

Cardiola Formation

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Österreichische Karte 1:50.000
Blatt BMN 197 Kötschach

Blatt UTM 3109 Oberdrauburg
Blatt UTM 3110 Kötschach-Mauthen
Blatt UTM 3116 Sonnenalpe Naßfeld

Carta Topografica d'Italia 1:50.000
Foglio 018 Passo di Monte Croce Carnico
Foglio 031 Ampezzo
Foglio 032 Tolmezzo

Definition

Alternating black nautiloid limestone (wackestone-packstone), marl and shale.

Description

The Cardiola Formation is constituted by dark gray to black shales with limestone intercalations as thin, planar to hummocky-laminated fine-grained calcareous levels and calcisiltites. Orthoconic nautiloid conchs are quite abundant and commonly oriented parallel to bedding surface. A distinctive and spectacular *Cardiola*-dominated molluscan fauna, for which the formation was originally named, developed in association with cephalopods.

Fossil content

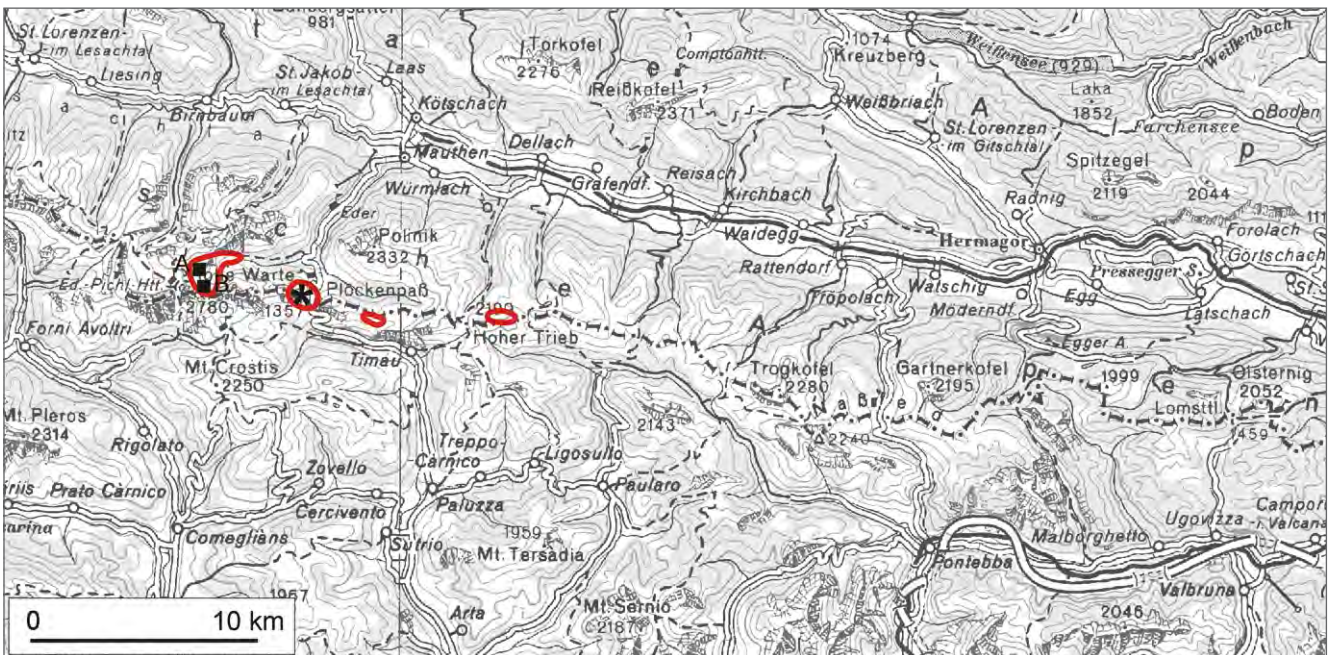
Acritarchs, bivalves, brachiopods, cephalopods, chitinozoans, conodonts, corals, graptolites, radiolarians, trilobites.

Depositional environment

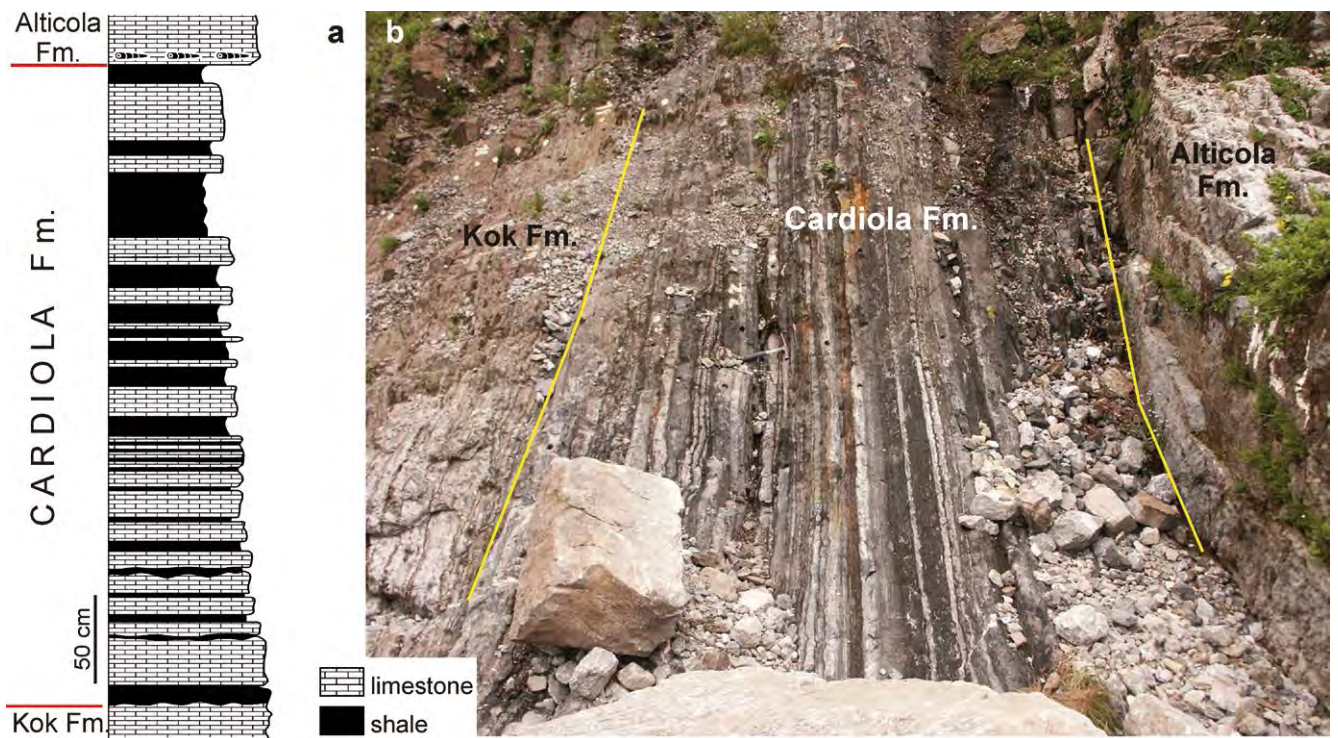
Moderately deep shelf.

Stratotype

Cellon Section (beds 20-24A in WALLISER, 1964), located in the eastern slope of Mt. Cellon/Creta di Collinetta, at coordinates N 46°36'32", E 12°56'30".



Main areal distribution of the Cardiola Formation in the Western Carnic Alps with indication of the stratotype (asterisk) and of the reference sections (squares). Asterisk: Cellon Section; A: Rauchkofel Boden Section; B: Lower Seewarte Base Section.



The Cellon Section. a) detailed log of the Cardiola Formation (modified after BRETT et al., 2009); b) overview photo of the Cardiola Formation (photo H.P. SCHÖNLAUB).

Reference sections

Lower Seewarte Base Section (SCHÖNLAUB, 1980), located in the southern flank of Wolayer valley at coordinates N 46°36'48", E 12°52'45", where a shallow-water facies is better exposed.

Rauchkofel Boden Section (SCHÖNLAUB, 1980) located on the southern slope of Mt. Rauchkofel at coordinates N 46°36'53.5", E 12°52'33.0", exposing contacts with underlying and overlying units in a shallow-water context.

Type area

Central Carnic Alps.

Main outcrop areas

The unit has been documented in Mt. Rauchkofel-Valentintörl, Mt. Cellon, Freikofel and Hoher Trieb areas.

Thickness

Thickness is variable, with a maximum value of ca. 3-4 m.

Boundaries

Underlying units – Kok Formation (conformable, sharp contact).

Overlying units – Alticola Formation (conformable, sharp contact).

Lateral units – Nölbling Formation.

Derivation of name

After the bivalve Genus *Cardiola* BRODERIP (in MURCHISON, 1839).

Synonymy

Untersilurische Schichten [partim]: STACHE (1874).

Cardiola-Horizont: STACHE (1874).

Grauer Plattenkalk: FRECH (1887).

Cardiola-Niveau: GEYER (1894).



Detail of the planar laminated fine-grained calcareous levels of the Cardiola Formation exposed in the Cellon Section (photo H.P. SCHÖNLAUB).

Cardiola-Schichten: GEYER (1894).
 Bunte Flaser- oder Bänderkalke und Kalkphyllite des Obersilur [partim]: GEYER (1899).
 Cardiolaniveau: GAERTNER (1931).
 Cardiola Beds: SCHÖNLAUB (1970).
 Cardiola Beds: SCHÖNLAUB (1980).
 Calcarei a *Cardiola*: VAI et al. (2002).
 Livello a *Cardiola*: CARULLI (2006).

Chronostratigraphic age

Silurian: Ludlow (Ludfordian).

Biostratigraphy

Conodonts. – *Ancoradella ploeckensis*-*Polygnathoides siluricus* zones (WALLISER, 1964; CORRADINI et al., 2015 and references therein).

Graptolites. – *M. bohemicus* group (JAEGER, 1975).

Chitinozoans. – ?*Angochitina elongata* Zone (PRIEWALDER, 1997) (see remarks below).

Complementary references

Sequence stratigraphy. – BRETT et al. (2007, 2009).

Taphonomy, sedimentology and microfacies analysis. – FLÜGEL (1965); KREUTZER (1992); FERRETTI & HISTON (1997); HISTON (2012, and references therein).

Paleocommunities. – VAI (1999).

Geochemistry. – TIETZ (1976).

Isotopes. – SCHÖNLAUB (1994); WENZEL (1997); JEPPSSON et al. (2012).

Remarks

The name *Cardiola* has been used for a long-time for this formation to document its peculiar bivalve association. Adaptation to the unique Silurian environment of the cephalopod limestone biofacies led in fact to the evolution of the *Praecardiina* bivalves (*Cardiola* in primis), which became cosmopolitan in northern peri-Gondwana (Bohemia, Sardinia, Spain, Montagne Noire, etc.; COPE & KRÍŽ, 2013). The paleogeographic significance of *Cardiola*-dominated communities makes the *Cardiola* Formation a distinctive marker interval for precise correlations outside the Carnic Alps (JAEGER, 1976).

PRIEWALDER (1997) only tentatively referred the chitinozoan association from the upper part of the Kok Formation and the *Cardiola* Formation to the *Angochitina elongata* Zone (most of taxa were identified in open nomenclature).

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