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Low-Temperature-Low-Pressure Mineral Paragenesis of the Lower-Middle Jurassic Volcanics in the Eastern Pontides, NE Turkey

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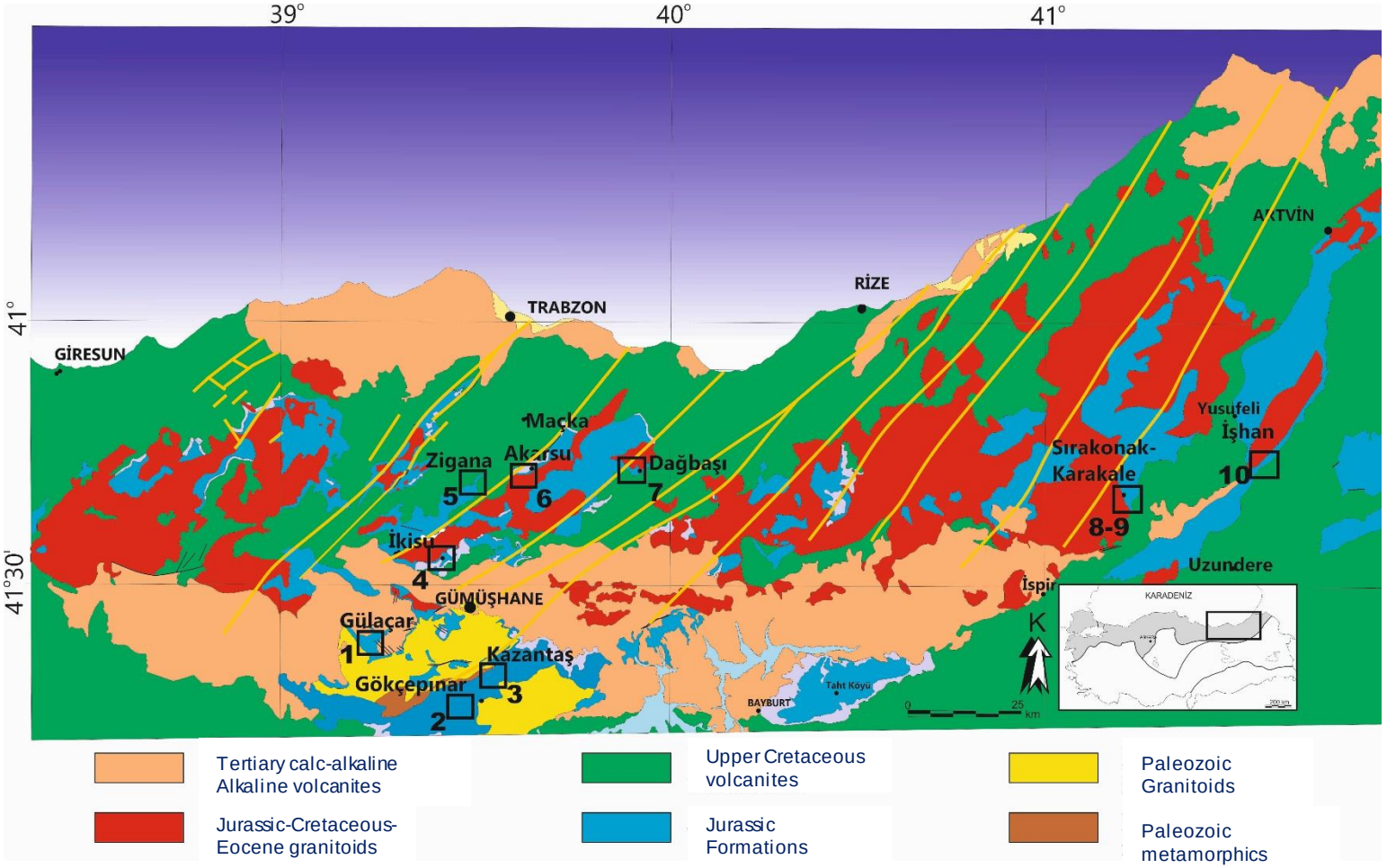
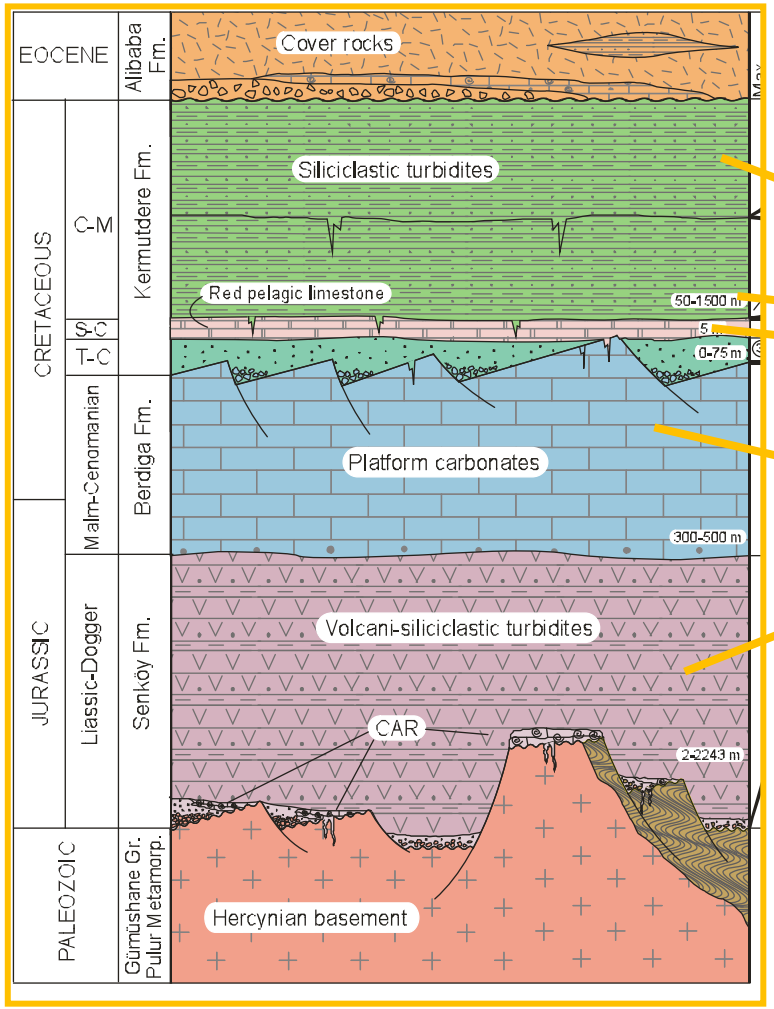
Study Areas



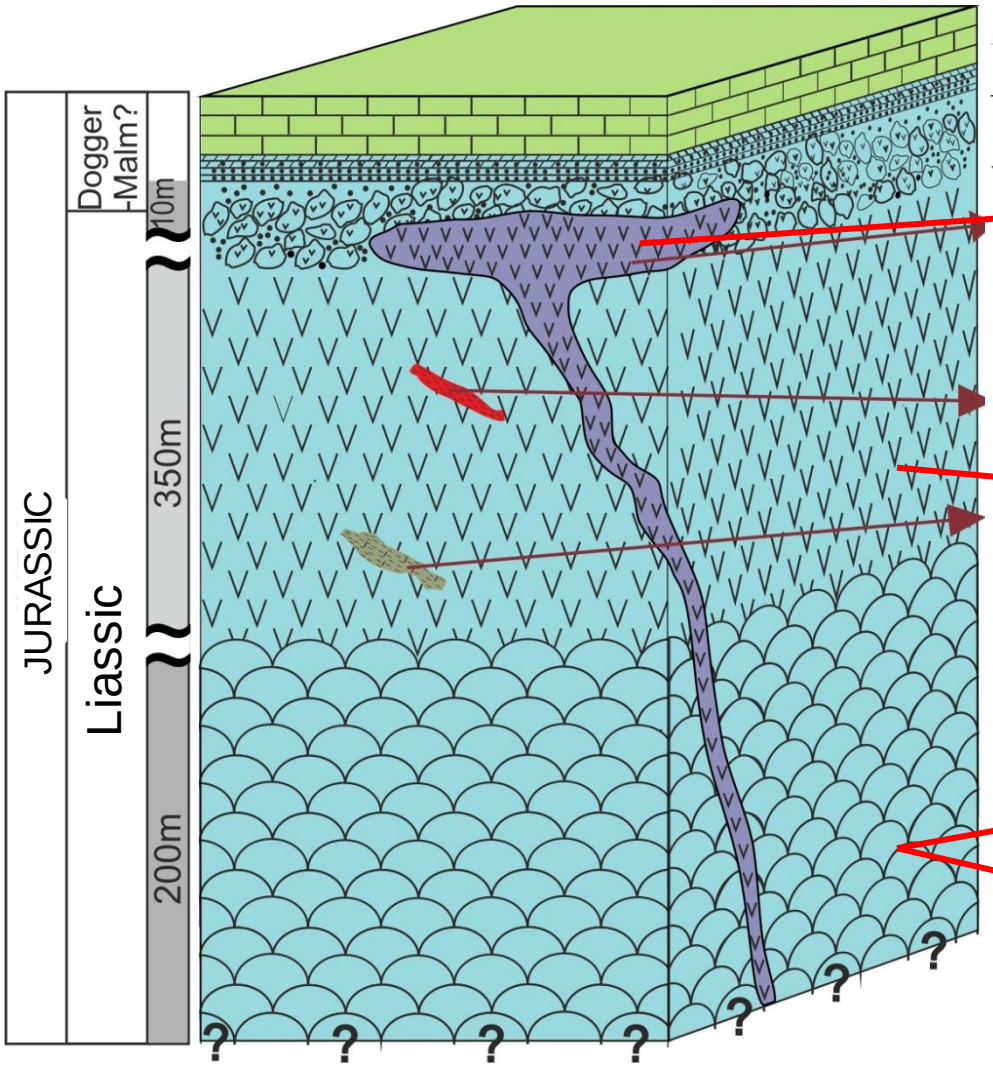
Simplified geological map of Eastern Pontide (*from MTA's 1/500.000' scale map)* and studied areas

Stratigraphy of Eastern Pontide



Simplified stratigraphic column section of Eastern Pontides (*Yılmaz, 2002*) and field relationships of rocks from the İkisu valley (Torul-Gümüşhane).

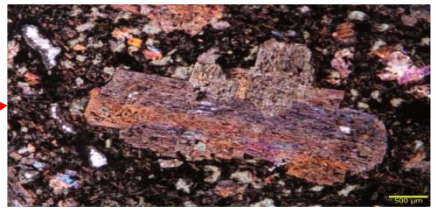
Stratigraphy of Jurassic volcanism



Dolomitic lime stone

Intercalation of light and dark color sediments

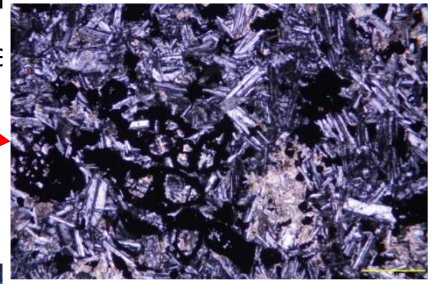
Breccia layer



Andesite porphyry

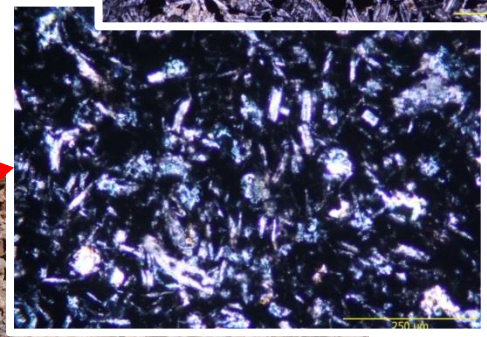
Basalt-Basaltic andesite
Vesicular-microlithic porphyric

Red color chert lense

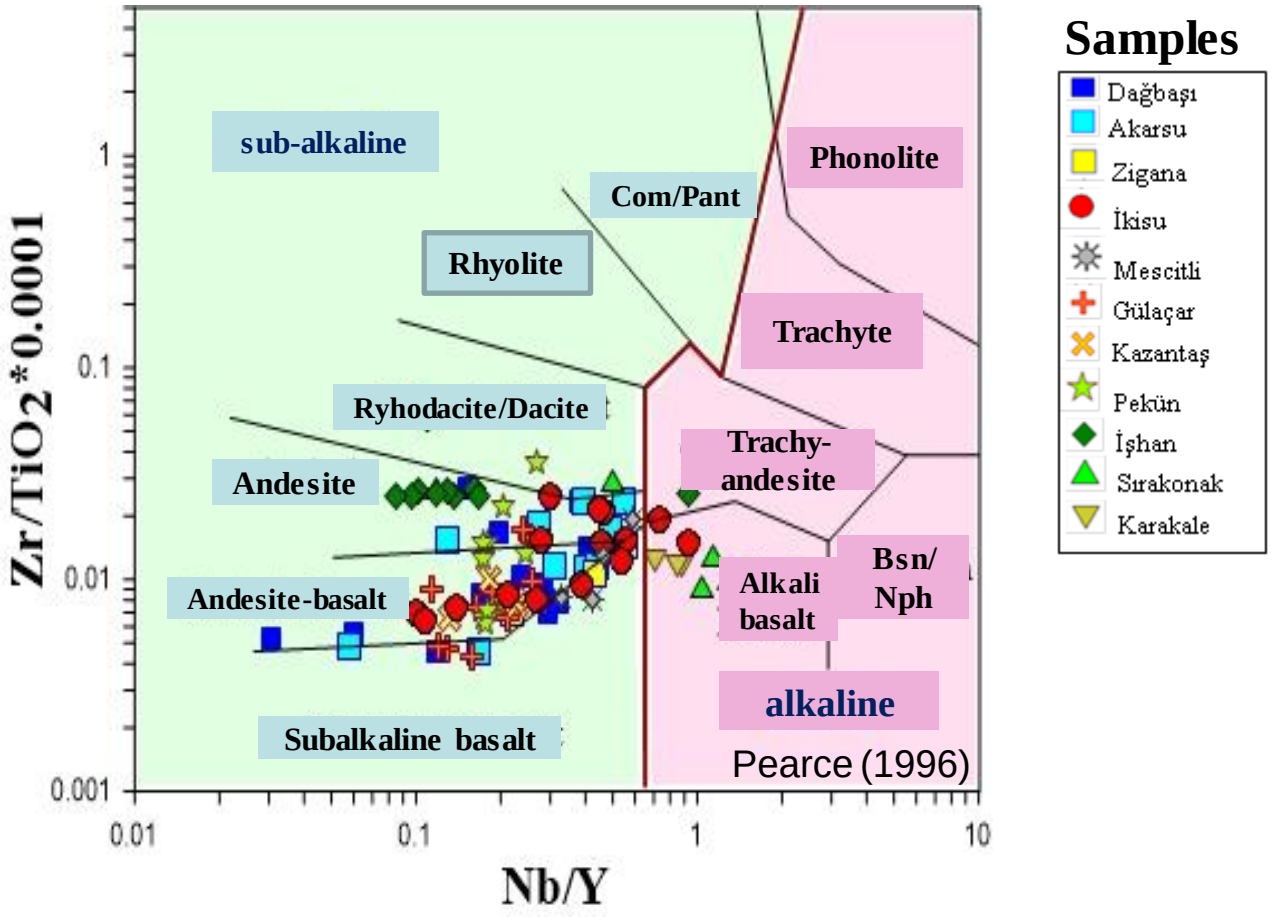


Pyroclastic lens

Pillow lavas

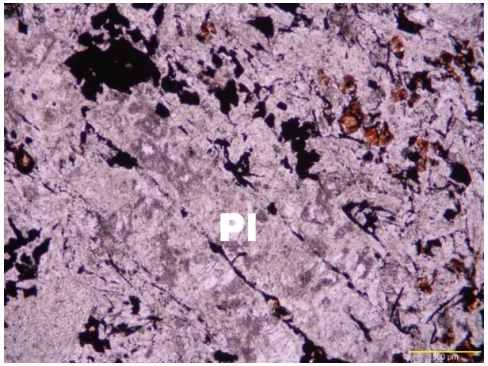


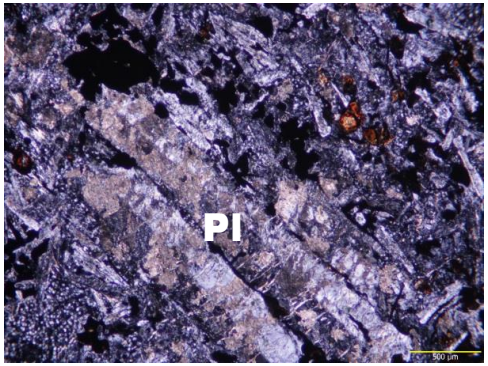
Classification of Studied Samples

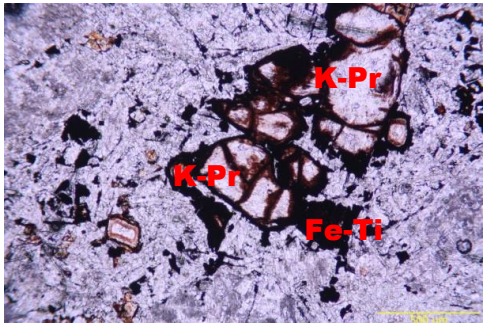


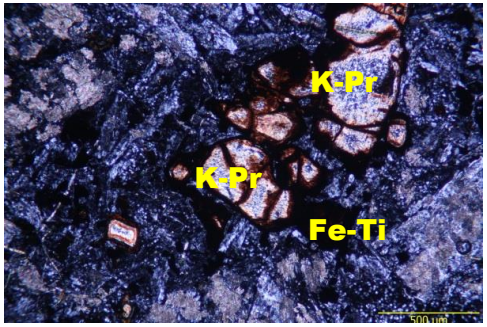
The Nb/Y vs Zr/TiO2 classification diagram (after Winchester ve Floyd 1976) of studied samples.

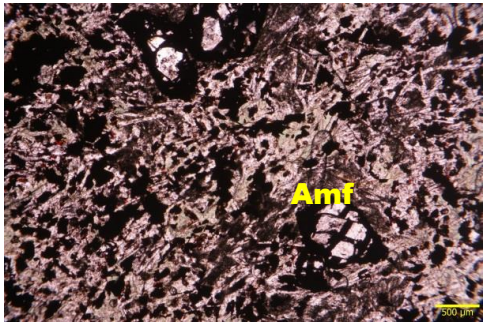
Textural and Mineralogical Changes due to Low T-Low P metamorphism

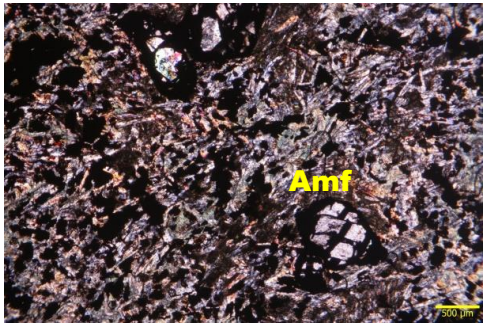










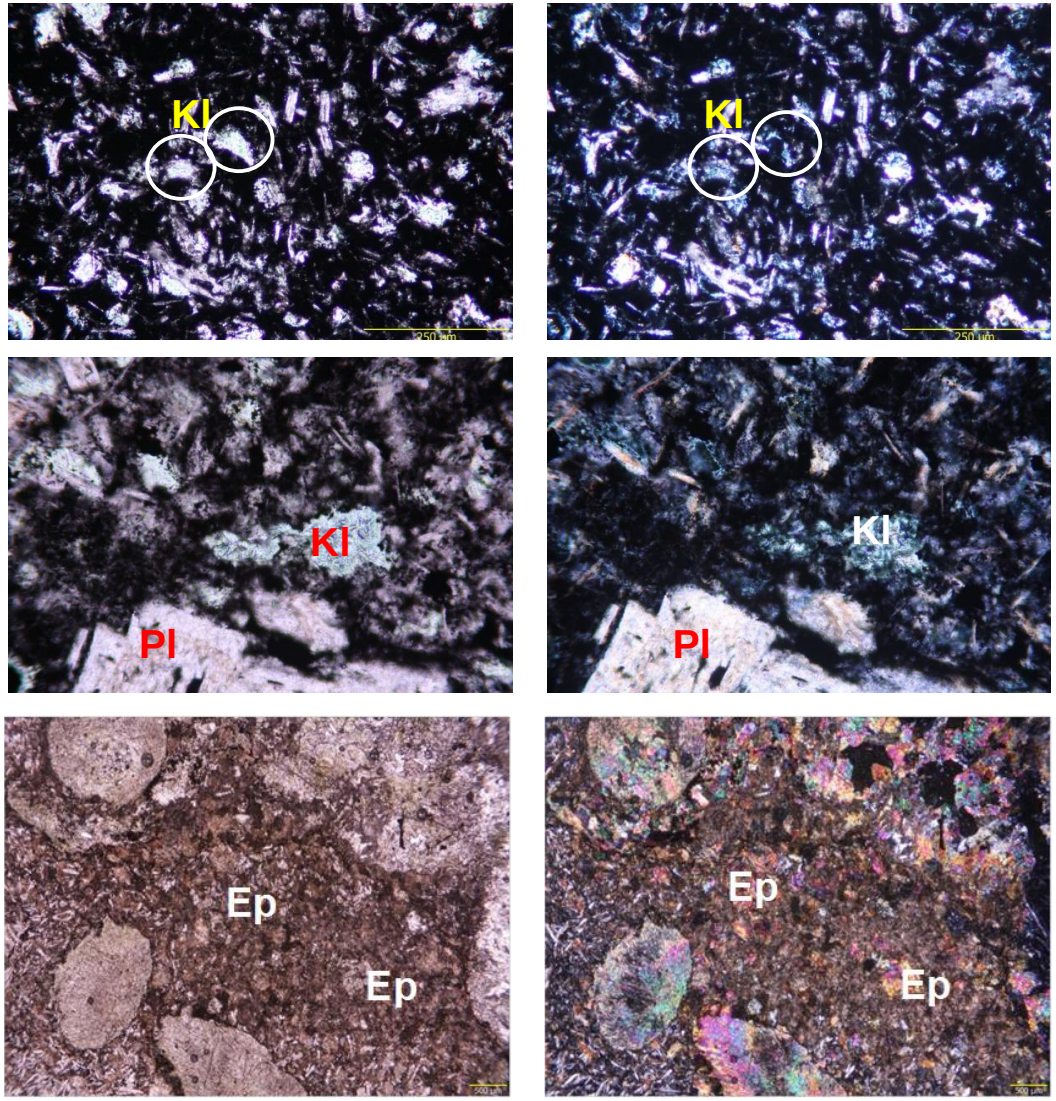


The change that started with seawater alteration and accompanying hydrothermal alteration turns into burial metamorphism with the lithostatic pressure of the rocks that accumulate on the volcanites after the Upper Jurassic. Upper Cretaceous and Eocene granites also exposed these rocks to contact metamorphism in places.

These changes are as follows:

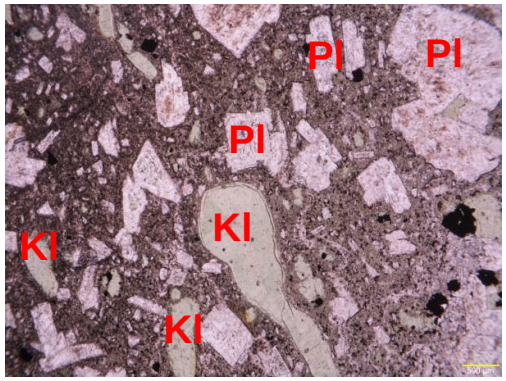
Mainly, the conversion of Ca-rich plagioclases in the rock as phenocrystals into Na-rich plagioclases
Rarely cause the decomposition to clinopyroxene / amphiboles to chlorite

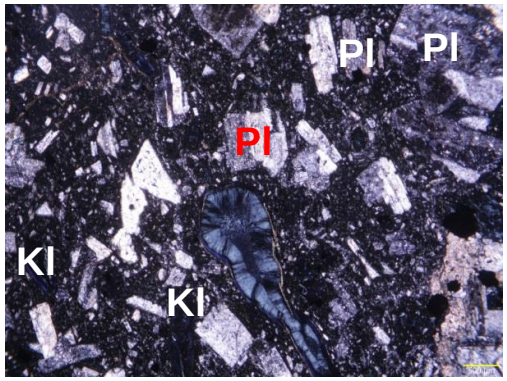
Textural and Mineralogical Changes due to Low T-Low P metamorphism

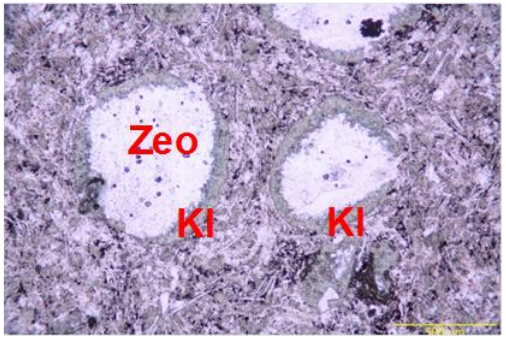


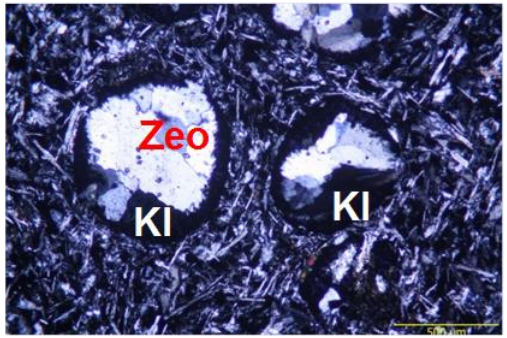
In the matrix
It causes to crystallize minerals such as clay minerals, zeolites, calcite / dolomite, chlorite, epidote, pumpelite, K-feldspar, albite, secondary quartz.
(Kl-Chlorite
Ep-Epidote)

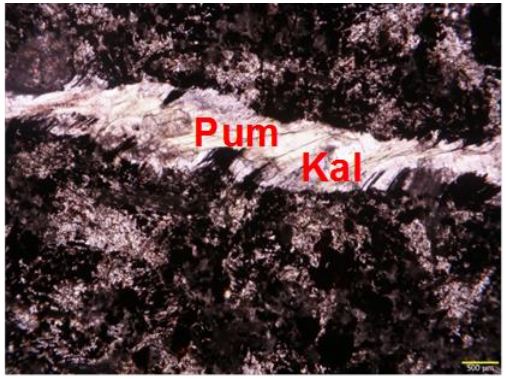
Textural and Mineralogical Changes due to Low T-Low P metamorphism

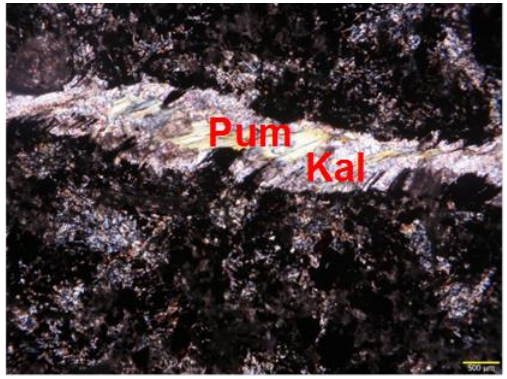






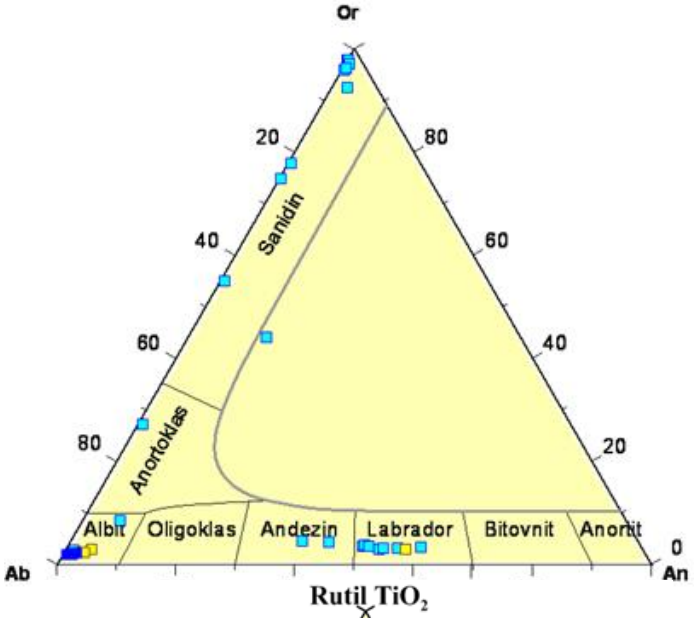


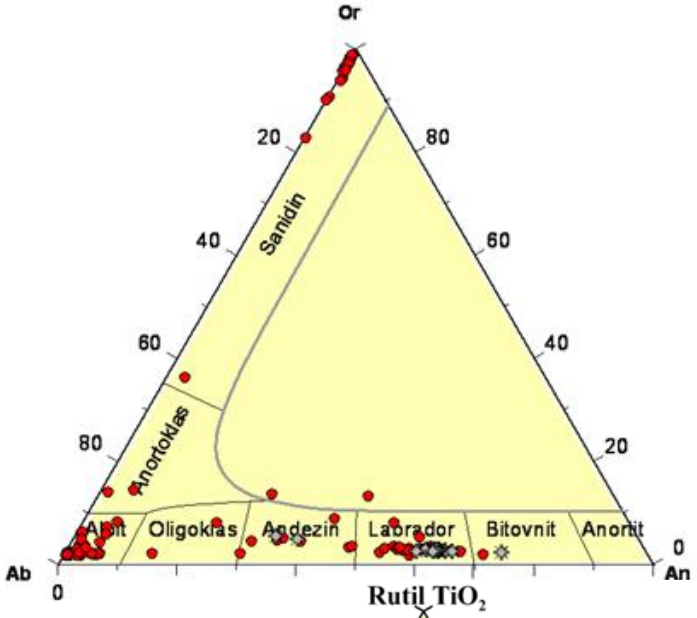


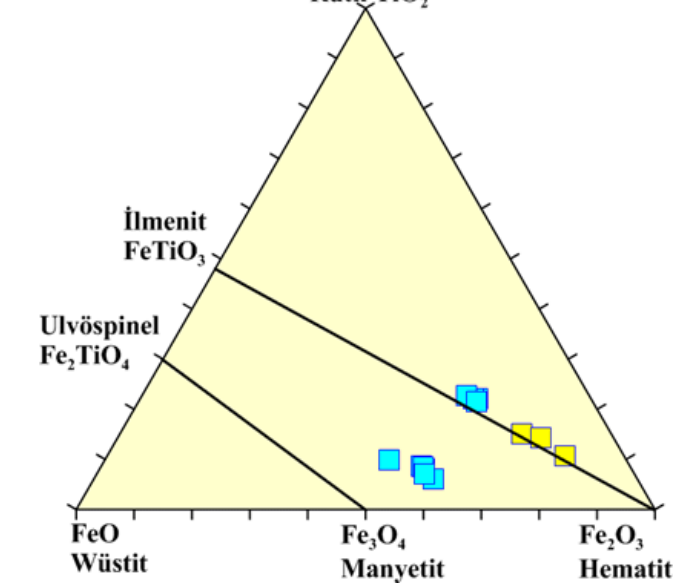


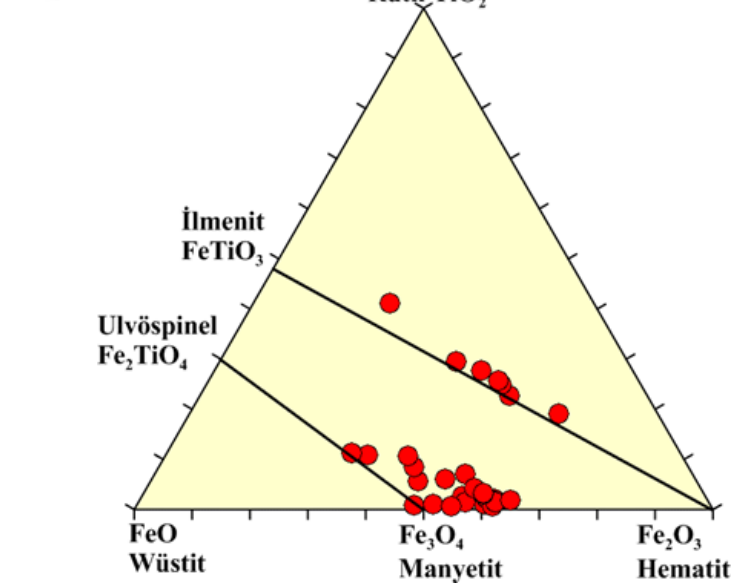
Gas cavities broken and cracked
It causes filling of clay minerals with minerals such as zeolites, calcite / dolomite, chlorite, epidote, pumpelite.
(Pl-plagioclase
Kl-Chlorite
Zeo-Zeolite
Kal-Calcite
Pum-pumpelyite)

Altered mineral compositions-I: Major phases: Plagioclase-FeTi oxides

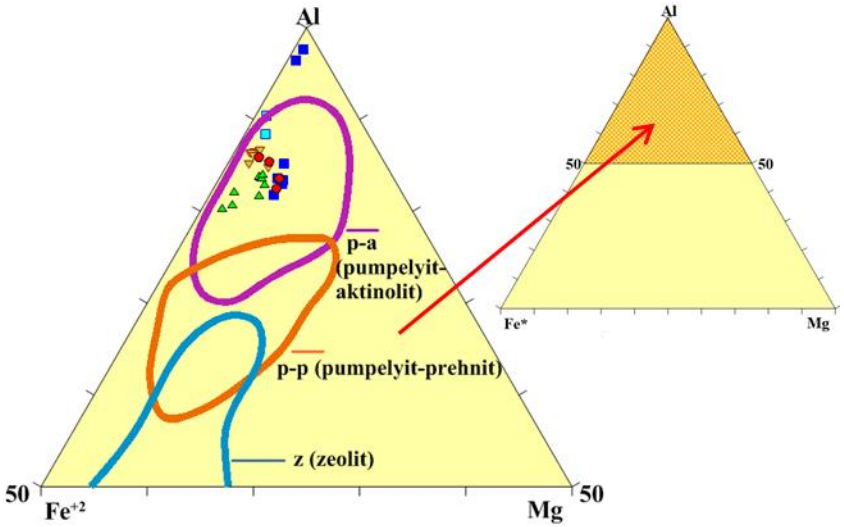


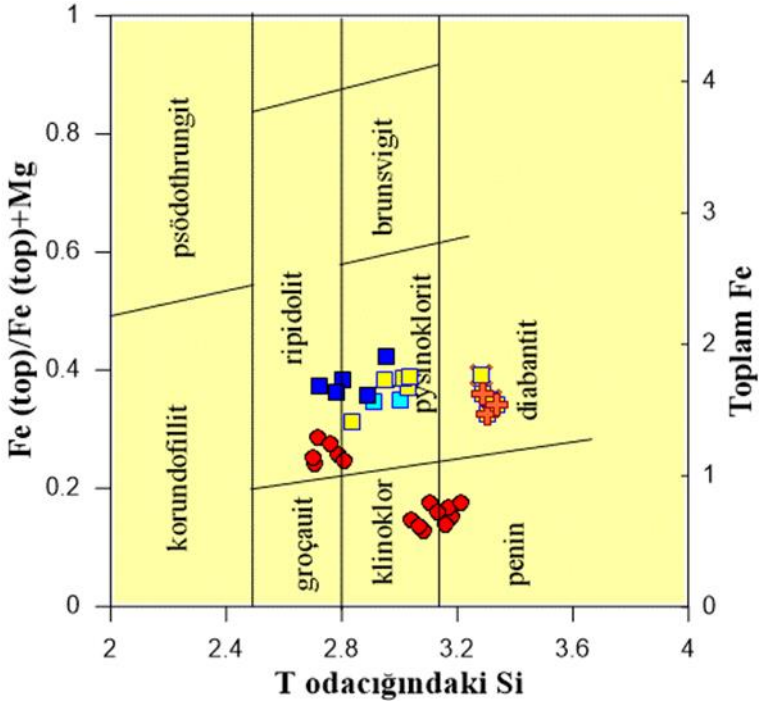




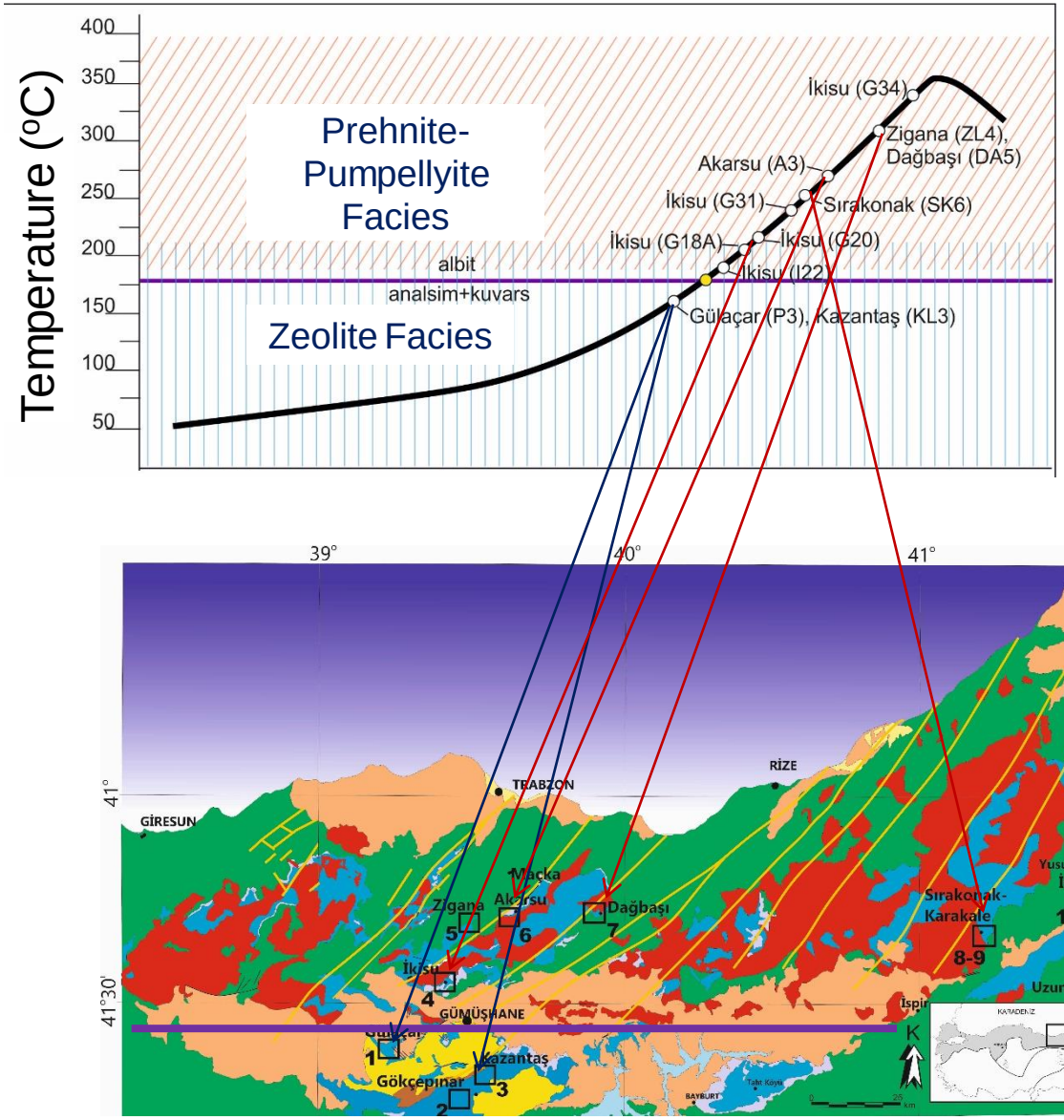


Altered mineral compositions-II: Secondary phases: pumpellyite-chlorite





Chlorite geothermometry



Calculated chlorite geothermometer temperatures (from *Cathelineau, 1988 and Jowett, 1991*)

Conclusions

1-Jurassic volcanism in the Eastern Pontides occured in submarine environmet. Pillow lavas, lenses of pyroclastics and/or red colored cherst and coarse to thiny sediments piles just under the Upper Jurassic to Lower Cretaceous aged Berdiga Limestones are the evidences.

2-Jurassic Formatins covered by Berdiga Limestones (with a thickness of up to 350 m), Upper Cretaceous Formations (reaching over 3000 m) and Eocene Formations (reaching approximately 750 m).

3-Rocks studied:

- sea water and hydrothermal alteration during their formation,
- exposed to burial metamorphism in the period following their formation.

Additionaly, at the north of Gümüşhane-İspir Line,

- Some of the Jurassic formations experience intense contact metamorphism with the Upper Cretaceous and Eocene magmatism.

4-When looking at the petrographic properties in general, it was determined that the samples underwent little or moderate textural and mineralogical changes.

Conclusions

5-Based on the weathering mineralogy in the studied rocks show that two different metamorphic paths. Gümüşhane-İspir Line (GİL) separates two distinct metamorphic facies.

At the northern part of the GİL, the temperature rised above 180°C (reached maximum 345 ± 25 °C, Prehnite-Pumpellyite Facies) during burial metamorphism + contact metamorphism of Upper Cretaceous and Eocene magmatism.

At the southern part of the GİL, the temperature is around 150 °C that results of only the burial metamorphism.

At both sides, litostatic pressure that estimated from the thickness of the formations, is less than 2 kilobars.