Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

Subject: Geology

Paper Code: GEC- 109

Paper Title: Metamorphic Petrology

Unit: II

Module Name: Contact Metamorphism: Characteristics and Products

Module No: 12

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Notes

Field Characteristics of Contact Metamorphism

Contact metamorphism takes place in rocks in the vicinity of plutonic or extrusive igneous bodies. Although heat is the dominant agent of metamorphism, fluids also play a major role. Contact metamorphic rocks lack foliation due to the absence of deviatoric stress. At greater depths, increase in pressure may impart a foliation to the rocks. A contact aureole is the zone of contact metamorphism in the country rocks which show contact metamorphic effects. The width of aureoles depends on the volume, composition, depth of intrusion of the magmatic body and also the properties of the country rocks, especially their fluid content and permeability. Larger volume of magma carries more heat and hence the metamorphic effects will be more pronounced.

At shallower levels, the temperature contrast between the country rock and the intrusion are at a maximum. Hence, the aureole will be well defined as compared to deeper crustal levels. If the country rocks are permeable, it would provide a passage for the fluids to seep through which would further extend the aureole. Lower temperature (700° - 850°C) hydrous granitic plutons have wider aureoles than higher temperature (900°C - 1100°C) dry mafic plutons, emphasizing the importance of fluids as heat transport agents in metamorphism. Indications of metasomatism are evident in areas where the chemical composition of the country rock differs considerably from that of the melt.

The grade of metamorphism varies within an aureole. In a metamorphic aureole, high temperature minerals like andalusite are formed near the contact. Low temperature minerals like chlorite, talc, and epidote are found farther away from the contact. Hence, zonation in mineralogy is a common occurrence. Each zone is known by the name of a particular characteristic mineral present in that zone known as an index mineral.

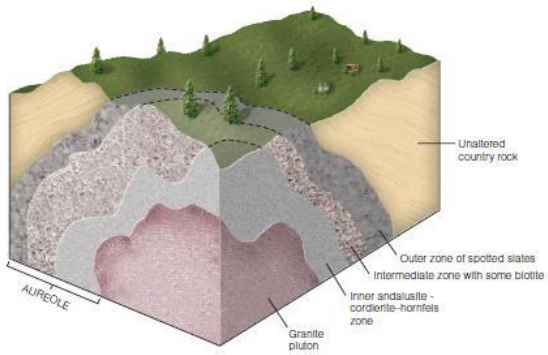

Fig 1: Contact aureole

source: https://slideplayer.com/slide/4136594/13/images/12/Metmorphic+aureole+commonly+surrounds+many+intrusions%3A+this.jpg

Products of contact metamorphism

Contact metamorphism produces rocks like **granoblastites** and **diablastites** called hornfelses.

Granoblastic texture is an isotropic texture comprising of equant to subequant mineral grains which dominate dominate a granular aggregate. Rocks exhibiting this texture are referred to as granoblastites.

Diablastic texture is an isotropic texture composed of non- aligned, radiating to randomly oriented acicular to platy mineral grains. Rocks exhibiting this texture are referred to as diablastites.

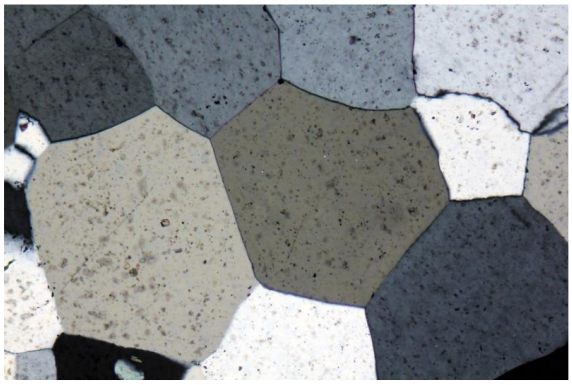

Fig 2: Granoblastite

Source:http://www.alexstrekeisen.it/english/meta/polygonal.php

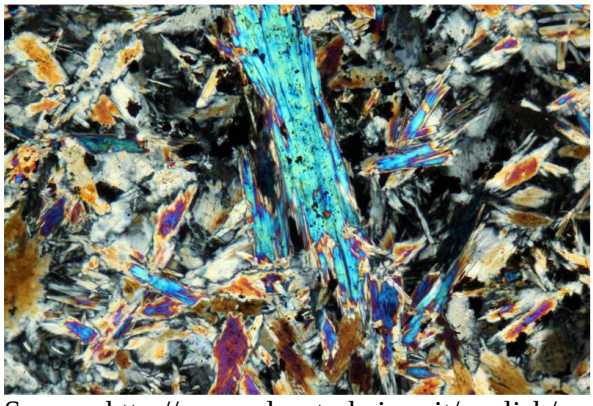

Fig 3: Diablastite

Source: http://www.alexstrekeisen.it/english/meta/decussate.php

A **hornfels** is a very fine grained, granoblastic/ diablastic rock, which has a baked appearance similar to a kiln-fired ceramic. These rocks are dense, tough and compact, and tend to splinter or display conchoidal fracture when broken. Hornfelses contain a variety of minerals such as quartz, feldspars, and epidote. Carbonate rocks contain spurrite and tilleyite. Mullite is a common phase in pelitic rocks. Whereas, Sanidine forms in rocks of appropriate chemistry. Growth of porpyroblasts in hornfelses, may give rise to a spotted appearance. Such a rock is then called a spotted hornfels.

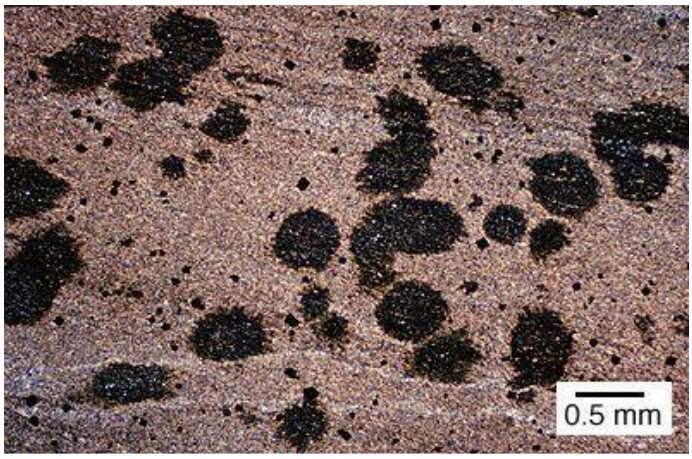

Fig 4: Spotted hornfels

Source:http://www.alexstrekeisen.it/english/meta/hornfels.php

Skarns are a common product of contact metamorphism when metasomatic effects are more pronounced. As hot, acidic, silica-rich waters are driven from the pluton into the country rocks they react with the carbonates, producing a variety of calc–silicate minerals. Skarns are granoblastic rocks that are rich in calcium silicate minerals such as calcite, dolomite, calcium rich garnets, epidote, vesuvianite, diopside, tremolite and wollastonite.

Fig 5: Skarn

Source: https://earthphysicsteaching.homestead.com/Skarn.html

Tactites are skarns that are rich in ore minerals such as chalcopyrite and galena. Many rare and unusual minerals that are rich in economically important trace elements like phosphates, tungstates, and molybdates are common constituents.

Fig 6: Partly skeletonal, but euhedral, galena crystal (about 4 by 2 by 2cm) on a bed of garnets in a tactite-skarn

Source:

http://www.science.smith.edu/geosciences/skarn/