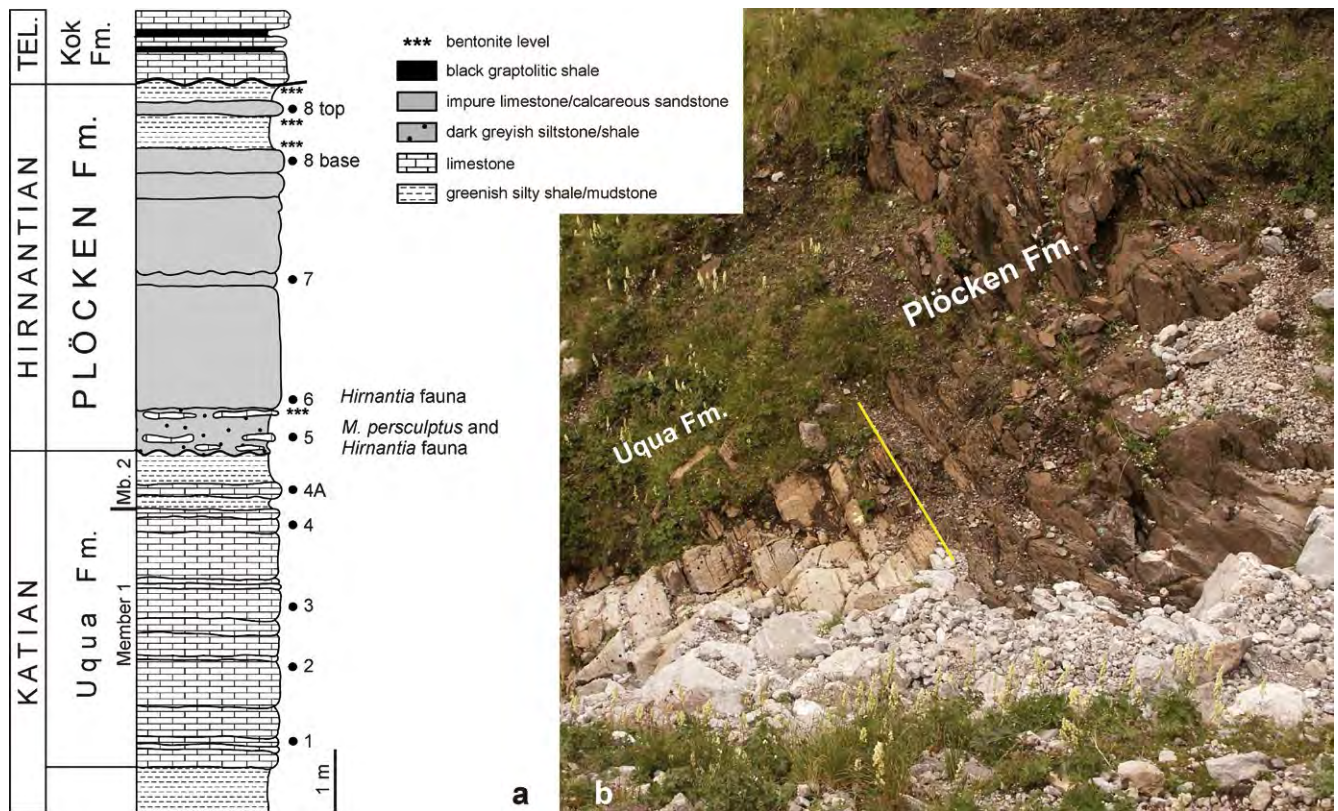
In the lower part of the indistinctly bedded Plöcken Formation grayish shales to siltstones occur followed by impure limestones with contorted deformation structures, slumpings, channel fillings, graded beds. Loosely packed matrix-supported subangular clasts of varying composition and the accumulation of fossil debris are common. This part strongly resembles diamictites. The upper part is composed of calcareous pyritiferous sandstones. Fossils comprise very few graptolites, brachiopods belonging to the *Hirnantia* Fauna and conodonts.

## Fossil content

Acritarchs, bivalves, brachiopods, cephalopods, chitinozoans, conodonts, echinoderms, foraminifers, gastropods, graptolites, ostracodes, sponge spiculae, trilobites.



Areas of outcrop of the Plöcken Formation with indication of the stratotype (asterisk) and reference section (square).



The Cellon Section. a) log of the Ordovician part of the section (modified after SCHÖNLAUB et al., 2011); b) view of the section (photo H.P. SCHÖNLAUB).

## Depositional environment

Marine sediments, which are strongly marked by the Late Ordovician glacial event. The influence of the Hirnantian ice age is characterized by diamictites, channeling, erosion and local non-deposition (SCHÖNLAUB, 2000; SCHÖNLAUB et al., 2011; HAMMARLUND et al., 2012).

## Stratotype

Cellon Section (Beds 5-8 after WALLISER, 1964), located in an avalanche gorge in the eastern slope of Mt. Cellon/Creta di Collinetta (GAERTNER, 1931) at coordinates N 46°36'32", E 13°29'03".

## Reference sections

Rauchkofel South Section (SCHÖNLAUB, 1971, 1988), located on the southern slope of Mt. Rauchkofel, at coordinates N 46°36'58.5", E 12°53'23.0", where clear evidence of diamictite layers is present.

## Type area

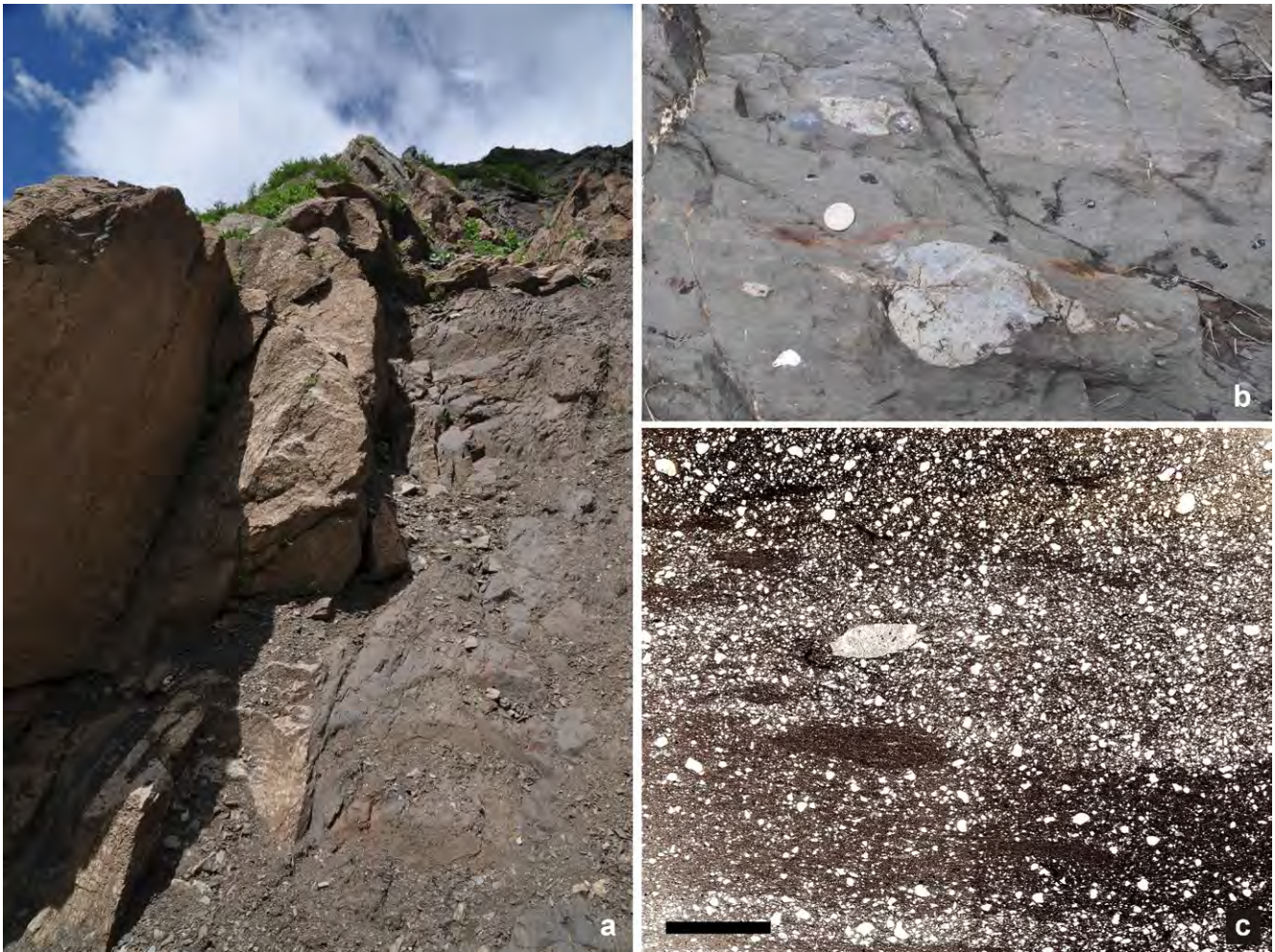
Central Carnic Alps.

## Main outcrop areas

Plöckenpass, Uqua Valley, Western Karavanke Alps, Hoher Trieb-Elferspitz, Oberbuchach, Nöblinggraben, Rauchkofel South, Mt. Pizzul.

## Thickness

From 1.5 to a maximum of 9 m at the Rauchkofel South section (6.17 m at the Cellon Stratotype).



Views of the Plöcken Formation at Rauchkofel South Section. a) view of the section (photo H.P. SCHÖNLAUB); b) detail of the Plöcken Formation containing ice-rafted (?) carbonate lithoclasts (photo H.P. SCHÖNLAUB); c) micrograph of diamictite (photo H.P. SCHÖNLAUB).

## Boundaries

*Underlying units* – Uqua Formation (disconformable contact).

*Overlying units* – Kok Formation (disconformable contact).

*Lateral units* – Bischofalm Formation (?).

## Derivation of name

After the geographic designation “Plöcken” in the central Carnic Alps.

## Synonymy

Untere Schichten: GAERTNER (1931).

Bereich I [partim]: WALLISER (1964).

Mikrofazies-Schicht 2: “Schillsandstein” und Mikrofazies-Schicht 3 “Gradierte Sandsteine”: SCHÖNLAUB (1969).

Grès Fins et Siltstones: VAI (1971).

Grès Moyens: VAI (1971).

Plöcken-Formation: SCHÖNLAUB et al. (1994), SUTTNER et al. (2014).

## Chronostratigraphic age

Ordovician: Hirnantian.

## Biostratigraphy

*Conodonts*. – *Amorphognathus ordovicicus* Zone (FERRETTI & SCHÖNLAUB, 2001).

*Graptolites*. – *Metabolograptus persculptus* Zone (ŠTORCH & SCHÖNLAUB, 2012).

*Chitinozoans*. – *Tanuchitina elongata* Zone (PRIEWALDER, 1997).

## Complementary references

*Geochemistry*. – SCHÖNLAUB et al. (2011). Iron, sulfur and carbon isotope geochemistry has been recently investigated. A distinctive carbonate  $\delta^{13}\text{C}$  excursion occurring at the unconformity between the underlying Uqua Formation and the Plöcken Formation in the Cellon section has been correlated with the prominent HICE carbonate  $\delta^{13}\text{C}$  peak (BERGSTRÖM et al., 2009), confirming the Hirnantian age of the Plöcken Formation (SCHÖNLAUB et al., 2011).

The diagnostic brachiopod *Hirnantia* Fauna is reported as well at the base of the formation (SCHÖNLAUB et al., 2011 and references therein).

## Remarks

The conodont fauna so far recorded from the Cellon Section (FERRETTI & SCHÖNLAUB, 2001) represents the only Hirnantian conodont fauna recorded and described along the Ordovician northern Gondwana margin. Several K-bentonites levels (asterisks in the log of Cellon Section) were described and discussed by HISTON et al. (2007).

In the western Karavanke Alps the equivalents of the Uqua Formation are exposed in the Feistritzgraben section (JAEGER et al., 1975; SCHÖNLAUB, 1980).

## References

- BERGSTRÖM, S.M., CHEN, X., GUTIÉRREZ-MARCO, J.-C. & DRONOV, A. (2009): The new chronostratigraphic classification of the Ordovician System and its relations to regional series and stages and to  $\delta^{13}\text{C}$  chemostratigraphy. – *Lethaia*, **42**, 97–107, Oslo.
- FERRETTI, A. & SCHÖNLAUB, H.P. (2001): New conodont faunas from the Late Ordovician of the Central Carnic Alps, Austria. – *Bollettino della Società Paleontologica Italiana*, **40**/1, 3–15, Modena.
- GAERTNER, H.R. von (1931): *Geologie der Zentralkarnischen Alpen*. – Denkschrift der Österreichischen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Abteilung 1, **102**, 113–199, Wien.
- HAMMARLUND, E.U., DAHL, T.W., HARPER, D.A.T., BOND, D.P.G., NIELSEN, A.T., BJERRUM, C.J., SCHOVSBO, N.H., SCHÖNLAUB, H.P., ZALASIEWICZ, J.A. & CANFIELD, D.E. (2012): A sulfidic driver for the end-Ordovician mass extinction. – *Earth and Planetary Science Letters*, **331–332**, 128–139, Amsterdam.
- HISTON, K., KLEIN, P., SCHÖNLAUB, H.P. & HUFF, W.D. (2007): Lower Paleozoic K-bentonites from the Carnic Alps, Austria. – *Mitteilungen der Österreichischen Geologischen Gesellschaft*, **100**, 26–42, Wien.
- JAEGER, H., HAVLICEK, V. & SCHÖNLAUB, H.P. (1975): *Biostratigraphie der Ordovizium/Silur-Grenze in den Südalpen – Ein Beitrag zur Diskussion um die Hirnantia-Fauna*. – *Verhandlungen der Geologischen Bundesanstalt*, **1975**, 271–289, Wien.
- PRIEWALDER, H. (1997): The distribution of the Chitinozoans in the Cellon Section (Hirnantian – Lower Lochkovian) – A preliminary report. – In: SCHÖNLAUB, H.P. (ed.): *IGCP-421 North Gondwanan Mid-Palaeozoic Biodynamics, Guidebook*. – *Berichte der Geologischen Bundesanstalt*, **40**, 74–85, Wien.
- SCHÖNLAUB, H.P. (1969): Das Paläozoikum zwischen Bischofalm und Hohem Trieb (Zentrale Karnische Alpen). – *Jahrbuch der Geologischen Bundesanstalt*, **112**/2, 265–320, Wien.
- SCHÖNLAUB, H.P. (1971): *Paleoenvironmental Studies at the Boundary Ordovician/Silurian in the Carnic Alps*. – *Mémoires du Bureau de Recherches géologiques et Minières*, **73**, 367–376, Paris.
- SCHÖNLAUB, H.P. (1980): Carnic Alps. Field Trip A. with contributions from JAEGER, H., HOUSE, M.R., PRICE, J.D., GÖDDERTZ, B., PRIEWALDER, H., WALLISER, O.H., KRÍŽ, J., HAAS, W. & VAI, G.B. – In: SCHÖNLAUB, H.P. (ed.): *Second European Conodont Symposium, ECOS II, Guidebook, Abstracts*. – *Abhandlungen der Geologischen Bundesanstalt*, **35**, 5–57, Wien.
- SCHÖNLAUB, H.P. (1988): The Ordovician-Silurian boundary in the Carnic Alps of Austria. – In: COCKS, L.R.M. & RICKARDS, R.B. (eds.): *A Global Analysis of the Ordovician - Silurian Boundary*. – *Bulletin of the British Museum (Natural History), Geology*, **43**, 107–115, London.
- SCHÖNLAUB, H.P. (2000): The Ordovician of the Southern Alps. – *Mitteilungen der Österreichischen Geologischen Gesellschaft*, **91**, 39–51, Wien.
- SCHÖNLAUB, H.P., KREUTZER, L.H. & PRIEWALDER, H. (1994): Section 2 - Cellon section – In: SCHÖNLAUB, H.P. (ed.): *Field Meeting Eastern + Southern Alps, Austria, Guidebook + Abstracts*. – *Berichte der Geologischen Bundesanstalt*, **30**, 83–93, Wien.
- SCHÖNLAUB, H.P., FERRETTI, A., GAGGERO, L., HAMMARLUND, E., HARPER, D.A.T., HISTON, K., PRIEWALDER, H., SPÖTL, C., ŠTORCH, P. (2011): The Late Ordovician glacial event in the Carnic Alps (Austria). – In: GUTIÉRREZ-MARCO, J.C., RÁBANO, I., GARCÍA-BELLIDO, D. (eds.): *Ordovician of the World*. – *Instituto Geológico y Minero de España, Cuadernos del Museo Geominero*, **14**, 515–526, Madrid.
- ŠTORCH, P. & SCHÖNLAUB, H.P. (2012): Ordovician-Silurian boundary graptolites of the Southern Alps, Austria. – *Bulletin of Geosciences*, **87**/3, 755–766, Prague.
- SUTTNER, T.J., SCHÖNLAUB, H.P. & FERRETTI, A. (2014): Plöcken-Formation/Plöcken Formation. – In: PILLER, W.E. (ed.): *The lithostratigraphic units of the Austrian Stratigraphic Chart 2004 (sedimentary successions), Vol. I - The Paleozoic Era(them)*. – *Abhandlungen der Geologischen Bundesanstalt*, **66**, 66, Wien.
- VAI, G.B. (1971): Ordovicien des Alpes Carniques. – *Mémoires du Bureau de Recherches géologiques Minières*, **73**, 437–449, Paris.
- WALLISER, O.H. (1964): Conodonten des Silurs. – *Abhandlungen des Hessischen Landes-Amtes für Bodenforschung*, **41**, 1–106, Wiesbaden.