

The formation of biotite mica biology essay



**ASSIGN
BUSTER**

Biotite Mica; is a common metamorphic, igneous and sedimentary mineral, the mineral is stable at a variety of grades of metamorphism but can be inverted into chlorite, and can be formed from the alteration of muscovite. The formation of Biotite Mica is most common at depths lower than 24 km and at temperatures exceeding 320°C.

Muscovite Mica; is a common metamorphic, igneous and sedimentary mineral, and often occurs ignoring for the most part metamorphic grade. The mineral is stable at a variety of grades of metamorphism (0 - 760°C) at depths generally lower than 18 km, but can be altered into biotite mica from 350°C.

Chlorite; is a common low grade metamorphic mineral, and often contains a green sheen from the Aluminium contained within the crystal lattice, chlorite often occurs around biotite where present. The chlorite zone is a zone of three subgroups of Muscovite, Chlorite, Quartz and Albite/ Muscovite-Chlorite, Quartz, Microcline, or Chloritoid, paragonite and spessarite, and the Calcite-Chlorite-Epidote-Albite Series with various opaque minerals occurring in addition to this. The mineral formed in conditions between 500 and 550°C, in depths generally lower than 18 km and is diagnostic of metamorphic grade. Chlorite can also form as a retrograde reaction with the biotite mica, which it forms when the P/T conditions are exceeded for chlorite stability.

Kyanite; is the common low temperature, medium to high pressure metamorphic mineral with P/T conditions within the blue area on the graph opposite generally at any temperature or pressure. The mineral is quite useful in addition to other minerals to gather an approximate temperature or

burial depth. Although Kyanite can form in any conditions, the greater the clay proportions in the protolith the greater the likelihood of Al₂SiO₅ polymorphs will be generated in fact these polymorphs only forms in high grade meta-pelites successions, the presence of Kyanite shows the placement of a barrowman zone entitled the " Kyanite xxx Zone"

Andalusite Sillimanite; as above, sillimanite can occur in both the tabular form and in some cases in the acicular form i. e. Fibrolite. The sillimanite likely denotes the location of a barrowman zone entitled the " Sillimanite Muscovite Zone" when there is a lack of Potassium feldspars and the Sillimanite XX Zone when it does occur. Sillimanite is the higher temperature and temperature representative of the Alumina Silicate group, but also represents lower pressure successions. According to Marakushev, 1973 the temperatures, between 600 and 800°C at approximately 18 km are most likely to have been responsible for the recrystallization this member polymorph sequence.

Andalusite; as above, Andalusite can occur in both the tabular form and in some cases in a chiastilite form with the sillimanization of the core of the mineral crystal. The Andalusite likely denotes the location of a barrowman zone entitled represents a Barrowman zone, within relatively lower pressure successions usually below 10 km (3 Gpa). At any temperature between 480 and 850°C according to Holdaway 1971 imposing Holdaway 1971 Alumina-Silicate cut-off limits.

Almandine; Almandine (Fe₃Al₂Si₃O₁₂) is the most common garnet group encountered in meta-pelitic rocks, and is likely to be almandine as it is

lighter in colour under PPL and shows a lighter refractive index than its dark coloured varieties. The mineral forms at any Depth but most often forms at temperatures between 450°C - 575°C, Almandine can substitute magnesium replacing its Fe with Mg thus, making it closer to the pyrope subgroup (although this does not generally apply in this metamorphic rock). Almandine is usually resistant to alteration but it can revert to chlorite, hornblende, Epidote and iron oxides.

Serpentine; Serpentine covers three polymorphs that cannot be identified by optical mineralogy, if the serpentine minerals are slightly yellow in colour then an olivine origin may be possible. A mesh serpentine texture is the most common which is fairly diagnostic of the mineral. Serpentine is formed most commonly by the redox reaction of "magnesium and silicon with infiltrating water to produce serpentine"- B Yardley 1991, which commonly also forms magnetite. The equation outlined above is the simplest method of generating serpentine in the rock, with the presence of water this occurs at approximately 430-470°C Hyndman 1972.

Fosterite; (Mg_2SiO_4) is the magnesium rich end-member of the olivine solid solution end member, and the most common constituent in metamorphic rocks because of its relatively low melting temperatures. Although pure Mg rich olivine is rare, there is only around 10% Fe in most metamorphic olivine's, which lowers the formation temperature to approximately 1400°C, combined with pore fluids and deeper pressures this can usually be reduced to between 800 and 1200°C, this can be found in some high grade metamorphic rocks. The generation of Fosterite is possible from mostly carbonate material, as shown by the second equation where Calcite, and

<https://assignbuster.com/the-formation-of-biotite-mica-biology-essay/>

talca, can form dolomite, and tremolite forming both Diopside and Fosterite if the equation is observed.

Calcite; (CaCO_3) The Rhombohedral calcite, and cleavage can be seen in several rocks, the polymorph of Calcite is aragonite this forms as seen by appendix 1. Calcite occurs in a wide range of igneous, metamorphic and sedimentary rocks however calcite occurs in the highest proportions in metamorphosed limestones (marbles) often as anhedral granular crystalline rocks. The calcite defines a Barrovian zone is a Si-dolostones of the Amphibolite-facies Mid-temperature and High pressure rocks. The main reason for the presence of the Calcite is derived most likely the shells of marine organisms, and due to stable P/T conditions this has allowed a high percentage of calcite to remain in some samples.

Dolomite; as above, is formed by equation 2a, from a consumption of Quartz and Calcite in a rock to create dolomite which is difficult to observe with optical mineralogy only being defined by an extra cleavage plain, in the rock.

Diopside; is the pyroxene group end member of pyroxene and is formed by equation 2a, from a consumption of Quartz and Calcite in a rock to create Diopside found in high temperature a Si-dolostones of the Amphibolite-facies Mid-temperature High pressure rocks.

Quartz; (SiO_2) is a polymorphic system of several mineral species however it is difficult to identify the difference between high and low quartz, the species of Quartz are outlined left. Quartz is a useful mineral on showing the presence of plastic deformation by the presence of sweeping undulose

<https://assignbuster.com/the-formation-of-biotite-mica-biology-essay/>

extinction. And is stable at most temperatures, and therefore, remains unless it is used in a reaction like equation 2. <http://classes.colgate.edu/raprill/geol201/images/stability.gif>

Plagioclase Feldspar; ($\text{NaAlSi}_3\text{O}_8$ – $\text{CaAl}_2\text{Si}_2\text{O}_8$) is a group of minerals that can be present in Sedimentary, Metamorphic or Igneous rocks and can be useful for showing the composition of the rock, and potentially its ancestry. The twinning sets developed within the rock can give us an insight into the deformation and formation of the rock Barker 1990.

Albite Feldspar; ($\text{NaAlSi}_3\text{O}_8$) as above; helps suggest the presence of the Green schist Facies Zone, and does not tend to form above 450°C , but at any depth.

Chloritoid; $(\text{Fe, Mg, Mn})_2\text{Al}_4\text{Si}_2\text{O}_{10}(\text{OH})_4$ is a mineral that forms in mid temperature and pressure metamorphic environments, and often contains a green sheen from the Aluminium contained within the crystal lattice, this is often in association with the mica group minerals if present. The mineral formed in conditions between 400 and 550°C , in depths generally above than 15 km and is a useful aid to metamorphic grade.

Hornblende; $(\text{Ca, Na})_{2-3}(\text{Mg, Fe, Al})_5(\text{Al, Si})_8\text{O}_{22}(\text{OH, F})_2$. hornblende is a common constituent in metamorphic rocks, the most common variety of which is the Amphiboles subgroup, the mineral forms within 550 – 950°C on a parabolic curve, between 0 and 30 km within the green schist facies zone (but can persist into Granulite and Eclogite Facies) well within the ductile deformation zone and lineation of hornblende and surrounding minerals may occur. A Corona or moat effects can be constructed by the oxidization of iron <https://assignbuster.com/the-formation-of-biotite-mica-biology-essay/>

into magnetite. The presence of Hornblende suggests that the rock is relatively dry, or certainly that it does not reach the right conditions for the formation of Actinolite.

Zoisite; this mineral occurs within Medium grade regionally metamorphosed rocks, eclogites, blue schist facies metamorphic rocks. Zoisite, typically is found with a calcareous shale protolith, and is found inter-grown with quartz, typically forming at temperatures around 500-650°C typically at depths between 15-20 km -Pistorius 1962

Cordierite; $(\text{Mg, Fe})_2\text{Al}_3(\text{Si}_5\text{AlO}_{18})$ this mineral occurs within Medium grade regionally and contact metamorphosed rocks of pelitic rocks. The mineral cordierite tends to form in low pressure, higher temperature environments at around 500 - 850°C lower than 18 km in the earth. Cordierite often shows the location of the granulite facies as it is formed by equation 3. Following this equation it is unsurprising that cordierite is often inter-grown with alkali feldspar. There is a common alteration product that forms in either cracks, or produces yellow halos this is due to the mineral pinite.

Staurolite; $(\text{Fe}_2+2\text{Al})_9\text{O}_6(\text{SiO}_4)_4(\text{O, OH})_2$ is a mineral which occurs in medium to high grade, regional metamorphic rocks and commonly is found in association with almandine, mica and Kyanite at temperatures 550 - 620°C above 10km but not 40 km.