

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, -psammities 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).

Derivation of name: After Magdalensberg (KAHLER, 1953: p. 12).

Synonyms: Kalktrapp und dioritischer Porphy (ROSTHORN & CANAVAL, 1853); grüne Schiefer (LIPOLD, 1856a); paläozoische Grauwackenschiefer und Diabasgesteine (BECK, 1931); Mandelgesteine und Lockergesteine (KAHLER & WOLFSEGGGER, 1934); Magdalensbergserie (RIEHL-HERWIRSCH, 1970); Magdalensberg-Folge [partim] (THIEDIG, 2005).

Lithology: Phyllitic shale, conglomerate layers; pillow lavas; greenish and purple tuffs, ferruginous dolomitic tuffs with carbonatic lenses, lydites.

Fossils: An overview of the fauna is provided by RIEHL-HERWIRSCH (1970) who listed bryozoans, chitinozoans (see also GROSCHOPF, 1970), conodonts, graptolites, ostracods, radiolarians and scolecodonts. Macrofossils from the Magdalensberg Group are brachiopods obtained by SEELMEIER (1939, 1940) and HAVLICEK et al. (1987). Acritarchs were described by REITZ (1994).

Origin, facies: Submarine stratovolcano(s).

Chronostratigraphic age: Floian–Darrwilian (?).

Biostratigraphy: According to the acritarch assemblage Early to Middle Ordovician age is suggested for the Lower Magdalensberg Group by REITZ (1994).

Thickness: > 500 m.

Lithostratigraphically higher rank unit: -

Lithostratigraphic subdivision: Following REITZ (1994), the Magdalensberg Group is divided into a Lower Magdalensberg Group (dominated by clastic rocks) and Upper Magdalensberg Group (dominated by volcanic rocks). This subdivision follows earlier discriminations of KAHLER (1953), RIEHL-HERWIRSCH (1970) and GROSCHOPF (1970).

Underlying unit(s): -

Overlying unit(s): Golzeck Formation, Schattloch Phyllites, Nock Group; “Gurktal Quartzphyllite Complex”.

Lateral unit(s): -

Geographic distribution: Carinthia, highland east of Magdalensberg between St. Christoph and Brückl (RIEHL-HERWIRSCH, 1970), in the surrounding of Bleiburg and at the border to Slovenia at St. Georgen (compare REITZ, 1994).

Remarks: -

Complementary references: PETERS (1855), MURBAN (1938), FRITSCH et al. (1960), STREHL (1962), FRITSCH (1969), BUCHROITHNER (1979), NEUBAUER (1979), SCHÖNLAUB (1979, 1992), NEUBAUER & PISTOTNIK (1984), GOSEN et al. (1985), MULFINGER (1988), LOESCHKE (1989a), PISTOTNIK (1989), HOLZER & GORITSCHNIG (1997), KETTRUP (1998).

Golzeck-Formation / Golzeck Formation

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Validity: Valid; the unit is well described as “Golzeck-Schiefer” by NEUBAUER (1979), but the name Golzeck Formation first appears on the scheme of SCHÖNLAUB (1992: Fig. 13, p. 399).

Type area: ÖK50-UTM, map sheets 3230 Tamsweg, 4225 Murau (ÖK50-BMN, map sheets 158 Stadl, 159 Murau).

Type section: The type section is located south of Murau in the Auen area (N 47°02'31" / E 14°09'23"; N 47°02'37" / E 14°09'28"; N 47°02'26" / E 14°09'25") near the Haid-

er farmstead along a forest road (NEUBAUER, 1979: Fig. 2, p. 460).

Reference section(s): -

Derivation of name: After Mount Golzeck (in the Auen area).

Synonyms: Arkosenschiefer (THURNER, 1958); Golzeck-Schiefer (NEUBAUER, 1979).

Lithology: grey to greyish green shale, metapsammities, phyllitic shale, ferruginous dolomite (NEUBAUER, 1979: p. 459).

Fossils: Conodonts, crinoids.

Origin, facies: Marine deposits consisting of weathering products of acidic volcanites and metamorphic areas (compare NEUBAUER, 1984: Fig. 17, p. 56); phyllitic unit.

Chronostratigraphic age: Middle–Late Ordovician (NEUBAUER, 1979).

Biostratigraphy: Among six conodont taxa described from this unit (compare NEUBAUER, 1979), fragments assigned to *Amorphognathus?* sp. indicate Late Ordovician. Based on the assemblage provided by NEUBAUER (1979), no further assignment can be made, which would constrain the unit to a distinctive biostratigraphic zone.

Thickness: > 100 m.

Lithostratigraphically higher rank unit: Auen Group (see remarks).

Lithostratigraphic subdivision: -

Underlying unit(s): Magdalensberg Group, Kaser Group, “Metadiabase”.

Overlying unit(s): Golzeck Porphyry (conformable contact).

Lateral unit(s): Schattloch Phyllites (conformable contact).

Geographic distribution: Styria and Carinthia, in the surrounding of Murau, especially south of it near the Styrian/Carinthian states border in the area of Auen (NEUBAUER, 1979: Fig. 1).

Remarks: NEUBAUER (1979) distinguished three groups within the Lower Paleozoic sequence of the Gurktal Nappe: the Auen Group, Pranker Group and Murau Group. Within the Auen Group (compare Text-Fig. 3) mainly carbonatic units (Lower Auen Dolomite, Middle Auen Dolomite, Haider Marble and Upper Auen Dolomite) together with shales (Golzeck Formation) and magmatic deposits (Golzeck Porphyry) are lumped.

Complementary references: SCHÖNLAUB (1979), NEUBAUER & PISTOTNIK (1984), GOSEN et al. (1985).

Golzeck-Porphyröid / Golzeck Porphyry

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Validity: Invalid; first mapped by GEYER (1891a, b); well described by NEUBAUER (1979).

Type area: ÖK50-UTM, map sheets 3230 Tamsweg, 4225 Murau (ÖK50-BMN, map sheets 158 Stadl, 159 Murau).

Type section: -

Reference section(s): Section in the vicinity of Haid-er farmstead located south of Murau in the Auen area (N 47°02'27" / E 14°09'24").

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	LOWER DEVONIAN			PRAGIAN	405				
				LOCHKOVIAN	410				
PERMIAN	DEVONIAN			WEN-LOCK / LOW	415	DEVONIAN	LOWER DEVONIAN		
				HIRNANTIAN	420				
				LLANDOVERY	425				
		AERONIAN	430						
		RHUDDANIAN	435						
		DEVONIAN	LOWER DEVONIAN	PRAGIAN	440				
				LOCHKOVIAN	445				
		PERMIAN	DEVONIAN	WEN-LOCK / LOW	450			DEVONIAN	UPPER ORDOVICIAN
				LLANDOVERY	455				
				AERONIAN	460				
RHUDDANIAN	465								
DEVONIAN	LOWER DEVONIAN			PRAGIAN	470				
				LOCHKOVIAN	475				
PERMIAN	DEVONIAN			WEN-LOCK / LOW	480	DEVONIAN	MIDDLE ORDOVICIAN		
				LLANDOVERY	485				
				AERONIAN	490				
				RHUDDANIAN	495				
		DEVONIAN	LOWER DEVONIAN	PRAGIAN	500				
				LOCHKOVIAN	505				
		PERMIAN	DEVONIAN	WEN-LOCK / LOW	510			DEVONIAN	LOWER ORDOVICIAN
				LLANDOVERY	515				
				AERONIAN	520				
				RHUDDANIAN	525				
DEVONIAN	LOWER DEVONIAN			PRAGIAN	530				
				LOCHKOVIAN	535				
PERMIAN	DEVONIAN			WEN-LOCK / LOW	540	DEVONIAN	UPPER CAMBRIAN		
				LLANDOVERY	545				
				AERONIAN	550				
				RHUDDANIAN	555				
		DEVONIAN	LOWER DEVONIAN	PRAGIAN	560				
				LOCHKOVIAN	565				
		PERMIAN	DEVONIAN	WEN-LOCK / LOW	570			DEVONIAN	MIDDLE CAMBRIAN
				LLANDOVERY	575				
				AERONIAN	580				
				RHUDDANIAN	585				
DEVONIAN	LOWER DEVONIAN			PRAGIAN	590				
				LOCHKOVIAN	595				
PERMIAN	DEVONIAN			WEN-LOCK / LOW	600	DEVONIAN	LOWER CAMBRIAN		
				LLANDOVERY	605				
				AERONIAN	610				
				RHUDDANIAN	615				
		DEVONIAN	LOWER DEVONIAN	PRAGIAN	620				
				LOCHKOVIAN	625				



- 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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