to the doming event (D4) with southeast dipping fold axis is also present. As in the Rauris valley, the post-Variscan cover of the Romate nappe is folded by axis perpendicular to those of the Mallnitz synform. These folds are related to the D3 event.

In contrast, in the main part of the synform and on the southwestern limb the main foliation is a composed foliation formed during the nappe stacking event (D2) and the doming event (D4). In the more competent lithologies (e.g., quartzites of the Piffkar Formation) the nappe stacking foliation is still visible, but isoclinally folded. Both foliations are steep, almost vertical and parallel to each other (dipping of foliation c. 210/70-80).

Towards the southwest, south of Obervellach the Mallnitz synform is rotated and the axial plane is dipping to the northeast (c. 040/30). Also the Sonnblick nappe, forming a narrow lamella is rotated and dipping towards northeast. This rotation is pre-brittle deformation (D5) as brittle planes measured in the rotated and un-rotated part are fitting perfectly to the strike of the brittle Mölltal fault. Along the slopes of the Möll valley an intense pattern of transpressive sinistral shear bands occurs within the nappes of the Glockner and Modereck nappe system. This pattern is interpreted as the continuation of the Katschberg Shear Zone System that swings around the gneisses of the Hochalm dome in the southeastern corner of the Tauern Window (SCHARF et al., in review). In contrast, the Sonnblick lamella disappears below the Austroalpine nappes.

Bericht 2012 über geologische Aufnahmen auf den Blättern 154 Rauris, 155 Bad Hofgastein und 181 Obervellach

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(Auswärtige Mitarbeiterin)

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In this report results from geological mapping in the Sonnblick area near to Kolm-Saigurn (ÖK154), from the Tauerntal near to Mallnitz (ÖK 155) and from the south-western slopes of the Mölltal near to Obervellach (ÖK 181) are documented. The geological maps improve the manuscript of ÖK 154 Rauris by PESTAL (Manuskript zur Geol. Karte 1:50.000, Blatt 154 Rauris, Geol. B.-A., 2011) and give additional information for the south-western part of map sheet ÖK 155 Bad Gastein. The mapping was focused on the north-western end of the Mallnitz synform and on the subdivision of pre-Mesozoic and Mesozoic rocks of the Subpenninic nappes. Additional structural investigations are reported in FAVARO, 2012 (this volume).

Tectonic subdivision of the investigated area

The area is situated in the Subpenninic and Penninic nappes of the Tauern Window. From bottom to the top the following tectonic succession occur (according to the tectonic nomenclature by SCHMID et al., Eclog. Geol. Helv., 97/1, 2004; PESTAL & HELLERSCHMIDT-ALBER, Jb. Geol. B.-A., 151/1+2, 2011; SCHMID et al., Tauern Window (Eastern Alps, Austria): new tectonic map, cross-sections and tectonometamorphic evolution. – Swiss J. Geosciences, in review):

- Hochalm-Ankogel nappe (Venediger nappe system of Subpenninic nappes).
- Romate nappe (Venediger nappe system of Subpenninic nappes).
- Sonnblick nappe (Venediger nappe system of Subpenninic nappes).
- Kolm nappe (lower element of Glockner nappe system of Penninic nappes).
- Modereck nappe system (Subpenninic nappes).
- Geißel nappe (upper element of Glockner nappe system of Penninic nappes).

The area is characterized by a km-sized fold structure with a northwest-southeast trending fold axes. It is termed Mallnitz synform and consists of elements of the Glockner and Modereck nappe system infolded between Subpenninc nappes. The Mallnitz Synform is bordered to the northwest by the Hochalm-Ankogel nappe with the overlying Romate nappe and to the southwest by the Sonnblick nappe. The nappe stack forming the Mallnitz Synform has been interpreted as a stretching fold by KURZ & NEUBAUER (J. Struc. Geol., 18/11, 1996) in the area southeast of Obervellach.

Description of the Subpenninic and Penninic nappes in the Rauris and Mallnitz valley

In this chapter the lithostratigraphy and the lithological content of the Subpenninic and Penninic units is described.

Subpenninic nappes

The Subpenninic nappes, derived from the Helvetic shelf, representing the southern European margin after the opening of the Penninic ocean in the Middle Jurassic. According to the older nomenclature (e.g. KOBER, Sitzber. Akad. Wiss., Math.-Naturw. Kl., 98, 1920; STAUB, Beitr. Geol. Kt. Schweiz, 52 (N.F. 82), 1924; EXNER, Erläuterungen zur Geol. Karte der Sonnblickgruppe. – Geol. B.-A., 1964) the "Venediger Nappe" comprises Permo-Carboniferous plutonites ("Zentralgneise"), intruding an old roof ("Altes Dach"). The old roof consists of pre-Carboniferous "Altkristallin" and Permocarboniferous schists belonging to the "Untere Schieferhülle". In 1962, Exner mentioned that due to insufficient knowledge also some Mesozoic rocks might be included in the "Untere Schieferhülle".

Maps of the area produced in the last Century are mostly lithological maps, but in the past years the lithostratigraphy of the Permomesozoic rocks of the Subpenninic nappes has been improved significantly (e.g. PESTAL et al., Erläuterungen zur Geologischen Karte von Salzburg 1:200.000. – 162 S., Geol. B.-A., 2009). The newly established lithostratigraphy constrained specifying quartzites or blackish schists in different stratigraphic positions. This leads to a better understanding of the tectonic style of the area. Equally important for the definition of individual nappes are different orthogneisses and the old roof lithologies.

A problematic lithological unit in the eastern part of the Tauern Window comprises the Permocarboniferous schists of the "Untere Schieferhülle". In the area between Mallnitz and Gastein KOBER (1920) summarized them as "Woisgenschiefer" based on their occurrence in the Woisgen valley. For the same rock association EXNER (Erläuterungen Geol. Karte 1:50.000 – Umgebung Gastein. Geol. B.-A., 1957) uses the term basal and central schist series ("Basale und Zentrale Schieferserie") and in the maps of the Sonnblick area by EXNER, Geol. Karte Umgebung Gastein 1:50.000. – Geol. B.-A, 1956; Geol. Karte Sonnblickgruppe 1:50.000.

– Geol. B.-A., 1962) they are shown as bright micaschist ("*Heller Glimmerschiefer*") and aplitic bright and black micaschist („*Aplitisch inizierter heller und schwarzer Glimmerschiefer*").

However, investigations of the last years allow subdividing these schists in at least two genetic types: The first is mostly composed of dark colored schists rich in biotite and intruded locally by granitic dykes. For these lithologies the term biotite-porphyroblast schist ("Biotitporphyroblastenschiefer"), "Furtschagelschiefer" or "Kleinelendschiefer" is in use. Detrital zircons from these schists yielded ages as young as 339 Ma (KEBEDE et al., Intern. J. of Earth Sc., 94, 2005; LÄRCHBAUMER et al., Austrian J. Earth Sci., 103/2, 2010). For this reason the protolite age of these rocks is Carboniferous or younger.

The second type is a garnet and chloritoid-bearing chlorite-muscovite schist. No granitic dykes have been found in these schists until now. They are expected to be younger than the dark variety and therefore maybe more pelitic equivalents to the Permian Wustkogel Formation. For this reasons they are quoted as a post-Variscan cover. This very typical rock type can be found to the northeast of the Mallnitz synform from the area of Kolm-Saigurn, along the eastern slopes of the Schareck (3.123 m), in the Tauern valley and further until Mallnitz. However, they do not appear in the Woisgen valley. Further occurrences of similar schists are present as thin slices below the Glockner nappe system at Törlkopf (2.446 m) and within the Mallnitz synform until Göriach in the lowermost part of the Möll valley (ÖK 182 Spittal a. d. Drau).

From Kolm-Saigurn until Mallnitz the schists are bright, shining, silvery to greenish colored and often sprinkled with red garnets up to 5 mm in diameter. Chloritoid appears in the rock matrix as tiny black dots 0.1–0.3 mm in size, but may form flakes up to 5 mm in diameter. Often chloritoid is also present as inclusions within the garnet. In thin section a layering of chlorite and mica-rich and quartz-rich lamellae and often also a folding and crenulation is visible. The micas show waving extinction, but in some cases they are recrystallized during the deformation. Chlorite is green colored, Fe-rich and forms larger patches. New white mica is overgrowing and cuts the older foliation. In associations with the mica also some crystals of plagioclase are visible. Quartz and mica are up to 0.5 mm in size, whereas the plagioclase is more fine-grained. Tourmaline is a frequent accessory mineral. It forms tiny bluish-green crystals with idiomorphic shape and up to 0.3 mm in length.

In the area around Mallnitz, chlorite is less frequent and some biotite is inter-grown with the white mica. Chloritoid is still present as inclusions within the garnet, but in the matrix instead of chloritoid tiny idioblastic staurolite crystals appear.

Southeast of Mallnitz the schists are pinched between elements of the Glockner and Modereck nappe system of the Mallnitz synform. They form several hundred meters long and up to 50 m thick slices. Staurolite was described by EXNER (Jb. Geol. B.-A., 127/3, 1984) from a locality in the Odengraben near Göriach. It appears in a 10 m thick layer of staurolite-garnet-muscovite-chlorite-quartz schist which occurs in the gorge at 1.200 m altitude. Garnets are 3 mm in diameter and staurolite forms 2 mm long prismatic crystals. In other localities no staurolite, but epidote is present forming often idioblastic and up to several millimeters big crystals. We guess that the epidote developed during the breakdown of chloritoid when calcium from the surrounding calcareous micaschist of the Glockner nappe system was available.

In our maps the subdivision of the Subpenninic nappes follows the suggestion by PESTAL & HELLERSCHMIDT-ALBER (2011), FAVARO et al., The Mallnitz synform and its relation to the Mölltal fault (Tauern Window, Eastern Alps/Austria). – EGU Abstract, 2012 and SCHMID et al. (in review).

The Subpenninic nappes are split into the Venediger nappe system, representing thick basement and cover nappes, and the Modereck nappe system forming thin slices mostly consisting of metasedimentary rocks. The metasedimentary rocks are subdivided into pre-Variscan metasediments and metavolcanics, syn-Variscan Upper Devonian to early Carboniferous metasediments, post-Variscan late Carboniferous and Permian metasediments and Mesozoic metasediments.

Venediger nappe system

In the investigated area three nappes of the Venediger nappe system occur. From bottom to the top are the Hochalm-Ankogel, Romate and Sonnblick nappe.

Hochalm-Ankogel nappe

This nappe is built up by different orthogneisses intruding an old roof consisting of pre-Variscan migmatic paragneisses, paragneisses, micaschists and amphibolites and syn-Variscan metasediments belonging to the "Kleinelendschiefer". Locally and with variable thickness a Permomesozoic transgressional sequence is preserved.

Orthogneisses ("Zentralgneis")

In the Hochalm-Ankogel nappe several types of orthogneisses are present (HOLUB & MARSCHALLINGER, Mitt. Österr. Geol. Ges., 81, 1989; SCHUSTER et al., Erläuterungen Geol. Karte 1:50.000 – Blatt 182 Spittal a. d. Drau, 2006). In general an increase of deformation from the central parts of the Reiseck Mountains towards the margins and the top of the nappe respectively can be recognized. In the investigated area orthogneisses of the Hochalm-Ankogel nappe appear north of Mallnitz around the Hindenburg Höhe (2.315 m). The most frequent lithologys are medium-grained augengneisses and fine- to medium-grained leucocratic granitgneisses. The latter also appear as up to several meters thick dykes within the old roof.

Old roof ("Altes Dach")

The pre-Variscan metasediments comprise paragneisses to micaschists and amphibolites. The paragneisses and micaschists of the old roof are monotonous with a pronounced schistosity. White mica, biotite and a few tiny garnets are visible with the naked eye. Sometimes the rocks are dark greyish, because of a small amount of graphitic pigment. Amphibolites form up to 100 m thick layers and bodies. They are mostly fine-grained, dark green and strongly foliated. Locally, a larger amount of feldspar is present and in some layers garnet up to 2 mm in diameter occurs. Further intercalations of metagabbroic amphibolites, with hornblende crystals up to 1 cm in a fine-grained plagioclase-rich matrix as well as bright colored hornblende gneisses appear.

Syn-Variscan cover

While they are missing in the southern part of the Hochalm-Ankogel nappe, north of the Törlkopf (2.446 m) an up to several hundred meters thick sequence of "Biotitpor-

phyroblastenschiefer" is present. They can be nicely studied on the northern slopes of the Seebachtal close to the Stappitzersee and in the Woisgen valley. They comprise bright colored, quartz-rich gneisses with biotite porphyroblasts, paragneisses and dark, sometimes graphitic, biotite dominated schists. Also layers of garnet-bearing muscovite-chlorite schists with some biotite are present. The biotite porphyroblasts reach up to 2 mm in size.

Permomesozoic cover

The lithologies and lithostratigraphic units on top of the Hochalm-Ankogel nappe are the same as in der Modereck nappe system and described there. Remarkable is the occurrence of garnet in the dark schists and graphitic quartzites of the Brennkogel Formation at Dösner Schönberg east of Mallnitz.

As mentioned above a Permomesozoic cover is only locally preserved: At the ridge to the Groneck (2.691 m) near to Obervellach a sequence of Wustkogel, Seidelwinkel and Pfiffkar Formation is several hundred meters thick. Further to the northwest at the Dösner Schönberg more than hundred meters of Brennkogel Formation are present. In contrast on the slopes on both sides of the Seebachtal no remnants of Permomesozoic cover have been found.

Romate nappe

The Romate nappe is termed after the Romatespitze (2.696 m, Rameterspitz in the most recent map) between Gastein and Tauern valley. It is a basement and cover nappe with a thickness up to several kilometers, built up by the following lithostratigraphic units: Carboniferous orthogneisses ("Zentralgneiss") are present in two varieties, the Romate monzosyenitegneiss and the Siglitz granitgneiss. These are overlain by garnet and chloritoid-bearing chlorite-muscovite schist. The Permian Wustkogel Formation is overlying in the Hüttwinkel valley outside the investigated area (Pestal & Hellerschmidt-Alber, 2011). Marbles of the Silbereck Group (Pestal et al., 2009) which are the continuation of the "Angertal marble" in the Gastein valley follow. They have been deposited in Jurassic to Lower Cretaceous time. The uppermost lithostratigraphic unit present is the Brennkogel Formation.

Romate monzosyenite gneiss ("Zentralgneis")

The Romate syenitegneis was mapped for the first time by Angel & Staber (Wiss. Alpenvereinshefte, 13, 1952). It is a medium to coarse-grained, white and black spotted orthogneiss. Less deformed types show rectangular dark green patches with biotite, whitish K-feldspat phenocrysts up to 3 cm in diameter, whitish plagioclase and minor greyish quartz. With increasing deformation a flaser texture develops.

Siglitz granitegneiss ("Zentralgneis")

According to Exner (Sitzber. Akad. Wiss., Math.-Naturw. Kl., 1949; 1957) the Siglitz orthogneiss is a leucocratic and fine to medium-grained Augen gneiss. It is rich in plagioclase and on the schistosity planes muscovite and minor flakes of biotite and chlorite occur. The feldspar augen are a few millimeters in size and consist of twinned albite, which developed from K-feldspar. The Siglitz granitgneiss does not appear in the investigated area.

Post-Variscan cover

In the mapped area the Siglitz and Romate orthogneiss are covered everywhere by silvery to greenish garnet and chloritoid-bearing chlorite-muscovite schist attributed as a Permian and therefore post-Variscan cover. When there is a stratigraphic contact the garnet and chloritoid-bearing chlorite-muscovite schist are overlain by Mesozoic rocks. This is the case between Mallnitz in the southeast and the Niedersachsenhaus in the northwest. In the area of Kolm-Saigurn a variegated rock series with garnet-bearing micaschists, dark grey micaschists, micaschists with biotite-porphyroblasts, greenschists, quartzitic gneisses is overlying. This rock series is interpreted as a shear zone including lithologies from the post-Variscan cover of the Romate nappe, but also pre- and syn-Variscan metasediments of the Sonnblick nappe which is following next in the succession.

Marble (Silbereck Group, "Angertal Marble"; Upper Jurassic to early Cretaceous)

In the Tauerntal and east of Mallnitz a rock series dominated by marbles is folded together with the post-Variscan cover of the Romate nappe. At its base it comprises bright colored siliziclastic schists, impure quartzites and carbonatic schists. This series is just a few meters thick, except in the area around the Greilkopf (2.581 m) where it reaches up to 100 m in thickness. In the uppermost part, close to the Hagener hut marble layers several decimeters in thickness are intercalated and form the transition to the overlying massive marbles. The latter are usually whitish to greyish and thick-bedded (up to 1 meter). They contain white mica in a variable amount, but also pure whitish marble with a thickness of several meters are present. In some places deformed layers and boudins of grey and yellowish weathering dolomite have been recognized.

Further, at the cliff 200 m northwest of the Laschghütte in the Tauerntal kyanite-bearing grayish quartzites have been found as loose blocks. These quartzites may represent the Schwarzkopf Formation.

A Sr-isotopic ratio of a pure whitish marble from an outcrop on the road up to the Jamnig hut yielded an $^{87}Sr/^{86}Sr$ ratio of 0.707721±3 (sample 11R33). Plotted on the Sr-seawater curve from Mc Arthur et al., J. of Geology, 109, 2001, it indicates a stratigraphic age in the Ladinian to Carnian or in the Upper Jurassic to early Cretaceous. Based on regional considerations the second possibility is supported.

Sonnblick nappe

The Sonnblick nappe forms a NW–SE orientated domal structure, about 25 km long and 5 km broad, with a 25 km long and just about 100 m thick continuation towards SE. This elongated part is the Sonnblick lamella. The Sonnblick nappe is built up mostly by orthogneisses, covered by an old roof. The latter consists of paragneisses with intercalated amphibolites and overlying graphitic micaschists. Whereas the paragneisses and amphibolites occur everywhere on top of the orthogneisses, the graphitic micaschists appear just locally, for example on the southern side of the Schareck. The top of the Sonnblick nappe is marked by a shear zone composed of variegated lithologies including Permomesozoic metasediments. However, no Permomesozoic metasediments with a transgressive contact to the old roof have been found until now.

Sonnblick Augengneiss

Three different types of orthogneisses with crosscutting relationships can be distinguished macroscopically in the Sonnblick nappe: The oldest is fine-grained, greyish, because of a larger amount of biotite and contains rare and up to 2 cm large K-feldspar phenocrysts. The main type,

forming more than 95 % of the whole body is a leucocratic granitic augengneiss. Both are cut by aplitic dykes. Outcrops with cross-cutting relationships can be studied to the south of the Schareck and northeast of the Sonnblick.

Old roof ("Altes Dach" – "Neubau nappe")

In general the pre-Variscan metasediments of the old roof comprise paragneisses, micaschists, amphibolites and quartzites. However, in detail within the Sonnblick nappe lots of different and heterogeneous lithologies can be subdivided based on the structural imprint and a various retrograde overprint.

On the north-western side of the Sonnblick Dome, near Himmelbauer homogeneous fine-grained to very fine-grained, dark grey and brownish paragneisses are present. Sometimes they contain larger amounts of chlorite. This lithology breaks in thin slices. On the exposed surface thin discontinuous layer of iron oxides occur. In contact with these paragneisses, an amphibole-bearing schist with 20–30 % of amphibole in a matrix composed by muscovite, biotite and quartz has been found. The amphiboles are up to 3 mm in size. In several places white to greyish, muscovite-rich quartzites breaking in coarse tabular slices are present.

Further to the northwest, close to the Zedelnig (2.330 m) and the Biwak hut at Feldseescharte (2.714 m) paragneisses with amphibolite lenses are frequent. Characteristic is a layered series of quartzitic gneisses, quartzites and partly boudinaged amphibolites). The individual layers are several centimeters up to a few meters thick.

South of the Schareck (3.123 m) close to Eisseehaus an old roof similar to Feldseescharte (2.714 m) is overlain by dark grey graphitic micaschists crosscut by some granitic dikes.

Modereck nappe system

The Modereck nappe system in the area southwest of the Sonnblick dome is subdivided in several nappes and slices: Trogereck Lamelle, Rotewand-Seidlwinkl nappe and Schuppen zone (Pestal & Hellerschmidt-Alber, 2011). In the Mallnitz synform an element of this nappe system is present between two elements of the Glockner nappe system, but its correlation to the tectonic elements in the southwest is not totally clear. In the following paragraphs the lithological content of the Modereck nappe system in the Mallnitz synform is described.

Wustkogel Formation (Permian–Lower Triassic)

The Wustkogel Formation mainly consists of greyish to greenish paragneisses with whitish albite porphyroclasts, which developed from arkoses. The rocks show a layering with greenish phengite-rich and greyish quartz-rich layers. When highly deformed, the albite porphyroclasts form ribbons. In contact with these lithologies, white mica-rich schist with small pyrites, leaving yellowish dots on the weathered surfaces have been found. The uppermost part consists of thin bedded, greenish quartzites (Lantschfeld quartzite). In the investigated area these rocks were found only in the gorge 500 m south of the Häusleralm near to Mallnitz.

In thin section sometimes grains of detrital magmatic biotite are visible. Mostly, they are transformed in chlorite, whereby rutile exolutions developed. Quartz shows a shape preferred orientation. Mineral content is: quartz, albite-plagioclase, phengite and chlorite. Accessory minerals are opaque ore and epidote.

Seidelwinkel Formation (Middle Triassic)

At the type-locality in the Seidelwinkel valley the Seidelwinkel Formation consists of dark grey calcitic marbles, turning into bright colored dolomites and yellowish rauhwacke. In contrast within the investigated area these carbonatic rocks occur just as dissected slices. Homogeneous mica-free marble is present in different colours: Often it is whitish, but sometimes it can be pinkish or greyish. Usually, it is without mica, but it also has been found mica-rich when it is highly deformed and sheared together with mica-bearing rocks. Further, there are whitish dolomites with a typical yellowish weathering colour and coarse cellular, yellowish "cargneules".

The largest outcrops of marbles occur on the crest between Häusleralm and Lonzaköpfl (2.317 m). Sheared marbles together with quartzites of the Piffkar Formation and other lithologies are present in the south-western limb of the Mallnitz synform, e.g., at the crest between Törlkopf (2.517 m) and Reßeck (2.498 m).

Piffkar Formation (Upper Triassic)

Whitish, thick-bedded quartzite (called also Keuper quartzites) with some muscovite is the most frequent lithology of the Pfiffkar Formation occurring in the mapped area. The quartzite breaks in decimeter to centimeter sized blocks or tabular sheets. Often they are intercalated with silvery mica- and quartz-rich schist and dark, carbonate-free schist. Frequently, these schists contain dark spots of chloritoid. On the south-easter slopes of the Kaponig some layers of metabreccies with components of yellowish or greyish marbles occur. The layers are up to 1 m thick and the size of the components is up to 10 cm. The sequence of the Piffkar Formation reaches locally up to hundred meters. However, most probable this thickness is due to isoclinal folding.

In thin sections the rocks exhibit a foliation and a crenulation. Grain-size of the minerals is up to 1 mm. Quartz is undulous and shows dynamic recrystallization by subgrain rotation and grain boundary migration. There is just one generation of slightly undulous white mica present. The following minerals can be recognized: quartz muscovite and minor plagioclase. Accessory opaque ore is present and as alterations carbonate and iron hydroxides can be found.

Schwarzkopf Formation (Lower Jurassic, "Lias")

Black, thin laminated phyllite intercalated with dark grey quartzite in beds with 5–6 cm thickness. Within these quartzites needles of kyanite up to 2 cm long may occur. In the Mallnitz area this lithologies have been found only 200 m south of the Häusleralm. In the Tauerntal kyanite-bearing, greyish quartzites occur as loose blocks at the cliff (1.900 m) 200 m northwest of Laschghütte.

Brennkogel Formation (Upper Jurassic to Cretaceous)

The Brennkogel Formation comprises dark greyish-brownish schist with layers of flyschoid quartzites.

The schists are rich in fine-grained white mica with a greyish colour due to a larger amount of graphitic pigment. A low amount of carbonate varies in the individual layers. Typical are reddish-brown iron-oxide dots. Locally, black chloritoid or albite porphyroblasts are present. In thin sections the following minerals occur within the Brennkogel schist: quartz, muscovite, plagioclase; accessory:

calcite, iron-oxide, apatite and chloritoid. Garnet is present in some places, e.g. in the basal part of the Brennkogel Formation between Neubau hut and Niedersachsenhaus.

The quartzites are usually porous due to dissolution of calcite components, reddish, yellowish or whitish depending on the amount of oxides and thin-bedded (from 3 to 30 cm). They form layers up to a few meters in thickness. In general, the amount and thickness of the quartzite layers increases upwards within the rock column. In the Kaponig valley and along the old Railroad trail track not more than one meter thick zones of actinolite and talc-bearing schists occur within the Brennkogel Formation. They are interpreted as shear zones including material of the nearby ophiolites from the Penninic nappes.

Penninic nappes

The Penninic nappes derived from the Penninic Ocean (Alpine Tethys Ocean) which opened in the Middle Jurassic and was closed in the Paleogene. According to SCHMID et al. (2004) the Penninic nappes can be subdivided into Lower, Middle and Upper Penninic nappes. In the investigated area the Matrei Zone is part of the Upper Penninic nappes. It just forms highly sheared slices which cannot be separated exactly from the underlying Glockner nappe system. The Glockner nappe system is attributed to the Lower Penninic nappes.

Glockner nappe system

The Glockner nappe system mainly consists of calcareous micaschist of the Jurassic to Cretaceous Bnerschiefer Group and ophiolite slices including amphibolite, prasinite and serpentinite. Its peleogeographic position is attributed to the Valais Ocean (SCHMID et al., 2004).

In the area of the Mallnitz synform we subdivided the Glockner nappe system in two nappes: the tectonically lower Kolm nappe and the upper Geißel nappe. West and north of the Sonnblick dome at least three elements of the Glockner nappe system are present according to the manuscript of ÖK 154 Rauris (PESTAL, 2011). The most important are the Glockner nappe and the tectonically higher Rauris nappe. These nappes exhibit typical rock associations: The Glockner nappe is characterized by the "Glockner facies" with larger ophiolite bodies, including serpentinites, prasenites and greenschists. In some places, pseudomorphs after lawsonite and eclogites indicate a high pressure imprint. In the Rauris nappe with the "Fuscher facies" dykes of metagabbroic rocks are typical whereas large ophioloite bodies and indications for a high pressure imprint are missing.

Kolm nappe

Typical lithologies of the Bundnerschiefer Group in the Kolm nappe are grayish-bluish, thick-bedded, mica-bearing marbles intercalated with dark greyish to brownish calcareous micaschists. Large ophiolite bodies with prasenites, amphibolites and serpentinites occur at the Auernig (2.130 m) and all along the southwest dipping slopes of the Möll valley. For this reason the Kolm nappe is characterized by the "Glockner facies".

Prasenites are massive greenish rocks with a high, but variable content of epidote together with amphibole, chlorite and albite. They are frequent at Auernig and built up the rock walls at the Törlkopf (2.446 m). The amphibolites are strongly foliated, fine-grained and greenish to blackish colored. They form blocks and tabular pieces. In thin section they look fresh, without evidences of a retrograde overprint and the mineral assemblage reflects peak metamorphic condition. The matrix consists of amphibole needles, plagioclase and minor quartz and titanite. Around epidote crystals Mg-rich chlorite with greyish interference colours and some amphiboles appear in pressure shadows. Bodies of dark green to blackish serpentinites occur between Auernig and Törlkopf.

A layer of schists with biotite and muscovite can be followed from the Törlkopf to the southern slopes of the Auernig. Chlorite-biotite schists occur as a more or less continuous layer with up to 15 m thickness between Kaponigwiesen and Hartlberg. Mainly, they consist of chlorite whereas biotite is present as individual black flakes or as elongated aggregates up to 2 cm in length.

Geißel nappe

The Bündnerschiefer Group of the Geißel nappe consists of calcareous micaschists with intercalated greenish chlorite-schist. Serpentinites are present as tiny bodies. The Geißel nappe can be attributed to the "Fuscher Facies".

The calcareous micaschists are rich in white mica and characterized by a yellowish to brownish weathering colour. Grey mica-bearing marbles are intercalated. During weathering fine-grained pieces are split of and forming brownish sand. The left rock walls are rounded, e.g., at the south-western slopes between Törlkopf (2.517 m) and Lonzaköpfl (2.317 m). The chlorite schists show nodules of albite porphyroblasts 1–3 mm in diameter. In thin sections a mineral assemblage with chlorite, albite and minor epidote, titanite and biotite is visible. Serpentinites are characterized by a grass-green weathering colour. Often they contain talc and up to 1 cm large ancerite crystals. They have been found south of Vorderer Geißelkopf (2.974 m), close to the old railway station of Obervellach and at Hartlberg.

Blatt 155 Bad Hofgastein

Siehe Bericht zu Blatt 154 Rauris von SILVIA FAVARO & RALF SCHUSTER

Blatt 181 Obervellach

Siehe Bericht zu Blatt 154 Rauris von SILVIA FAVARO

Siehe Bericht zu Blatt 154 Rauris von SILVIA FAVARO & RALF SCHUSTER