

Derivation of name: After the Steilbachgraben (N 47°26'22" / E 14°29'57" to N 47°26'26" / E 14°30'06") NE of Hohentauern (N 47°26'04" / E 14°29'01"), ÖK50-UTM, map sheet 4214 Trieben (ÖK 50-BMN, map sheet 130 Trieben).

Synonyms: Steilbach Formation in the ASC 2004. "Magnesit Karbon" (EBNER, 1997) according to the magnesite deposits in the Steilbachgraben Formation. The sparry magnesite of the Veitsch Nappe is known in the international mineral deposits' literature as "Veitsch type magnesite" (EBNER et al., 2004a, b).

Lithology: Fine grained clastics with intercalations of sandstone and layers/lenses of grey, bedded limestones and dolomites. Lenses and irregular stocks of sparry magnesite are included in the dolomitic parts. Intercalations of volcanic layers (metatuffs) derived from tholeiitic intraplate basalts occur outside the type area (PROCHASKA & EBNER, 1989). Some layers of gypsum and anhydrite are known from clastic sediments closely related to the magnesite deposits of Hohentauern (PETRASCHECK, 1978) and Oberdorf (SCHROLL et al., 1989).

Fossils: Corals, brachiopods, crinoids, trilobites, gastropods, agglutinated foraminifers, spicula, ostracods especially from the Hohentauern area and the abandoned magnesite mine in Veitsch (ÖK50-UTM, map sheet 4211 Neuberg an der Mürz, ÖK50-BMN, map sheet 103 Kindberg) (HERITSCH, 1907, 1917a, 1933a; KLEBELSBERG, 1927; KOCH, 1893; FELSER, 1977; HAHN & HAHN, 1977; KRÄINER, 1992, 1993a).

Origin, facies: Shallow marine, mixed siliciclastic-carbonatic shelf environment formed in a marine foredeep (molasse) environment after an early Carboniferous orogeny (FLÜGEL, 1977; KRÄINER, 1992; EBNER, 1992; EBNER et al., 2007, 2008).

Chronostratigraphic age: Lower Carboniferous (?Tournaisian–upper Visean). $\delta^{34}\text{S}$ values of gypsum/anhydrite intercalations indicate Carboniferous ages (PETRASCHECK, 1978; SCHROLL et al., 1989). $^{86}\text{Sr}/^{87}\text{Sr}$ ratios from limestones are increased relative to the Visean seawater curve (EBNER et al., 2008; AZIM-ZADEH et al., 2008).

Biostratigraphy: Trilobites indicate the lower Visean (HAHN & HAHN, 1977) and corals upper Visean *Dibunophyllum* Zone (H. FLÜGEL, 1975; FELSER, 1977).

Thickness: Up to 230 m.

Lithostratigraphically higher rank unit: Veitsch Group (NEUBAUER et al., 1994).

Lithostratigraphic subdivision: -

Underlying unit(s): Middle Austroalpine Crystalline unit (tectonic contact) (TOLLMANN, 1977; RANTITSCH et al., 2004; NEUBAUER et al., 1994).

Overlying unit(s): Triebenstein Formation.

Lateral unit(s): Clastic sediments (RATSCHBACHER, 1984, 1987) and other parts of the "Magnesite Carboniferous".

Geographic distribution: E-GWZ; Styria, Lower Austria.

Remarks: In ASC 2004 this formation is wrongly named "Steilbach-Formation" instead of Steilbachgraben Formation.

Complementary references: SCHÖNLAUB (1979, 1980a), EBNER et al. (1989, 1991), KRÄINER (1993a), EBNER & PROCHASKA (2001).

Triebenstein-Formation / Triebenstein Formation

FRITZ EBNER

Validity: Valid; first nomination by RUMPF (1874), formal description by RATSCHBACHER (1984).

Type area: Rottenmanner Tauern, ÖK50-UTM, map sheet 4214 Trieben (ÖK50-BMN, map sheet 130 Trieben).

Type section: At mountain Triebenstein (N 47°26'43" / E 14°29'14") north of Hohentauern (N 47°26'04" / E 14°29'01"). Section 7 (RATSCHBACHER, 1984: Fig. 3) represents only a small part (~ 60 m) of the formation.

Reference section(s): -

Derivation of name: After the mountain Triebenstein (N 47°26'43" / E 14°29'14") north of Hohentauern (N 47°26'04" / E 14°29'01"), ÖK50-UTM, map sheet 4214 Trieben (ÖK50-BMN, map sheet 130 Trieben).

Synonyms: "Triebensteinkalk" in the older literature (HERITSCH, 1933a; TOLLMANN, 1977) before formalization by RATSCHBACHER (1984); "Triebensteinkalkmarmor" (RATSCHBACHER, 1984).

Lithology: Bedded, partly fossiliferous limestone marbles with metapelitic and rare metapsammitic/psephitic intercalations. Locally lenses of pure limestone marbles of greater thickness (RATSCHBACHER, 1984).

Fossils: Crinoids, corals, brachiopods, bivalves in the lower parts (HERITSCH, 1908, 1917a, 1933a).

Origin, facies: Carbonatic shelf facies interfingering with individual bioherms.

Chronostratigraphic age: Uppermost Visean–Serpukhovian.

Biostratigraphy: Lower parts within the *Dibunophyllum* Zone (HERITSCH, 1933a; FELSER, 1977).

Thickness: 35–300 m (RATSCHBACHER, 1984).

Lithostratigraphically higher rank unit: Veitsch Group (NEUBAUER et al., 1994)

Lithostratigraphic subdivision: -

Underlying unit(s): Steilbachgraben Formation (note typological error "Steilbach-Formation" in the ASC 2004).

Overlying unit(s): Sunk Formation.

Lateral unit(s): -

Geographic distribution: E-GWZ; Styria, Rottenmanner Tauern.

Remarks: -

Complementary references: TOLLMANN (1977), SCHÖNLAUB (1979, 1980a), EBNER et al. (1989, 1991, 2007, 2008), KRÄINER (1992, 1993a), EBNER & PROCHASKA (2001).

Sunk-Formation / Sunk Formation

FRITZ EBNER

Validity: Valid; formal description by RATSCHBACHER (1984).

Type area: Rottenmanner Tauern, ÖK50-UTM, map sheet 4214 Trieben (ÖK50-BMN, map sheet 130 Trieben).

Type section: Sections 1–6 (RATSCHBACHER, 1984: Fig. 3) around the abandoned graphite mine Sunk (N 47°27'49" / E 14°28'29") 3.4 km N of Hohentauern (N 47°26'04" / E 14°29'01"), ÖK50-UTM, map sheet 4214 Trieben (ÖK50-BMN, map sheet 130 Trieben).

Reference section(s): -

Derivation of name: After the valley “Sunk” N of Hohentauern between (N 47°27'12" / E 14°28'11") and the Triebenbachtal (N 47°27'45" / E 14°29'08"), ÖK50-UTM, map sheet 4214 Trieben (ÖK50-BMN, map sheet 130 Trieben).

Synonyms: “Graphitführende Serie des Oberkarbon” (HERITSCH, 1911); “Graphitkarbon” (HAMMER, 1924).

Lithology: Coarsening upward sequence of graphitic metapelites, -psammites and -psephites, locally with thin carbonate intercalations with debris of bivalves and crinoids. Lenses of graphite are intercalated at several localities.

Fossils: Plant fossils are concentrated in some localities from Semmering in the E as far as to Lassing in the W (TOULA, 1877; GLAESSNER, 1935; JONGMANS, 1938; VAN AMERON & BOERSMA, 1974).

Origin, facies: River dominated delta facies near to a regressive shoreline with distributary bay deposits and channel fillings (RATSCHBACHER, 1984, 1987; KRAINER, 1992, 1993a).

Chronostratigraphic age: Bashkirian–Moskovan (TENCHOV, 1980; KRAINER, 1993a).

Biostratigraphy: Stratigraphic important floral elements: *Alethopteris lonchitica* (main occurrence Westfalian A); *Alethopteris decurrens* and *Neuropteris heterophyllia* (upper Westfalian A–lower Westfalian C); *Sphenophyllum cuneifo-*

lium (extinction in lower Westfalian C); *Linopteris cf. regniezii* (Westfalian C) (STUR, 1871, 1883; JONGMANS, 1938; VAN AMERON & BOERSMA, 1974; TENCHOV, 1980; WAGNER, 1984; KRAINER, 1992).

Thickness: 50–150 m.

Lithostratigraphically higher rank unit: Veitsch Group (NEUBAUER et al., 1994).

Lithostratigraphic subdivision: -

Underlying unit(s): Triebenstein Formation.

Overlying unit(s): Only at one locality (?) Permian pinkish metaclastics (Graschnitz Formation; NEUBAUER, 1983); in other localities tectonic contact to the higher Alpine thrust units/sheets of the Greywacke Zone (NEUBAUER et al., 1994).

Lateral unit(s): -

Geographic distribution: E-GWZ; Styria to Lower Austria.

Remarks: The formation includes the operating graphite mine of Kaisersberg (N 47°20'05" / E 14°58'29"), ÖK50-UTM, map sheet 4221 Knittelfeld (ÖK50-BMN, map sheet 132 Trofaiach) and other abandoned graphite operations of the Graphite district Veitsch Nappe (EBNER, 1997; WEBER, 1997a, b).

Complementary references: TOLLMANN (1977), BERGER (1950), SCHÖNLAUB (1979, 1980a), EBNER et al., (1989, 1991, 2007, 2008), EBNER & PROCHASKA (2001).

Gurktaler Deckensystem / Gurktal Nappe System

The Gurktal Nappe System contains Ordovician to lower Carboniferous basement sequences and upper Carboniferous to Triassic, and Upper Cretaceous to Paleogene cover sequences. In general, the nappe complex is subdivided into two major tectonic units, the lower, low grade metamorphic Murau Nappe and the higher, very low to low grade metamorphic Stolzalpe Nappe. Both nappes contain Lower Paleozoic successions with similar stratigraphic trends but striking differences in detail (FLÜGEL & NEUBAUER, 1984; NEUBAUER & PISTOTNIK, 1984). Additionally, a nappe of medium grade metamorphics (Ackerl Nappe) occurs in the uppermost structural position (GOSEN et al., 1985; NEUBAUER & PISTOTNIK, 1984).

Murau Nappe

The basal sequence of the Murau Nappe consists of phyllites with prasinites and greenschists derived from lava flows, sills and tuffs which are overlain by a phyllite-rich unit.

Carbonatic phyllites, black phyllites, and quartzites with minor greenstones and orthoquartzites build up the next higher stratigraphic unit; at the southern border of the Gurktal Nappe System widespread acidic volcanoclastics occur. The overlying sequence is characterized by laterally differentiated upper Silurian to Lower Devonian carbonates.

Stolzalpe Nappe

Basal parts of the Stolzalpe Nappe are almost similar to those of the Murau Nappe consisting of mafic volcanic sequences. These sequences are divided into the Middle to Upper Ordovician Magdalensberg Group and the Nock Group which represents the Upper Ordovician followed by the volcanic lower to middle Silurian Eisenhut Group at the

northern edge of the Gurktal Nappe System. These volcanic successions are overlain by sequences dominated by pelitic-psammitic rocks passing into pelagic deposits at the top.

The Gurktal Nappe System is tectonically underlain by Middle Austroalpine units (sensu TOLLMANN, 1977).

Magdalensberg-Gruppe; Kaser-Gruppe; „Metadiabase“ / Magdalensberg Group; Kaser Group; “Metadiabase”

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Validity: Invalid; first observed by ROSTHORN & CANAVAL (1853); further paleontological and sedimentological research by KAHLER (1953), RIEHL-HERWIRSCH (1970), REITZ (1994) and THIEDIG (2005).

Type area: ÖK50-UTM, map sheets 3106 Radenthein, 4102 Althofen, 4107 Klagenfurt, 4108 Sankt Veit an der Glan (ÖK50-BMN, map sheets 184 Ebene Reichenau, 186 Sankt Veit an der Glan, 202 Klagenfurt, 203 Maria Saal).

Type section: -

Reference section(s): Magdalensberg south of St. Paul (N 46°43'38" / E 14°25'45"), Paule Quarry which is located approx. 1.5 km northeast of St. Donat, Christofberg near Brückl (N 46°42'40" / E 14°28'53"), exposures along the road between Brückl and St. Veit an der Glan (all outcrops show parts of the Magdalensberg Group); Frauenalpe (locality where the “Metadiabasserie” is outcropping; compare THURNER, 1931); north of Gesgeralm (N 46°55'13" / E 13°54'07"), western cliffs of Engeleriegel, outcrops near the Michelealm, southwest of Lake Zelin, northwest of the Rapitzsattel and the Speikkofel (latter six localities expose deposits of the Kaser Group).

Austrian Stratigraphic Chart 2004 - Paleozoic

(sedimentary successions)

Austrian Stratigraphic Commission



ERA	SYSTEM / PERIOD / SERIES / EPOCH	STAGE / AGE	DURATION Ma	Global Classification					
				ERATHM / ERA	SYSTEM / PERIOD / SERIES / EPOCH				
PALEOZOIC	PERMIAN	CHANGHSINGIAN / Dorashanian	251	PERMIAN	MID PERMIAN / GUADALUPIAN / LOPINGIAN				
		WUCHIAPINGIAN / Dzhulfian	255						
		CAPITANIAN	260						
		WORDIAN	265						
		ROADIAN	270						
		PERMIAN	LOWER PERMIAN / CISURALIAN			KUNGURIAN	275		
						ARTINSKIAN	280		
						SAKMARIAN	285		
						ASSELIAN	290		
		PERMIAN	TRIAS			GZHELIAN	295	TRIAS	U. CARBONIFEROUS / PENNSYLVANIAN
KASIMOVIAN	300								
MOSKOVIAN	305								
BASHKIRIAN	310								
TRIAS	LOWER CARBONIFEROUS / MISSISSIPPIAN			SERPUKHOVIAN	315				
				VISEAN	320				
				TOURNAISIAN	325				
PERMIAN	DEVONIAN			FAMENNIAN	350	DEVONIAN	UPPER DEVONIAN		
				FRASNIAN	355				
				GIVETIAN	360				
		EIFELIAN	365						
		DEVONIAN	LOWER DEVONIAN	EMSIAN	370				
				LOCHKOVIAN	375				
		PERMIAN	DEVONIAN	LUDFORDIAN / GORSTIAN	380			DEVONIAN	MIDDLE DEVONIAN
				HOMERIAN / SHEINWOOD	385				
				TELYCHIAN	390				
				AERONIAN	395				
RHUDDANIAN	400								
DEVONIAN	UPPER ORDOVICIAN			DARRIWILIAN	405				
				TREMA-DOCIAN	410				
PERMIAN	DEVONIAN			WEN-LUD-LOCK / LOW	415	DEVONIAN	LOWER DEVONIAN		
				HORNBLAND / GORSTIAN	420				
				PRAGIAN	425				
		LOCHKOVIAN	430						
		DEVONIAN	MIDDLE DEVONIAN	EMSIAN	435				
				LOCHKOVIAN	440				
		PERMIAN	DEVONIAN	LUDFORDIAN / GORSTIAN	445			DEVONIAN	UPPER DEVONIAN
				HOMERIAN / SHEINWOOD	450				
				TELYCHIAN	455				
				AERONIAN	460				
RHUDDANIAN	465								
DEVONIAN	UPPER ORDOVICIAN			DARRIWILIAN	470				
				TREMA-DOCIAN	475				
PERMIAN	DEVONIAN			WEN-LUD-LOCK / LOW	480	DEVONIAN	LOWER DEVONIAN		
				HORNBLAND / GORSTIAN	485				
				PRAGIAN	490				
		LOCHKOVIAN	495						
		DEVONIAN	UPPER ORDOVICIAN	DARRIWILIAN	500				
				TREMA-DOCIAN	505				
		PERMIAN	DEVONIAN	LUDFORDIAN / GORSTIAN	510			DEVONIAN	UPPER DEVONIAN
				HOMERIAN / SHEINWOOD	515				
				TELYCHIAN	520				
				AERONIAN	525				
RHUDDANIAN	530								
DEVONIAN	UPPER ORDOVICIAN			DARRIWILIAN	535				
				TREMA-DOCIAN	540				
PERMIAN	DEVONIAN			WEN-LUD-LOCK / LOW	545	DEVONIAN	LOWER DEVONIAN		
				HORNBLAND / GORSTIAN	550				
				PRAGIAN	555				
		LOCHKOVIAN	560						
		DEVONIAN	UPPER ORDOVICIAN	DARRIWILIAN	565				
				TREMA-DOCIAN	570				



- Legend**
- pelagic, offshore, siliciclastic
 - pelagic, nearshore, calcareous
 - shallow marin, neritic
 - terrestrial-continental, coarse clastic
 - terrestrial-continental, fine clastic
 - evaporite (chloride, sulphate)
 - rhyolite, dacite
 - (basaltic) andesite, trachyandesite
 - basalt
 - phyllite
 - mixed-facies (in corresponding colors)
 - coal (may include several seams)
 - ? position/age doubtful/controversial
 - | equal units
 - \ older unit left \ younger unit right
 - hiatus
 - unconformity
 - GSSP
 - Fm. Formation
 - Ls. Limestone

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Cutout and English adaptation of the "Die Stratigraphische Tabelle von Österreich 2004": Geological Survey of Austria

The Austrian Stratigraphic Chart 2004 - Paleozoic is a supplement of:
 Hubmann, B., Ebner, F., Ferretti, A., Kido, E., Krainer, K., Neubauer, F., Schönlaub, H.-P. & Suttner, T.J. (2014): The Paleozoic Era (them), 2nd edition. - In: Pillner, W.E. (Ed.): The lithostratigraphic units of the Austrian Stratigraphic Chart 2004 (sedimentary successions) - Vol. 1 - Abhandlungen der Geologischen Bundesanstalt, 66, 9-133, Wien.

Printing: Grasl Druck & Neue Medien GmbH, Bad Vöslau 2014

