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OLD AND YOUNG STRUCTURES ALONG SOME FAULT ZONES OF THE CENTRAL EASTERN ALPS

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With 1 Figure

Prominent fault zones reaching deeply into the outer part of the earth's crust separate different geological units of the Eastern Alps. By geological investigation of some special areas (Fig. 1), age relationships of the structures observable in the field were analyzed. The observations include relic structures of Paleozoic deformation, diversified structures of Cretaceous to Paleogene age, features of Neogene tectonics as well as Quaternary and Recent movements. Field investigation has been completed by thorough petrographic research of the metamorphic rocks.

In the period from 1972 to 1979, teamwork has been carried out together with geophysical working groups along the Periadriatic lineament and at the eastern margin of the Tauern Window. In the eastern Hohe Tauern, Recent movements of the earth's crust have been investigated in co-operation with geodetic surveyors. Along the Periadriatic lineament, a fault zone of 700 km length between Maribor and Torino, comparative studies were carried out in co-operation with Slovenian, German (F. R.), Italian and Swiss geologists.

1. The Periadriatic lineament in the eastern Karawanken range ("KAR" in Fig. 1; publications: 2, 6)

Paleozoic structures are preserved in the contact aureole of the Karawanken granite which intruded in Hercynian times: there are hornfelsized fold structures in Paleozoic phyllite and greenschist ("diabase belt of Eisenkappel-Ebriach") as well as in Lower Paleozoic paragneiss, amphibolite and orthogneiss ("Altkristallin of Eisenkappel"). The time of intrusion of the Karawanken tonalite is still uncertain. Biotite of the tonalite yielded Oligocene radiometric age. In Alpidic time, both granite and tonalite have strongly been deformed along Periadriatic lineament into lamellae of up to 40—45 km length and only 2 km width. Numerous petrographic details confirm the close relationship to other intrusive bodies along the lineament (e. g., the granodiorite of Brixen or the Adamello tonalite).

Young tectonic structures are reflected by north-vergent slices, slickensides with N-S oriented strias, and mylonite zones up to 30 m thick.

2. The Periadriatic lineament in the Gail valley near Nötsch and in the western Karawanken range near Finkenstein ("NO" in Fig. 1; publications: 4, 6, 9)

Paleozoic (Lower Devonian) strata, i. e. thin lenses of carbonate rocks in the Gailtal phyllite, could be verified paleontologically by SCHÖNLAUB (Geological Survey, Vienna). The granite of Nötsch forms a 7 km long and a few tens of metres wide tectonic lamella. Granite pebbles revealing retrograde metamorphism of Paleozoic age, are found in the transgressive Permo-Scythian sandstone. Alpidic compression and late mylonites are also characteristic of this section of the Periadriatic lineament. The deformation of boudinaged, strongly thinned rock bodies persisting over a length of 100 km along the strike of the lineament, is remarkable.

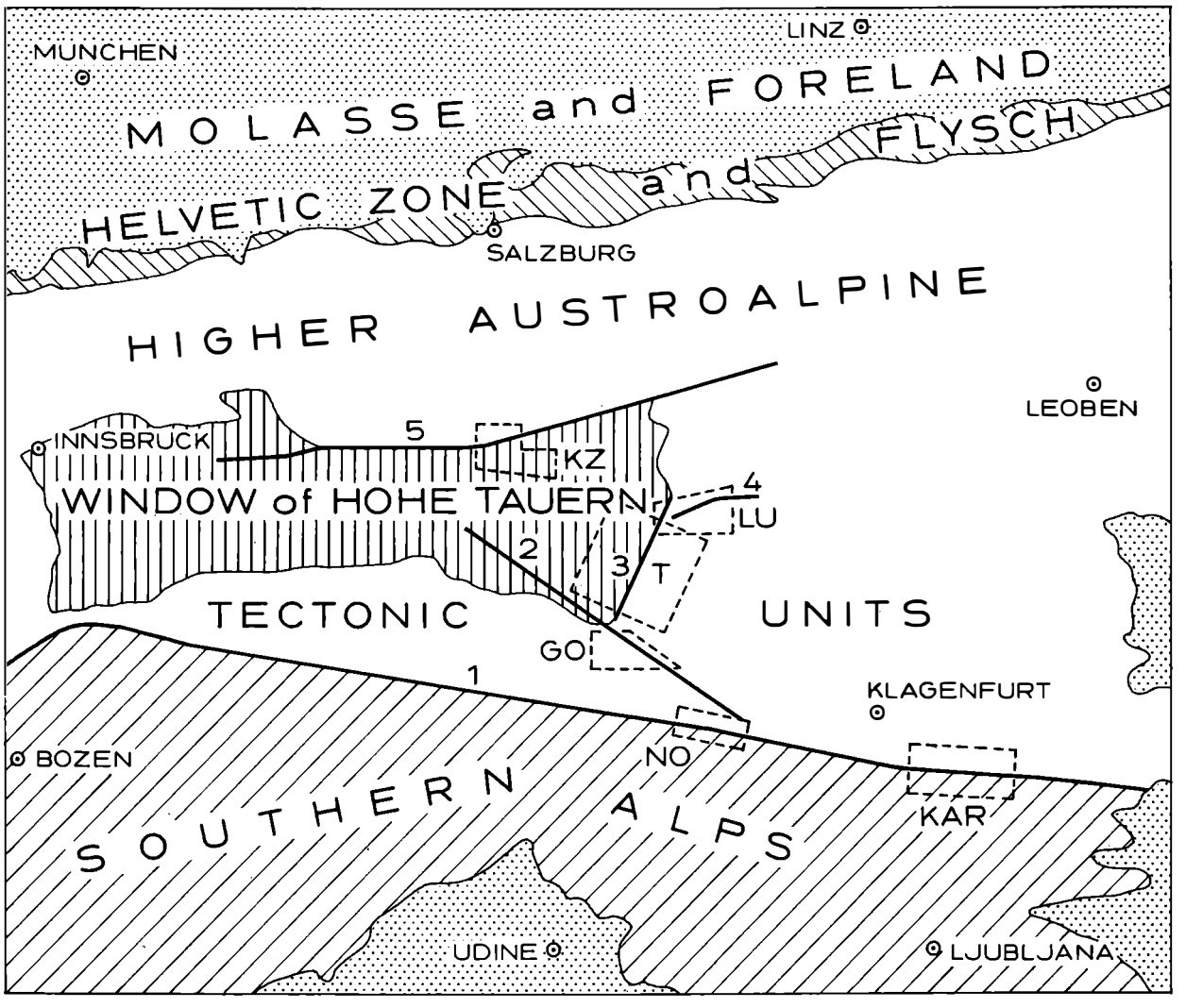

Fig. 1: Fault zones investigated in the central part of the Eastern Alps. 1 = Periadriatic lineament. 2 = Möll-Drau fault. 3 = Katschberg zone. 4 = Fault zone of Lessach. 5 = Salzach-Enns fault.
Special areas investigated: GO = Goldeck mountain group. KAR = Eastern Karawanken range. KZ = Klammkalk zone. LU = Lungau. NO = Surroundings of Nötsch and Finkenstein in Carinthia. T = Eastern margin of Hohe Tauern.

3. The Möll-Drau fault, the Goldeck mountain group, and the repeated levelling across the eastern part of the Hohe Tauern ("GO" in Fig. 1; publications: 1, 11, 17)

The Paleozoic structures south of the Möll-Drau fault have been studied in the eastern Goldeck mountain group: There is an unconformity between folded phyllite and transgressively overlying Permo-Scythian sandstone. From Lower Paleozoic dolomite within phyllite, conodonts are reported (SCHÖNLAUB). There is also an unconformity of the fold axes between the Paleozoic phyllite and the Permo-Triassic members. The intense Alpidic deformation along the Möll-Drau fault can be traced from the tectonically deep level of the Tauern Window into the high level of the Higher Austroalpine Units (mylonites in the Altkristallin of the Goldeck mountain group).

The repetition of the precision levelling across the strike of the Hohe Tauern (Gastein, Mallnitz and Möll valleys) carried out by SENFTL (Bundesamt für Eich- und Vermessungswesen, Vienna) revealed vertical uplift of the Hohe Tauern of about 1mm per year. The highest values have been measured immediately north of the Möll-Drau fault.

4. The Katschberg zone ("T" in Fig. 1; publications: 3, 4, 8, 12, 13, 16)

SCHÖNLAUB determined Silurian conodonts in lenses of dolomite and limestone embedded within Katschberg phyllite. The gneisses and micaschists of the Altkristallin of the Higher Austroalpine Units east of the Katschberg zone contain Paleozoic and possibly Precambrian relic minerals and structures. Pebbles of these Altkristallin rocks metamorphic in amphibolite facies, are found as components in the Upper Caboniferous conglomerates of Turrach-Innerkrems.

The rocks of the Hohe Tauern west of the Katschberg zone are recrystallized in Alpidic time, mainly in greenschistfacies. The structures are rather flat-lying with an axial plunge of 30—35° to the east. The E-W trending fold axes formed by the main Alpidic deformation act, are locally overprinted by N-S trending axes. In the Zentralgneiss area, it was possible to trail over a great distance a tonalite gneiss nappe lying upon micaschists.

West of the Katschberg zone, the sequence of formations already known from the Lungau could be traced to the south as far as the Drau valley.

The Alpidic movements along the Katschberg zone are responsible for retrograde metamorphism and the formation of mylonites. The distinction between progressively metamorphic Lower Paleozoic phyllite and phyllite retrograde after micaschists ("phyllonite") was principally made with the aid of the hiatus in the grain size of the white micas. There are relics of gneiss within the phyllonite in some places.

An interesting new result is the existence of a zone made up of phyllitic micaschists containing phenoblasts of garnet and albite; this zone is restricted to the base of the Higher Austroalpine Units between Lungau and Gmünd in Carinthia.

It is suggested by the geomorphology, observable faults, seismic activity (earthquake of Gmünd), and mineral springs that faults are active along the Katschberg zone. To evaluate this suggestion, a new levelling profile was installed across the Katschberg zone in E-W direction. The western end of the profile is based on the Schieferhülle of the Hohe Tauern, the eastern end on phyllitic micaschists at the base of the Higher Austroalpine Units.

It is provided to repeat the measurements after periods of several years. The levelling profile was specifically built up for this scientific porpose across the Katschberg pass in 1973/74 by the Bundesamt für Eich- und Vermessungswesen, Vienna (SENFTL). Direction measurements and electronic distance measurements were carried out a the Torscharte in 1976/79 by the Institut für Landesvermessung of the Technical University of Vienna (SCHMID, PETERS) with the aid of geodetic pillars on both sides of the fault zone.

5. The fault zone of Lessach and the Lungau basin ("LU" in Fig. 1; publications: 10, 15, 16, 18)

At the northern end of the Katschberg zone, the fault zone of Lessach branches off in an easterly direction. Lenses of dolomite contained in the phyllite yielded Silurian conodonts which were determined by SCHÖNLAUB.

The basement of the Paleozoic syncline are gneisses and micaschists of the Higher Austroalpine Units which were intensely sliced in Alpidic time. Phyllonites are originated from micaschists by retrograde metamorphism.

The clastic sediments of the Miocene fresh-water sediments of the Lungau basin contain the material derived from gneisses and micaschists of the adjacent Altkristallin of the Higher Austroalpine Units. Rocks typical of the Tauern Window are missing. Therefore it is suggested that, in the Miocene, the rocks of the Tauern Window were still buried beneath the erosion level.

Post-Miocene movements could be established in several places of the Lungau basin. Steeply inclined bedding planes, formation of graben structures, strike slip displacements and slickensides bear witness of the deformation of the fossiliferous Miocene strata.

6. The Salzach-Enns fault ("KZ" in Fig. 1; publications: 4, 7, 14, 19)

In continuation of the investigations of HEISSEL, HORNINGER and MOSTLER (University of Innsbruck, Technical University of Vienna), the E-W striking fault on the northern margin of the Hohe Tauern was analyzed in a special area (Salzach valley, Klammkalk zone).

In the section investigated, the Graywacke zone of the Higher Austroalpine Units north of the Tauern Window consists of Lower Paleozoic phyllites, diabases and carbonate rocks; the metamorphic influence increases from north to south (anchimetamorphism to greenschist facies). South of the Salzach fault, the bordering Bündner Schiefer (Schistes lustrés) of the Tauern Window in part closely resemble the phyllites of the Graywacke zone in their lithology, composition and fabric. Graywacke zone and Bündner Schiefer jointly suffered deformation and recrystallization during a late phase of Alpidic orogeny.

Breccias, flysch-like sandstones, diabases and ultramafic rocks are characteristic of the tectonically mobile, marin domain of the Bündner Schiefer during older periods of the Alpidic orogeny (Sandstein-Breccien zone).

Postdating the deposition of the Neogene fresh-water sediments, intense compression accompanied by vertical and lateral slip motions affected the rocks along the Salzach-Enns fault. Mylonites formed during this phase attain a thickness of 100 m. HORNINGER reports faulting in Quaternary sand and gravel.

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