NEW LITHOSTRATIGRAPHIC TERMS USED IN THE GEOLOGICAL MAP OF THE WESTERN DOLOMITES.

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The Geological Map of the Western Dolomites is based on the new mapping and compilation of the entire sedimentary cover of the Autonomous Province of Bozen/Bolzano. It was carried out as part of the project "Geological Base Map of South Tyrol". In the course of this new mapping, new lithostratigraphic terms were introduced, or conventional ones redefined, across the boundaries of official map sheets. This was not always in line with the Italian national mapping programme CARG. New and newly defined lithostratigraphic terms are explained below. Their position is shown in the lithostratigraphic table (Fig. 1).

Werfen Formation: Von Lilienbach (1830) and Peters (1854) originally described the "strata of Werfen" or "Werfen schist" in the type region south of Salzburg. Later, this term was also

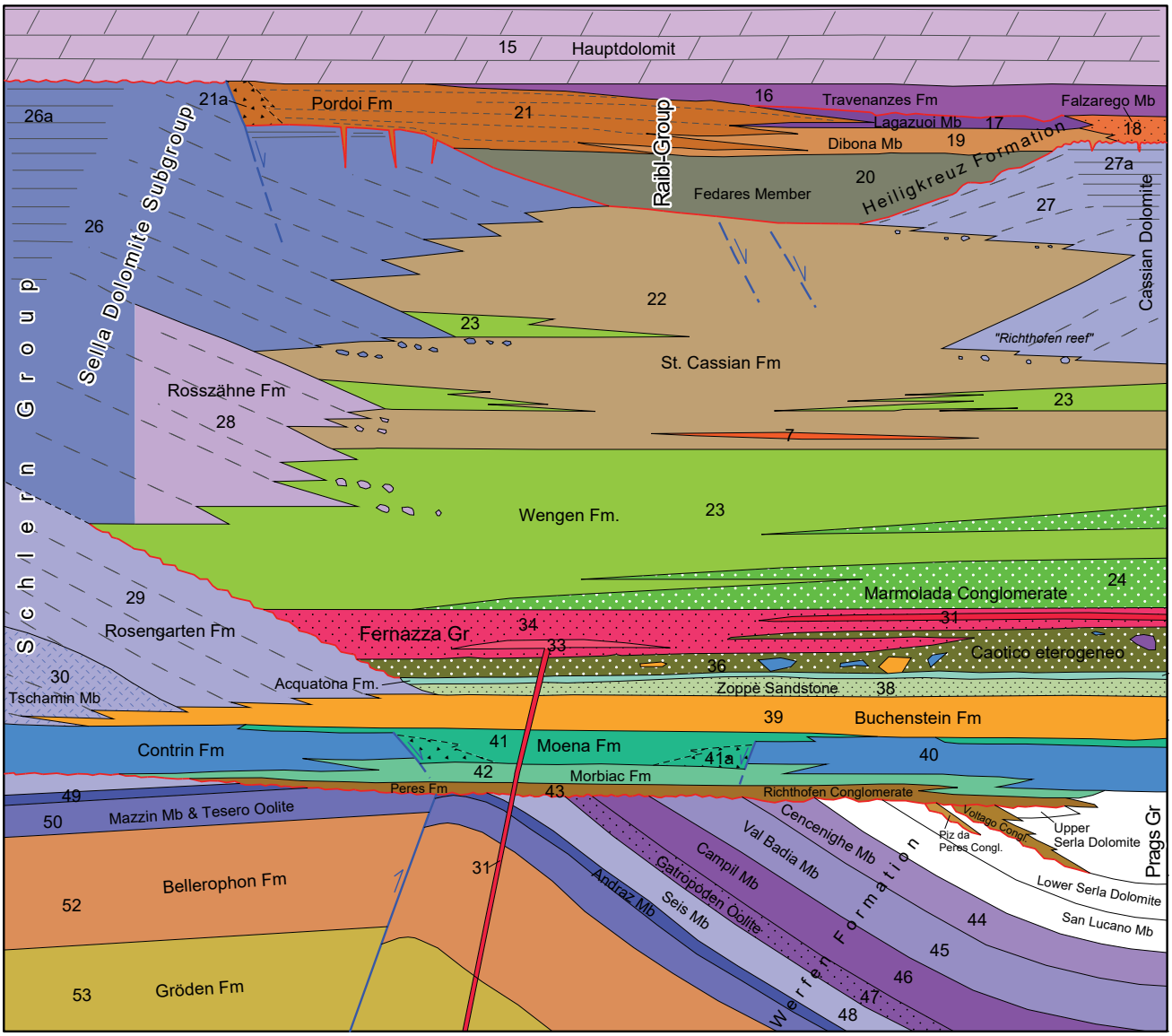

FIG. 1: Stratigraphic scheme of the Permian to Upper Triassic succession of the Western Dolomites. Geological Map of Südtirol/Alto Adige, Western Dolomites, 1:25.000 (2019).

transferred to the Dolomites and defined here by Bosellini (1968) and Broglio Loriga et al. (1983) as Werfen Formation, subdivided into subformations (members). However, the clearly different facial and lithological development in the type region in the Northern Calcareous Alps requires a new definition (see also Neri (2006). If the term "Werfen" is to be retained, it can only be used as in **"Werfen Group"**. This would have the advantage that comparable developments in the Werfen facies (mixed siliciclastic-carbonatic, cyclical sedimentation in shallow shelf environments with specific faunal developments) could be summarized by the term "Werfen Group". In wide areas of the western Tethys, developments in the Werfen facies presently carry different formation names in different countries. Use of the term Werfen Group would mean that units, which in the Dolomites are currently defined as members, would become formations (fig. 2). The possibility to map these units, which is a basic prerequisite for the term ‚formation', is given, and mapping has already been carried out on all new map sheets, albeit using the member classification. Unfortunately, the proposal for a new classification could not yet be introduced for the Geological Map of the Western Dolomites, as the editors of adjacent geological maps of the CARG project as well as the client (Geological Survey of South Tyrol) were afraid of a confusion of terms.

For mapping reasons, the **"Gastropod Oolith Member"** was assigned to the **Campil Member** (in anticipation of the future formation name) in certain areas, where separation between the two members in the field was not possible. The Gastropod Oolith Member is very variable in the Dolomites and adjacent areas (see e.g. Venturini et al., 2009, in the Carnic Alps) and is often difficult to identify in individual outcrops, in particular if the sequence is disturbed. An easily recognisable criterion for mapping in the field is the increase in the terrigenous siliciclastic content, which can be observed in the background sedimentation even in facially different sequences. Both the Gastropod Oolith and the Campil Members were distinguished from the Seis Member by the appearance of the first distinct layers of fine-grained sandstone.

Peres Formation: The term was introduced by Pia (1937) and extended by Bechstädt & Brandner (1970). It refers to terrigenous clastic deposits with silty, mostly red marls and intercalated lenses of conglomerates. In the basin area of the Prags/Braies Group, the Peres Formation occurs at three stratigraphic levels (Lower, Middle and Upper Peres Beds in Bechstädt & Brandner, 1970), which combine to one level on the adjacent Etsch-Gadertal/Adige-Val Badia platform and are no longer distinguishable here. The individual designation of the three horizons with their conglomerate intercalations (Piz da Peres Conglomerate, Voltago Conglomerate and Richthofen Conglomerate, according to De Zanche et al., 1992) does not appear useful for the mapping of the entire area and was therefore not applied. In the area of the western Etsch/Adige platform, it is not possible either to distinguish correctly between the various conglomerates. Therefore, the term "Peres Formation" was given preference here (Geological Base Map of the A.P.B., sedimentary cover, 2003, sheets Bozen/Bolzano, Eppan/Appiano, Mezzolombardo and Predazzo; unpublished).

Schlern Group: This is a collective term for the Upper Anisian to Lower Carnian carbonate platforms between the Contrin

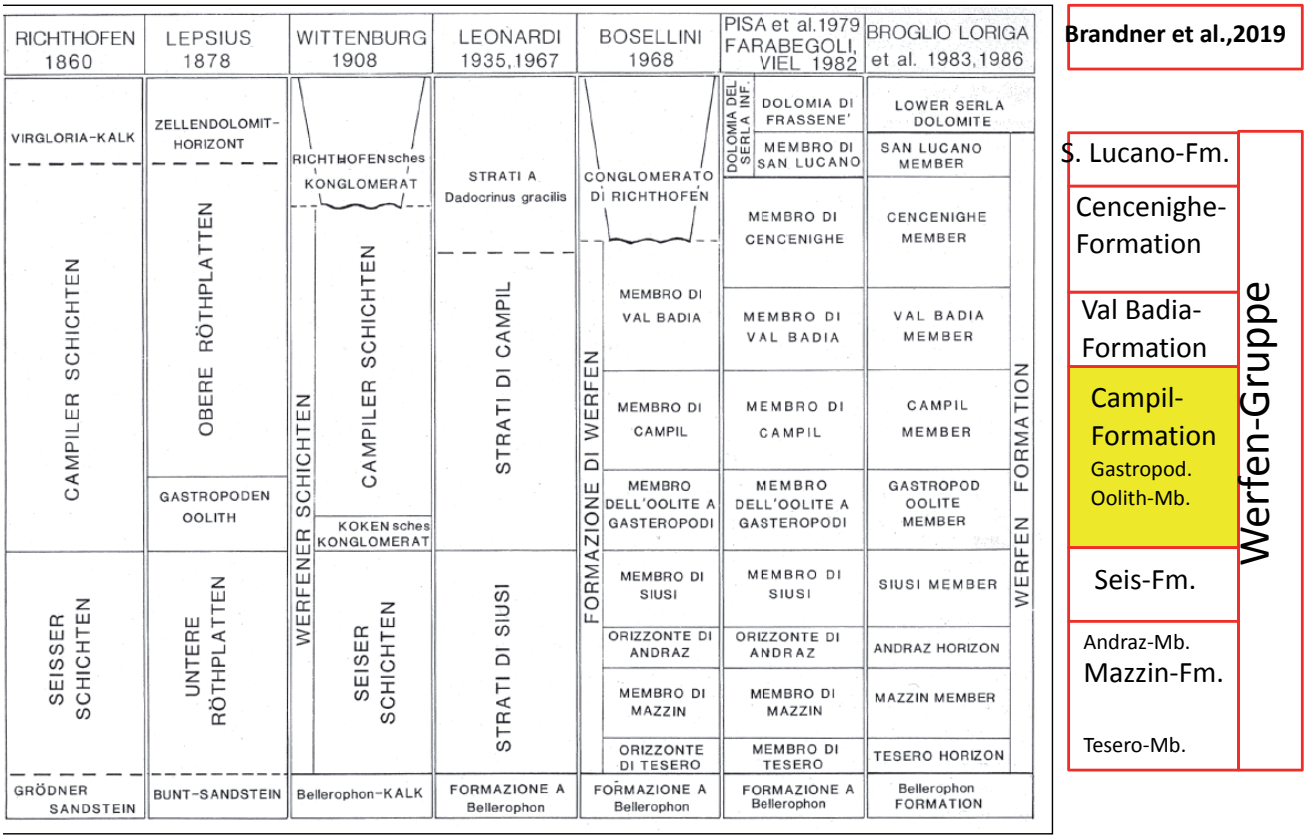

FIG. 2: Proposal for a new classification of the Werfen Formation in the Western Dolomites. The introduction of the new term „Werfen Group" is indicated to have the possibility to include the „Werfener Schichten" of the type locality in Salzburg with their quite different lithological habit.

Formation and the Raibl Group. The newly introduced term is appropriate in those areas where continuous carbonate platform developments are present without intercalation of carbonates interfingering with basinal sediments or volcanites. This is the case, for example, at the western edge of the Schlern/Sciliar massif or at the northern edge of the Dolomites (Toblach/Dobbiaco sheat). The "Sexten/Sesto Dolomite Group" on the geological map of the Sexten/Sesto Dolomites Nature Park 1:25,000 (2004) is equivalent to the Schlern Group. The term is ideal for geological overview maps.

The Schlern Group comprises the pre-volcanic **Rosengarten/ Catinaccio Formation**, the post-volcanic **Rosszähne/ Denti di Terra Rossa Formation** and the Cassian Dolomite, respectively the post-volcanic **Sella Dolomite Subgroup**. The cartographic representation of all these carbonate platform formations is easily possible as long as they interfinger with the respective basinal sediment formations (Buchenstein, Wengen and Cassian formations). At Langkofel/Sassolungo, on Sella and in the Geisler/Le Odle group, the subdivision of post-volcanic platforms into Rosszähne Formation and Cassian Dolomite is not possible. Therefore, the new umbrella term **"Sella Dolomite Subgroup"** was introduced. Incidentally, this coincides with earlier names, such as "Dolomia dello Sciliar Superiore" (Leonardi, 1967), "post-volcanic platforms" (= Cassian Dolomite) sensu Bosellini (1984), or the "Upper Schlern Dolomite" (Schlager et al., 1991).

The **"Tschamin-Member"** was added to the Rosengarten Formation as an independent, mapable unit. In the lower section of the Rosengarten Formation, a discordance is developed which can be easily recognized in the Tschamin/Ciamin valley, in the König Laurin/Re Laurino wall of the Rosengarten group and in the Langkofel/Sassolungo cirque. The discordance is located at the top of the Tschamin Member and interpreted as a "drowning-unconformity surface". Clinoforms with a steep inclination overlie a sequence of dolomitized litharenites of variable thickness and with stromatactis and microbial structures. In the König Laurin wall, the carbonate platform interfingers with the Plattenkalk of the Buchenstein Formation. The sequence increases considerably in thickness towards the East (Rosengarten: 130 m, Langkofel: approx. 300 m) and reaches up to 600 m, for example at Monte Carrera. Here, the platform drowns and is covered by pelagic sediments („pelagic drape“) of the Upper Ansian (R. Reitzi-Zone) (Brack et al., 2007). The drowning unconformity can be correlated directly with the unconformity at the top of the Tschamin Member. The former term "Lower Edifice" (De Zanche et al., 1995) partly coincides with the newly introduced Tschamin Member.

Col Rodela-Olisthostrom: This term was newly introduced to take account of the complex geological situation at Col Rodela and in the area south of the Duron valley. This region represents the proximal area of thick sliding blocks which merge distally into the **Caotico Eterogeneo**. These blocks constitute stacks of sedimentary rock layers which can be thrusted on top of each other. The layer stacks consist of sedimentary rocks of the Bellerophon Formation up to the Rosengarten Formation / Marmolada Limestone. To a lesser degree, they include clasts of volcanites. They contain remarkably large hiatuses which Ampferer (1928) recognized and took as cause for his theory of "relief overthrusts". The Caotico Eterogeneo, together with the volcanites of the Fernazza Formation, overlies the Col Rodela Olisthostrom. The area of origin of the gravitational sliding blocks is the transpressive bulging zone in the area of Cima Bocche-Costabella (Doglioni, 1984).

Raibl Group: The Raibl Group is divided into three formations in the mapped area: Pordoi Formation, Heiligkreuz Formation and Travenanzes Formation.

The term **"Pordoi Formation"** was newly introduced. It constitutes a maximally 120 m thick sequence of basal green sandstones, brown dolomites and marly dolomites, doloarenites and intercalated banks of shell detritus with *Myophoria kefersteini kefersteini*. The sequence is located on top of the Sella Dolomite, the surface of which is characterized by synsedimentary extensional tectonics and karstification. The limit between Sella Dolomite and Pordoi Formation is well defined. Local breccias as well as thin-layer conglomerates are present at the base of the Pordoi Formation. At the upper part, there is a gradual transition to the Hauptdolomit/Dolomia Principale. The Pordoi Formation has only been found at Gardenacia, Sella and Langkofel/Sassolungo.

The **Heiligkreuz Formation** (for a definition see Keim et al. 2001) is divided into four members: Lagazuoi Member, Falzarego Member, Dibona Member and Fedares Member. Deviating from the definition of members of the Heiligkreuz Formation by Neri et al. (2007), the Falzarego Member is separately defined here according to Bosellini et al. (1982, "Arenarie del Falzarego") because of the reddish sandstones with cross-stratification.

The new term **"Fedares Member"** was already used in the first edition of the Geological Map of the Western Dolomites (2007). On the basis of surface outcrops in the area of the Heiligkreuz Hospice, and above all, based on the research drilling BS1, the Fedares-Member was defined as a monotonous, up to 100 m thick sequence of black marls and slates, marly limestones and limestone banks exhibiting an ostracod and bivalve fauna with low species diversity. The sequence corresponds only partly to the sequence of the Borca Member (Neri et al. (2007), which is why the term is now used again in the new edition of the Geological Map of the Western Dolomites.

Gardenacia Formation: The newly introduced term denotes a remarkable, 17 m thin facies development at the base of all formations of Cretaceous age. At the eponymous type locality, the formation typically consists of sandy, medium to coarse crystalline dolomites. Their greenish colour (and glauconite content) increases towards the top. Relics of grainstones, ooids and coated grains are visible in thin sections. In addition, breccias with clasts of different sizes occur locally. The Gardenacia-Formation rests on the Hauptdolomit, which shows a distinct relief with karst phenomena at its top surface. The mapping reveals a large bulging zone with synsedimentary graben tectonics and a clearly defined erosional unconformity. The shallow water facies of the Gardenacia Formation is abruptly superimposed by the pelagic Maiolica Formation of late Berrasium to early Valangium age (Gögl, 1999).

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