DSPMU UNIVERSITY, RANCHI.
DEPARTMENT OF GEOLOGY

M.Sc. SEMESTER-II **DATE-03/05/2020**

PAIRED METAMORPHIC BELTS

In 1961, Miyashiro noted that in the Cicum Pacific region, belts of high pressure, low temperature metamorphism on the oceanic side were associated with belts of high pressure, high temperature metamorphism on the continent side. He termed such an occurrence - *Paired Metamorphic Belts*.

The term "paired metamorphic belts" may be used for "penecontemporaneous belts of contrasting type of metamorphism that record different apparent thermal gradients, one warmer and the other colder, juxtaposed by plate tectonics processes" (Brown, 2009).

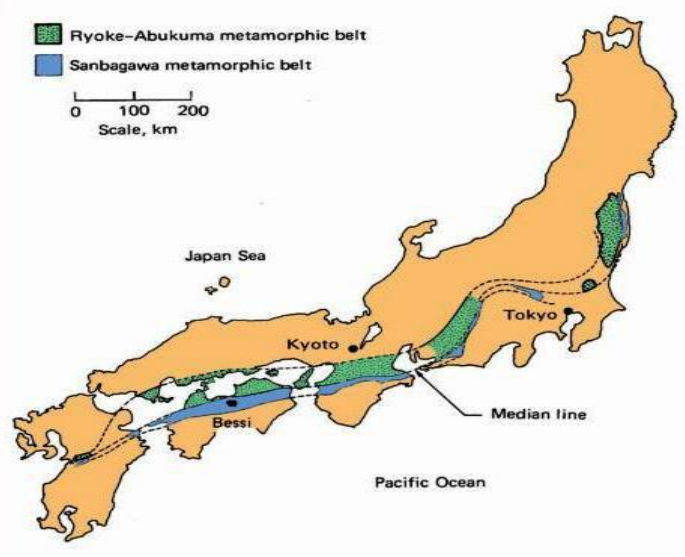
Other occurrences of paired belts have since been recognized throughout the world and include areas in New Zealand, Indonesia, Washington State, in the U.S., Chile, and Jamaica. Other such paired belts have been recognized in the Alps of central Europe, the northern coast of South America.

Most of these areas show evidence of having been associated with convergent plate margins, where subduction has occurred. It appears that subduction is necessary to produce the low geothermal gradient necessary to form the belt of high pressure and low temperature. Such belts are probably not more commonly persevered in the geologic record because during blueschist facies metamorphism hydrous minerals are still present. Only if these rocks are uplifted and exposed at the surface relatively rapidly after subduction ceases would they escape being overprinted by facies of normal geothermal gradient, because there would still be fluids available to make the greenschist and amphibolite facies mineral assemblages.

The high pressure- high temperature belts are expected to form in areas beneath the island arc or continental margin volcanic arc. During emplacement of the arc, these areas are subject to higher than normal geothermal gradients that could produce Buchan Facies Series metamorphic Rocks. Furthermore, emplacement of batholiths and isostatic adjustment after magmatism has ceased causing these belts of high T, high P metamorphism to be uplifted and exposed at the surface.

Example 1-

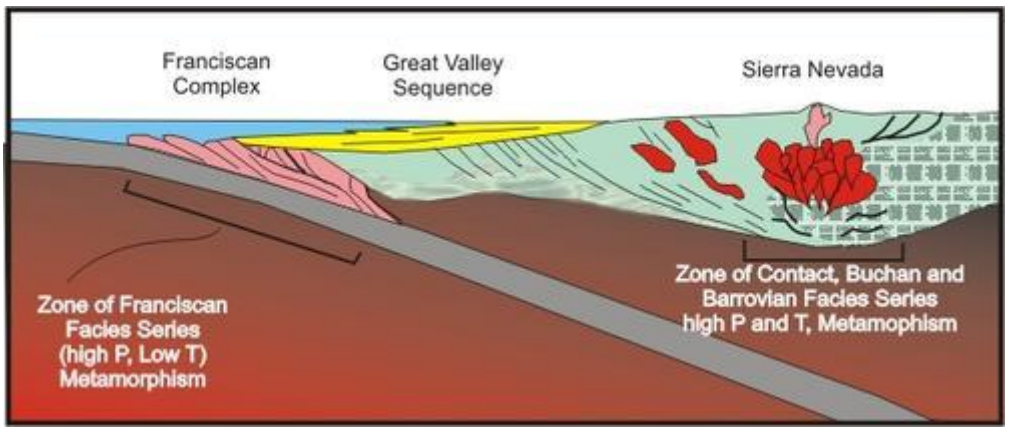
Japan, where the Sanbagawa Belt represents the high pressure, low temperature belt, and an adjacent belt, called the Ryoke-Abukuma Belt, represents the high pressure, high temperature belt. Here the Ryoke-Abukuma belt consists of Barrovian and Buchan Facies series metamorphic rocks.In the case of the Japanese paired belts, the two belts are adjacent to one another likely because subduction has moved farther off the coast. Compressional tectonics between the Pacific and Eurasian Plate has accreted the island arc and trench complex to Japan at the end of the Mesozoic.



Example 2-

The western U.S., where the Franciscan complex contains rocks metamorphosed at high pressure and low temperature, and rocks exposed in the Klamath Mountains and Sierra Nevada Mountains have remnants of Barrovian and Buchan Facies Series metamorphic rocks. Since most of the Sierra Nevada mountains now consist of batholiths, as discussed previously, one had to look at the roof pendants above the batholiths and in the western foothills of the Sierra Nevada to see the high pressure - high temperature metamorphic rocks.

In the case of the western U.S., the paired belts are separated from one another. This is because the oceanic ridge that was off the western coast of North America was subducted, and the margin changed from one dominated by compression and subduction to a transform fault margin dominated by strike slip faulting. Isostatic rebound of the highly deformed Franciscan Complex has resulted in its exposure at the surface.



Reference-

https://www.tulane.edu/~sanelson/eens212/regionalmetamorph.htm