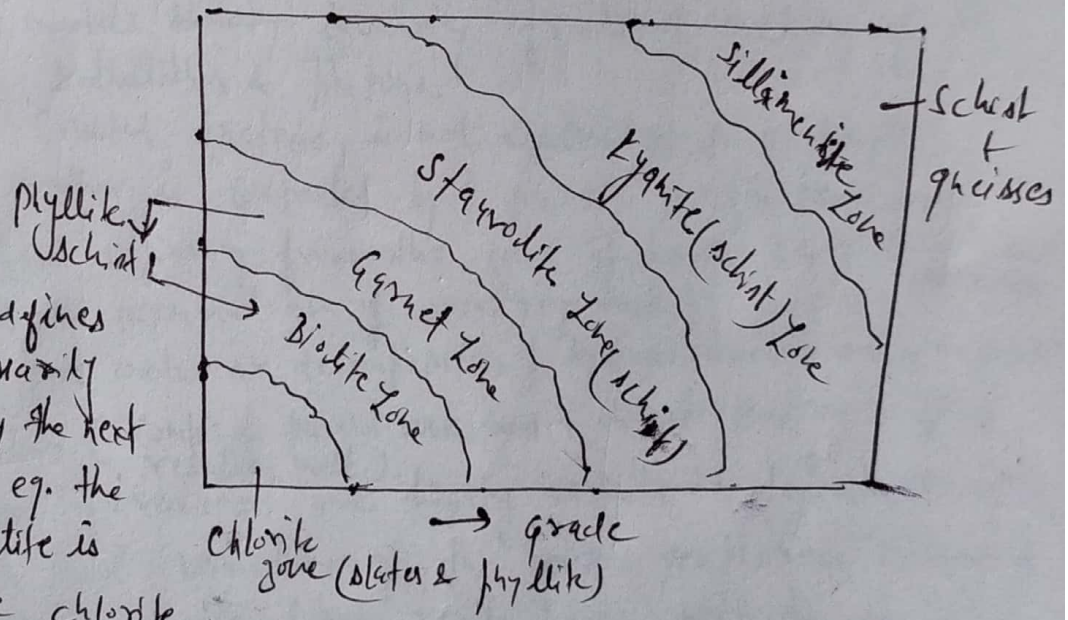
Concept of index minerals: The classic example of a regionally metamorphosed area is the Dalradian Series of Scotland. The Dalradian series occurs in a zone 50-80 km wide, north of the highland boundary fault. The rocks were originally shales, limestones, sills & basalts, that had been emplaced in the precambrian metamorphic zones in pelitic rocks based on mineral assemblages, observed in a small part of the area

Barrow recognized 6 zones of distinctive mineral assemblages which he recognized as representing increasing grade of metamorphism. The boundaries for this zone were based on the first appearance of a particular mineral, called an index mineral which is the characteristic of the zone. These boundaries were later called isograds (equal grade). He called the zone of lowest grade rocks the 'zone of digested clastic mica' but Tilley, mapping the area in 1925, renamed this zone the chlorite zone.



⇒ The index min that defines a zone, does not necessarily disappear when entering the next higher grade zone. For eg. the first appearance of biotite is at biotite grade where chlorite is seen to be reacting to produce biotite. Biotite does not disappear at the garnet isograde and infact continues to be seen though the garnet staurolite, kyanite, sillimanite zones.

⇒ Staurolite kyanite & sillimanite only occur in staurolite, kyanite & sillimanite zone respectively.

⇒ The composition of the plagioclase changes with increasing grade of meta^{m}. It is nearly pure albite in chlorite & biotite zone, and becomes somewhat more calcic (oligoclase) in higher (zones) grade zones.

⇒ The texture of the rocks changes from slate & phyllite in the chlorite zone to schist in the staurolite & kyanite zone, to schists and gneisses in the sillimanite zone.

Anatexis:

Anatexis means to melt down (Latin word) or can say partial melting of rocks. So it is used specifically to discuss the partial melting of crustal rocks, while the generic term 'partial melting' refers to the partial melting of all rocks, in both the crust & mantle.

Anatexis can occur in a variety of different setting, from zones of continental collision to mid-ocean ridges. It is believed that anatexis is the process largely responsible for the formation of migmatites. Furthermore, scientists have recently discovered that partial melting plays an increasingly imp role in active crustal processes, including the advancement of active deformation & the emplacement of crustal granites. As a result, active feedback between crustal shearing, melting & granite emplacement, has become largely accepted in the place of large scale, unreasonable models ~~thereby~~ involving fractional melting of the mantle into granitic batholiths & plutons.

Crustal anatexis is not restricted to a single tectonic setting, but rather is controlled by 4 primary parameters. ie.

- Temperature (i.e. heat originating from the core of Earth.) & radioactive elements.
- Pressure (due to the accumulation of overlying rock)
- Volatile content (pore water or decomposition of hydrous minerals, mica, amphibole
- Rock type / composition (Comp^{n} of parent rock has a direct effect on comp^{n} of resulting melt).

⇒ & these parameters are highly variable & depend on depth, crustal thickness, & local variation of the Earth's geotherm. The amount & composition of partial melts likely varies locally, reflecting the heterogeneity of the Earth crust.