Mineralogy and petrology of magmatic and metamorphic rocks in the Permian–Lower Triassic Haselgebirge of the Eastern Alps: geodynamic implications

Manfred Bernroider (1), Franz Neubauer (1), Anja Schorn (1) & Thomas Ziegler (1)

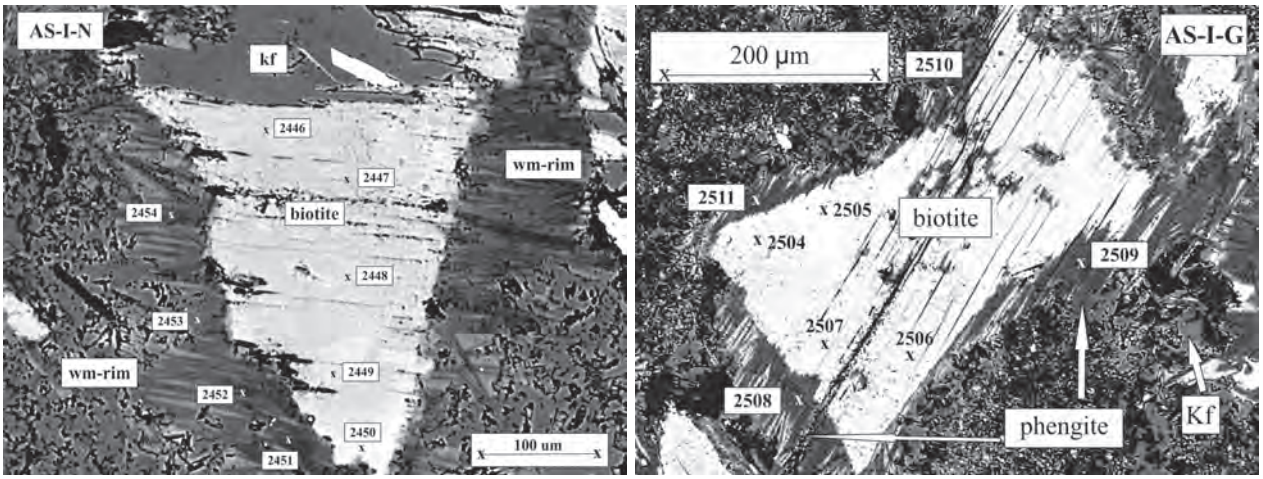
Abstract

The evaporite mélange of the Haselgebirge Formation exposed in the central Northern Calcareous Alps (Moosegg, Weitenau, Hallstatt, Grundlsee) comprises a wide range of dm- to m-sized tectonic blocks of magmatic and metamorphic rocks. Few metagabbro clasts contain a partly altered magmatic mineral assemblage including plagioclase, clinopyroxene and titanomagnetite. The patchy clinopyroxene grains have cores of $Wo_{40.2}En_{47.6}Fs_{12.2}$ and rims of $Wo_{36.4}En_{44.2}Fs_{19.4}$. The rims are partly replaced by a fine-grained mixture of chemically unresolvable amphiboles, opaque and other minerals. The metamorphic assemblage of other pseudomorphs contains phengitic white mica (3.55 to 3.65 Si per formula unit; Early Variscan $^{40}Ar/^{39}Ar$ ages) and Na-rich amphiboles (winchite). Because of the missing foliation, the metamorphic assemblage represents likely ocean floor metamorphism.

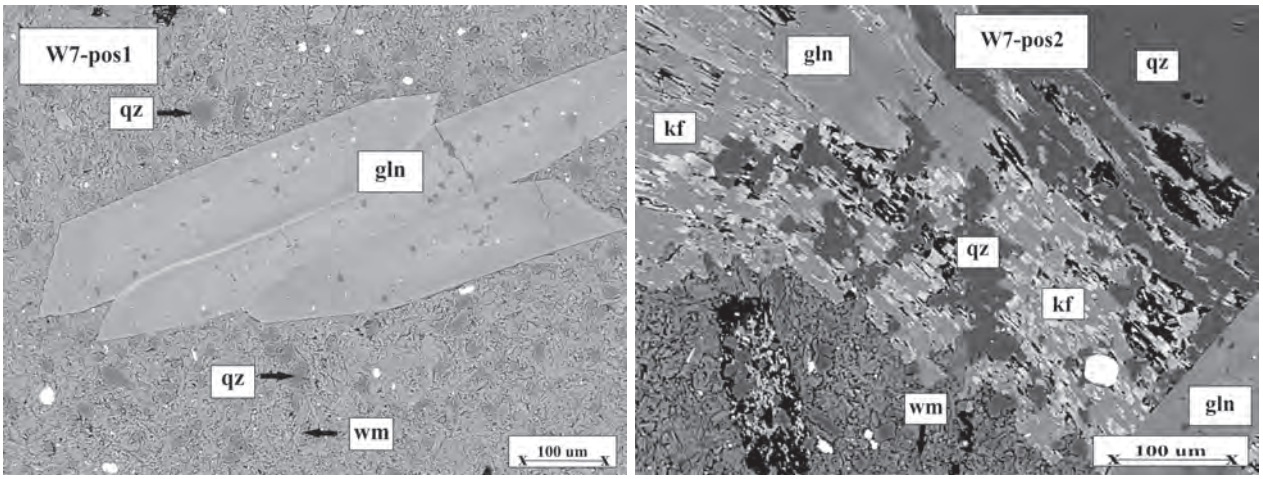
Other samples of meta-biotite-diorite/-gabbro as well as meta-syenite contain plagioclase, kaersutite, and Ti-rich biotite as primary minerals, and actinolite, chlorite and epidote in a metamorphic assemblage. Biotite $^{40}Ar/^{39}Ar$ ages range from 270 to 248 Ma. In some of these rocks we also found a magnesio-hornblende/actinolite + opaque minerals in the core of kaersutite, which could be a pseudomorph after clinopyroxene. We also found idiomorphic glaucophane with small phengite-rich white mica, respective rims of phengitic white mica around biotite indicating static high-pressure conditions during their formation (Text-Fig. 1). In deformed amphiboles, exsolution resulted in formation of riebeckite-rich rims against actinolite cores. Na-rich amphiboles (mainly magnesio-riebeckite) are particularly important in many metamorphic rocks as well as infill of extensional gashes, particularly in dolomite lenses. As a working hypothesis, we postulate formation of Na-rich amphiboles by interaction between a brine and rock at an elevated temperature.

In fine-grained, well preserved blueschist samples from an abandoned quarry at Weitenau, idiomorphic glaucophane in a fine-grained mat-

Text-Fig. 1.
Back-scattered electron images of magmatic biotite with a rim of phengitic white mica (wm) in fine-grained K-feldspar (Kf) bearing matrix of a meta-syenite sample. Numbers represent spots of microprobe analyses. The biotite of samples has an apparent $^{40}Ar/^{39}Ar$ age of ca. 250 Ma. Consequently the phengitic white mica has grown during the Alpidic cycle.



(1) University of Salzburg, Department of Geography and Geology, Hellbrunnerstraße 34, 5020 Salzburg.
manfred.bernroider@sbg.ac.at



Text-Fig. 2.
Back-scattered electron images of a fine-grained blueschist with zoned idiomorphic glaucophane (gln) in a fine-grained matrix of quartz (qz), white mica (wm) and K-feldspar (kf).

rix of K-feldspar, quartz and phengitic white mica and some carbonate is common (Text-Fig. 2). The glaucophane can be zoned with a prograde zonation with decreasing CaO and FeO_{tot} and increasing Al_2O_3 contents towards the rim. Unfortunately, the white mica is too fine for dating with the $^{40}Ar/^{39}Ar$ technique. Other unusual rocks are greenschists, in which green colored Cr-celadonite was found within carbonate-anhydrite layers in addition to fine-grained Mg-riebeckite. Preliminary $^{40}Ar/^{39}Ar$ ages scatter at ca. 160 Ma. Together, the fine-grained blueschists with idiomorphic glaucophane and the Cr-celadonite bearing greenschist potentially constrain a Jurassic metamorphic event within blueschist facies conditions.

The new data indicate a magmatic suite in the Alpine Haselgebirge, which is dominated by mildly alkaline rocks of a potentially rift origin. The phengitic white mica and glaucophane of meta-gabbro indicate a phase of post-Permian blueschist metamorphism as well as the Cr-celadonite dated at ca. 160 Ma. We speculate that part of blocks preserve remnants of a Mesozoic subduction zone of a rift-related passive continental margin sequence of the Meliata Ocean.