

The plagioclases are highly albitized and sericitized. Microscopically the biotite is brown in colour, partially chloritized, with pleochroic haloes around zircon inclusions. Chlorite in the form of flakes is also present due to chloritization of garnet during retrogressive metamorphism. Quer biotite is megascopically noticed in the hand specimens.

Metacrysts of almandine garnet which are rather sharply bounded, and of Diam. 1.5 mm are common.

Mica schist series: The series correspond the low-grade pelitic schist. The rock types of the series are:

1. Phyllonitic schist.
2. Muscovite-chlorite-quartz schist.

These rocks are mainly composed of muscovite, quartz, chlorite and feldspar. Conspicuous eyes of feldspar crystals of diam. 2 cm as maximum, developing the augen („eyed“) structure. Lamination and schistosity is prominent.

Amphibolite rocks: Exposures of these rocks are found in the North. Sometimes as intercalations in both Grogneis and mica schist rocks, and as inclusions in the Grogneis are found in the west part. These rocks are related to the higher series of the old crystalline rocks.

Marbles: A narrow zone of metamorphosed limestone in the form of two pockets are exposed in the area studied. These rocks show intercalation with the amphibolite rocks in the north part of the area. According to further petrographical studies, and discussions, these rocks are related to the amphibolite rocks.

Studies of Metamorphics in and around Lindner, Birkfeld (East-Styria, Austria)

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Abstract

The metamorphics in and around LINDNER, BIRKFELD, include six rock types of low grade regional metamorphism.

Meta-Arkosic Sandstone is a fine grained rock with medium grains sandwiched in between. It lacks in structural features but in thin sections it sometimes shows schistose-like structure. Quartz and Feldspars are coarse grained with moderate sorting and are irregular and angular in habit. Quartz shows recrystallisation. Analysis of Mica under X-ray diffraction gives the following data: $a_0 = 5.04 \text{ \AA}$, $b_0 = 9.01 \text{ \AA}$, $c_0 = 20.07 \text{ \AA}$ and $\beta = 97^\circ 24'$. The polymorph is 2M and gives a near data value for Phengite (?). This rock is a derivative of sedimentary material which has undergone considerable metamorphic effects.

Two types of Quartzite are recognized, one is Feldspar bearing and the other is Feldspar free, the former type showing much mineral variation. Mica is present throughout. The rock might have resulted from Sandstones of Feldspathic and Micaceous composition by regional metamorphism. In places, the Quartzite shows conglomeratic nature imparting a greenish colour behaving like sedimentary rocks with tectonic effects.

Micaceous Phyllitic Schist retains the Phyllitic nature though the transition from Phyllitic Schist to proper Mica Schist is in progress. The rock is fine to coarse grained in nature and the

Schistosity is accentuated by thin segregation bands of alternatively Quartzo-Feldspathic and Micaceous minerals, formed by local concentrations of individual minerals during chemical reconstitution. Garnets are skeletal and Albites are fresh. Inclusions of Epidote common. The altered Chlorite exhibits flaky nature. It is assumed that this rock is formed by low grade regional metamorphism of pelitic sediments and belongs to Albite-Epidote-Amphibolite facies.

Fine grained Gneiss possesses a well defined linear arrangements of the minerals. Inclusions of Plagioclase inside the Microcline grains seem to indicate metasomatic replacement. Feldspar show hydrothermal alteration and Quartz shows considerable grain size variations. Bending of the Micas is another metamorphic feature. The presence of Hornblende indicates progressive metamorphism. Microcline shows perthitic structure due to unmixing of soda- and potash-rich material. The rock is a derivative of Quartzo-Feldspathic material which has undergone regional metamorphism.

Meta-Gabbro is consisting mainly of Actinolite which is altered from Pyroxene. Biotite is giving secondary alteration to Chlorite. Clino-Zoisite is found to be derivative of Plagioclase. Near the contact of Micaceous Phyllitic Schist, Chloritoid is present and the amount of Quartz and potash Feldspar is increasing towards the fine grained Gneiss. Ore-microscopic studies indicate the presence of Pyrite and Phyrrotite along with Ilmenite. This rock might have formed from original Gabbroic composition when mixed with aluminous rich pelitic sediments.

Bending of twin planes in Plagioclase, twisting of Muscovite in Grob Gneiss indicate effects of stress and strain. Under high pressures Biotite has become unstable in lowest temperature facies, giving rise to Chlorite. The source material might be Granitic in composition with rich content of Iron. The rock belongs to Quartz-Albite-Chlorite sub-facies.

Results of trace and major element studies point out that in all rocks, the correlation between K and Rb, Ca and Sr, K and Ti is normal.

Geology of Birkfeld Area (East-Styria, Austria)

Between Lat $47^{\circ}24'12''$ — $47^{\circ}22'19''$ and Long. $15^{\circ}36'48''$ — $15^{\circ}38'48''$

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A b s t r a c t

The mapped area consists of five formations; each is different in structure and lithology. The unit 1 consists of epizonal quartzite, with quartz, muscovite and small amount of alkali feldspar. The unit 3 which consists of augengneiss, phyllite and phyllonite rocks, is thrust over unit 1. It is possible to observe two kinds of crystal generations, one is probably pre-Alpidic (microcline and oligoclase), and the other was recrystallized during Alpidic time (albite); it is from epizonal metamorphism. Intercalated in the unit three, like tectonics scales, is the marble (unit 2), which is composed essentially of calcite and muscovite; this rock belongs to the epizonal metamorphism. The unit 3a amphibolite, appears as narrow band, and is formed by hornblende, alkali feldspar, clinozoisite, quartz, garnet, calcite and abundant sphene; from our point of view, this body could be an old basic rock, connected with some old intrusive rock; it belongs to the epi-mesozonal metamorphism. Superimposed over the unit 2 is the fine grained gneiss (unit 4) consisting of quartz, biotite, muscovite, garnet and alkali feldspar. The mineral association belongs to the "Quartz-Albite-Epidote-