

Lateral unit(s): See above in chapter “Origin, facies”.

Geographic distribution: Carnic Alps, west and northeast of Naßfeld (Zweikofel Massif, Zottachkopf, Rudnig Kar, Rudnigalm, Reppwand, upper Garnitzen gorge).

Remarks: In the ASC 2004 the old lithostratigraphic term “Upper Pseudoschwagerina Formation” was printed by a mistake in place of the term Zweikofel Formation. KRAINER (1995: p. 689) already formalized and renamed the unit in Zweikofel Formation after the mountain Zweikofel (2,059 m) between Rattendorfer and Rudnig Alm.

Complementary references: SCHÖNLAUB & FORKE (2007).

Trogkofelkalk / Trogkofel Limestone

HANS P. SCHÖNLAUB

Validity: Invalid; the term was introduced by GEYER (1898: p. 252) to designate this limestone complex as an equivalent of the Permian Artinskian Stage and not as Triassic as suggested previously by FRECH (1894b).

Type area: ÖK50-UTM, map sheet 3116 Sonnenalpe Naßfeld (ÖK50-BMN, map sheet 198 Weißbriach), Carnic Alps, Carinthia.

Type section: Not defined.

Reference section(s): -

Remarks: The section at the Trogkofel mountain (2,280 m) along the Überlacher trail (N 46°34'10" / E 13°13'05") or at the westernmost edge of the steep cliff may serve as type section in the future. Additional sections are exposed at the Reppwand cliff and in the upper Garnitzen gorge.

Derivation of name: After the mountain Trogkofel (2,280 m) between Rattendorfer and Rudnig Alm.

Synonyms: Trogkofel Schichten (SCHELLWIEN, 1898: p. 279).

Lithology: The Trogkofel Limestone is mainly composed of massive, light-colored, partly reddish carbonates. Large parts correspond to a *Tubiphytes/Archaeolithoporella*-cement boundstone. Dolomitization is common and ranges from isolated euhedral dolomitic rhombs to a complete replacement. Boundstones may occur as clasts and boulders, probably representing syndimentary breccias. Indistinctly bedded, well preserved dasycladacean grainstones with a spotty distribution of fusulinids can be found in the upper part of the Trogkofel Mountain along the Überlacher trail. The bedded, ruditic limestones with shale intercalations represent an exceptional lithofacies in the Zweikofel section.

Fossils: Fusulinids, smaller foraminifers, conodonts, crinoids, bryozoans, corals, sponges, dasycladacean algae, microproblematica (*Tubiphytes*, *Archaeolithoporella*).

Origin, facies: The Trogkofel Limestone includes reefs that differ from those of the previous formations as being interpreted as shelf margin reefs (FLÜGEL, 1981). These types are the thickest reefs of the Upper Paleozoic sequence in the Carnic Alps. They are characterized by the interaction of encrusting organisms (algae, sponges, bryozoans) and syndimentary cementation, supported by microbial and algal activities forming an organic framework. Other lithofacies types within the Trogkofel Limestone point to platform sediments (limestones with dasycladaceans and fusulinids) and upper slope (breccias) deposits. No detailed reconstruction of the stratal patterns in the Trogkofel Lime-

stone has been elaborated so far. However, similar platform – reef – slope geometries are known from carbonate platform systems in northwestern Spain (BAHAMONDE et al., 2000), which may serve as a model for the Trogkofel Limestone.

Chronostratigraphic age: Late Artinskian.

Biostratigraphy: Rare occurrences of *Robustoschwagerina spatiosa* together with a single conodont taxon (*Neostreptognathodus* cf. *pequopensis*) from the ruditic limestones indicate upper Artinskian for the Trogkofel Limestone.

Thickness: Maximum thickness at Trogkofel approx. 400 m, at Reppwand and Garnitzen gorge 200 to 300 m.

Lithostratigraphically higher rank unit: -

Lithostratigraphic subdivision: -

Underlying unit(s): Upper Pseudoschwagerina Formation (Zweikofel Formation).

Overlying unit(s): Trogkofel Conglomerate (not indicated in the ASC 2004), Tarvis Breccia, Gröden Formation.

Lateral unit(s): The locally occurring Tressdorf Limestone in the Naßfeld area (a polymict limestone breccia) and the Goggau Limestone occurring along the old road from Tarvisio to the village Goggau (KAHLER & KAHLER, 1980) and in the western Karavanke mountains of Slovenia (pers. comm. FORKE and NOVAK) may represent lateral equivalents of the Trogkofel Limestone.

Geographic distribution: Carnic Alps (Trogkofel, Zweikofel Massif, Rudnigalm, Reppwand, upper Garnitzen gorge, northeast slope of Col Mezzodi near Forni Avoltri). At the latter locality the boundary between the Zweikofel Formation and the overlying Trogkofel Limestone is not precisely known yet), Karavanke Mountains, Slovenia.

Remarks: -

Complementary references: -

Treßdorfer Kalk / Treßdorf Limestone

HANS P. SCHÖNLAUB

Validity: Invalid; the term was introduced by HOMANN (1969: p. 278) to designate isolated occurrences of polymict limestone breccias in the surroundings of the Treßdorf Alm northeast of Naßfeld.

Type area: ÖK50-UTM, map sheet 3116 Sonnenalpe Naßfeld (ÖK50-BMN, map sheet 198 Weißbriach), Carnic Alps, Carinthia.

Type section: No reference section exists since the main occurrence WNW of Treßdorf Alm is only some meters in thickness (N 46°34'42" / E 13°15'28").

Reference section(s): -

Derivation of name: After Treßdorf Alm located closely to this limestone unit (see SCHÖNLAUB & FORKE, 2007).

Synonyms: -

Lithology: According to HOMANN (1969) and FLÜGEL (1968) the Treßdorf Limestone represents a clast-supported stylonbreccia. The cm-sized angular and subrounded clasts reflect different types of microfacies which are supposedly derived from the Trogkofel Limestone and the underlying Zweikofel Formation. The majority of the clasts are light-greyish *Tubiphytes-Archaeolithoporella*-cement boundstones and thus resemble the typical Trogkofel Limestone

while others are oosparites and biosparites with fusulinids, echinoderms and microproblematica (*Tubiphytes*, *Epi-mastopora*). Some others are massive indistinct limestone clasts not known from the Trogkofel Limestone.

Fossils: In the limestone clasts fusulinids, smaller foraminifers, crinoids, bryozoans, corals, sponges, ostracods and microproblematica (*Tubiphytes*, *Archaeolithoporella*, *Epi-mastopora*) were identified.

Origin, facies: The origin of the Treßdorf Limestone is yet not fully understood. It either represents a lateral equivalent of the Trogkofel Limestone or reworked Trogkofel and Zweikofel Limestones formed at a later stage.

Chronostratigraphic age: Based on the fusulinids in the breccias KÄHLER & KÄHLER (1980) concluded an Artinskian age for the Treßdorf Limestone. In addition, they pointed out that this limestone is much younger than the Trogkofel Limestone near Forni Avoltri.

Biostratigraphy: Fusulinids, i.e., representatives of *Pseudofusulina* and *Praeparafusulina* in the clasts of the Treßdorf Limestone were identified by KÄHLER & KÄHLER (1980) and partly revised by FORKE (1995b, c, 2002).

Thickness: Maximum thickness is less than 10 m.

Lithostratigraphically higher rank unit: -

Lithostratigraphic subdivision: -

Underlying unit(s): Trogkofel Limestone (?).

Overlying unit(s): Trogkofel Conglomerate (not indicated in the ASC 2004), Tarvis Breccia, Gröden Formation.

Lateral unit(s): It has been suggested that the more than 120 m thick Coccau/Goggau Limestone occurring along the old road from Tarvisio to the village of Coccau/Goggau is a lateral equivalent of the Treßdorf Limestone. However, in the Coccau/Goggau Lst. a more diversified fusulinid fauna occurs which is slightly different from the one in the Treßdorf Limestone suggesting different ages of both limestones. Apparently coeval limestones occur in the western Karavanke mountains of Slovenia.

Geographic distribution: Carnic Alps in the vicinity of Treßdorf Alm and close to Coccau/Goggau near Tarvisio (Italy).

Remarks: -

Complementary references: -

Tarviser Brekzie / Tarvis Breccia

HANS P. SCHÖNLAUB

Validity: Invalid; the term was introduced by HERITSCH (1928b) to designate a breccia horizon at the road near Coccau/Goggau half distance between the Austrian/Italian border and Tarvisio (Italy).

Type area: Vicinity of the village Coccau/Goggau, Carta Geologica d'Italia 1:100.000, F° 14^A Tarvisio (1968). ÖK50-UTM, map sheet 3117 Nötsch im Gailtal (ÖK50-BMN, map sheet 200 Arnoldstein).

Type section: Outcrop at the road near Coccau/Goggau (Italy) southeast of the church of Upper Coccau (N 46°30'49" / E 13°36'41") (BUGGISCH & FLÜGEL, 1980).

Reference section(s): According to FORKE (pers. comm.) better outcrops are located near Forni Avoltri (Italy) and in Dovzanova soteska (Slovenia).

Derivation of name: After the city of Tarvisio (German: Tarvis) in the Regione Autonoma Friuli-Venezia Giulia, Italia.

Synonyms: Breccia di Tarvisio, Conglomerato di Sesto (Sexten-Konglomerat) (BUGGISCH et al., 1976; BUGGISCH & FLÜGEL, 1980; SCHÖNLAUB & FORKE, 2007).

Lithology: The Tarvis Breccia east of Straniger Alm consists of a 10 m thick succession of massive dolomite, Rauhwaacke, interbedded red siltstones and greyish dolomitic breccias. It thus contrasts with the Trogkofel Breccia which is composed of carbonate clasts (reworked Trogkofel Limestone) with a negligible amount of siliciclastics (BUGGISCH et al., 1976). Such clasts have diameters of 2 to 8 cm and are cemented either in a fine-grained dolomitic matrix or a grey massive homogenous one.

Fossils: The breccia does not contain any fossils.

Origin, facies: The breccia was formed during tectonic uplift of the Lower Permian succession under karstic conditions resulting from an arid environment. Synsedimentary faults have aided the formation of mainly subaerial fan deposits of strongly varying thickness intergrading with the base of the Gröden Formation.

Chronostratigraphic age: The age of the Tarvis Breccia can only indirectly be inferred from the underlying fossiliferous Trogkofel Lst. indicating a late Artinskian age and the "Illawara Reversal-Event" identified some 170 m above the base of the overlying Gröden (Val Gardena) Formation near Paularo and also in the Dolomites (MAURITSCH & BECKE, 1983; DACHROTH, 1988). According to MENNING (2001) this event occurred 265 Ma ago in the uppermost Wordian Stage (Middle Permian). The formation of the breccias can thus be attributed to a time interval between the end of the Artinskian and the beginning of the Wordian.

Biostratigraphy: -

Thickness: Maximum thickness is some 10 m.

Lithostratigraphically higher rank unit: -

Lithostratigraphic subdivision: -

Underlying unit(s): In the area between Straniger Alm and Passo del Cason di Lanza the Tarvis Breccia rests unconformably on the Auernig Formation, north of Gartnerkofel (Reppwand), however, on Trogkofel Limestone.

Overlying unit(s): Gröden (Val Gardena) Formation.

Lateral unit(s): Conglomerato di Sesto (Sexten-Kalkbrekzie) in the westernmost Carnic Alps (FLÜGEL & KRAUS, 1988; SCHÖNLAUB, 2000c).

Geographic distribution: Carnic Alps of northern Italy and southern Austria (Naßfeld area, surroundings of Straniger Alm and Passo del Cason di Lanza, west of mountain Seikofel near Sexten).

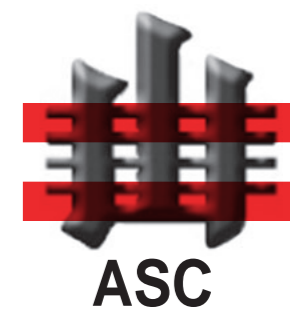
Remarks: A summary of the various breccia horizons at the base of the Gröden Formation was published by BUGGISCH et al. (1976) and BUGGISCH & FLÜGEL (1980). In the Naßfeld area detailed sedimentological investigations to characterize the deposits according to their stratigraphy and genesis have not been carried out. All those deposits at the base of the Gröden Formation above the Auernig Group are herein described as "Tarvis Breccia" while those resting directly on the Trogkofel Limestone are named "Trogkofel Breccia" and "Trogkofel Conglomerate", respectively. However, these are neither mentioned in the ASC 2004, nor described herein.

Complementary references: -

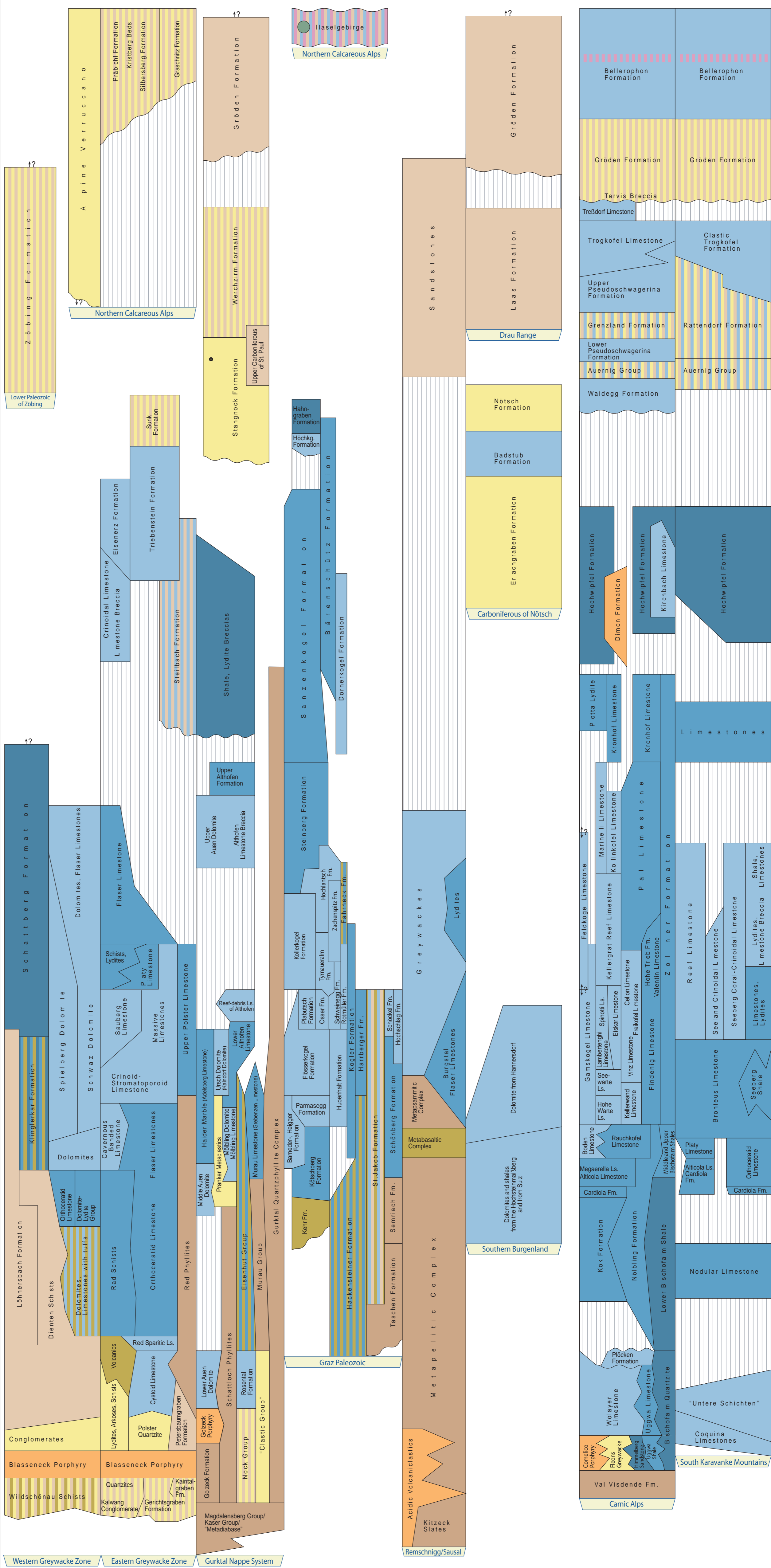
Austrian Stratigraphic Chart 2004 - Paleozoic

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

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