Igneous And Metamorphic Geology And Mineralization Of Istranca Region
JEOTECTONIC SETTING ANM MINERALIZA TION OF ISTRANCA REGION

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ABSTRACT : Eastern of the Rhodophian fragment are exposed in the Istranca regions that are represented by granitic rock, namely Kırklareli Groub, which is comprises preorogenic, synorogenic and late orogenic granitoid.

The oldest preorogenic blasto mylonitic trondjheimite (Kurudere tronjheimite) is represented early ocntinental crust. Synorogenic granite is esentially content of K feldspar porphyroblast therefore is called porphyroblastic granite (Kırklareli porphyroblastic granite). The youngest granite (Sergen hypersoluus granite) is emplaced in the late oregenic stage which are mainly hypersoluus granite compose of perthite and Quartz.

The basement granites of the Istranca area are strongly simillar to precambrian granite that are build up precambrian terrain with green stone. Western extent of the Istranca masifs comprises greenstone as metadunit, pyroxenite, amphibolite in the Rhodophian complex (Kczhukhorov, 1974).

Kırklareli group is surrounded by Istranca group from north. Triasic to jurasic metamorphic belt leis along the northwest to southeast trend where is bounded by Rhodophian fragment from south and Moesian platform from north (Dimitrov, 1958).

Istranca metamorphic belt i sbuild up by arkosic schist at the base (Koruköy formation). Metagreywake (Elmacık fm) is overlei on the arkosic schist. Meta arkose is transition to pelitic phylute (Demirköy formation). Liasic meta carbonate (Demirköy formation) is cover on these detritus formation.

Volcano plutonic complex namely a Sivriler pluton pre or syn orogenic pluton and late orogenic a İkiztepeler pluton had been emplaced in these sedimentary succetion. Triasic to Jurasic basen had been opened in the Istranca region as a marginal basin between Rhodophian fragment and Moesian. Triasic, Jurasic marginal basin had began to closure during the preliasic time by the south faceing subduction zone. Metamorphic volcano plutonic ocmplex (Sivriler and İkiztepeler pluton) had emplaced in the meta sedimentary rocks of the Istranca belt as continental margin arc like andean or Cordillar type.

Triasic - Jurasic Istranca marginal basin had closed by the collition of Rhodophian fragment and Mosesian platform. The Rhodophian granites had overthrusted on peripherial Istranca Triasic - Jurasic metamorphic. The very wide extensive cataclasis belt had been developed on overthrusted nappe of the basement granites.

Post metamorphic plutonic and subvolcanic complex had been emplaced in the Istranca group by the result of the Tibetian type continental collition magmatizm which is represented by Demirköy, Dereköy and Karacadağ plutonic and subvolcanic intrusives.

The most important mineralization in the Istranca area is İkiztepeler Mo-Cu-W deposits. İkiztepeler deposits had occured as two type mineralization. The important one is stokwork type molybdenite deposits. The next one is skarn type Cu-W mineralization which are both of related with İkiztepeler pluton.

Introduction

To establish relation between geological evolution of the igneous and metamorphic geology and geotectonic setting of the Istranca region is the main aim of this investigation which have been continuous since 1977. Geological results had been established by the consequence of mapping over 2100 km² area of the eastern part of the Istranca region and determination of the 1500 thin section. Further geochemical studies shall have been continued. Early studying on the geology of the Istranca region had been hold by Pamir and Baykal (1948), Akartuna (1952), Ayhan at all (1972) had mapped central and North eastern Part of the Istranca region. Crinoid Relict had been found in the schistose lime stone by Ayhan and other (1972), Aydın (1974) had studied on geology geochemistry of central Part of the Istranca region.

Verydetail geochemical investigation of the Demirköy pluton had been studied by Aykal (1979).

Jeologic Setting:

Istranca region is build up by granitic basement and surrounding peripherial metamorphic belt. Syn metamorphic concordant metamorphic plutonic bodies and post metamorphic plutons had emplacement in peripherial metamorphic belt.

THE BASEMENT (KIRKLARELİ GROUP)

Different opinions have been expressed concerning the age and origin of the Kırklareli group Dimitrov (1958), Kozhukhorov (1974) considered western extent of Kırklareli group as arkeen ultra metamorphic complex which is build up by migmatites and related granitic greisses and granites. Pamir, Baykal (1947) divided two formation namely Kırklareli gneisses and Fatma Kaya gneisses as caledonian or Pre cambrien age. Akartuna (1954) assumed lower paleozoic age and mapped as four different units, namely coarse granied gneisses, fine grained gneisses feldspatic schist and Quartzite Recent investigations Ayhan (1972) and Aydın (1974) consider paleozoic or upper paleozoic age. Aydın interpreted as hersinian granite, which is later subjected by slightly alpin metamorphism. Ayhan (1972) interpreted granitic gneisses, grano dioritic gneisses.

Kırklareli group are build up by three distinctive granitioid body namely, Kurudere trondhjemite, Kırklareli porphyro blastic granite and Sergen perthite granite.

KRUDERE BLASTO MYLONITIC (TRONDHJEIMIT)

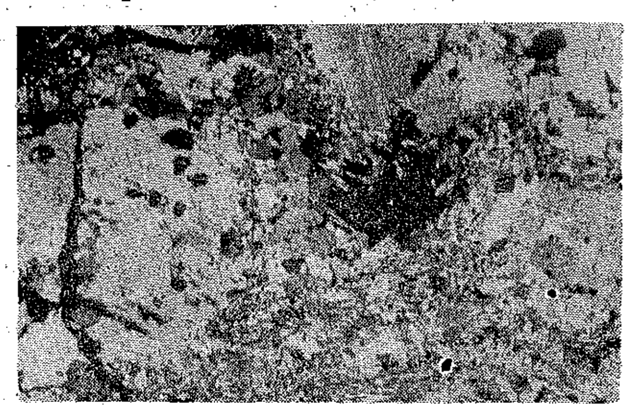
Kurudere granitoid are divisible in two main units;

1 — K feldspar porphyroblast bearing blastomylonite, (granodorite)

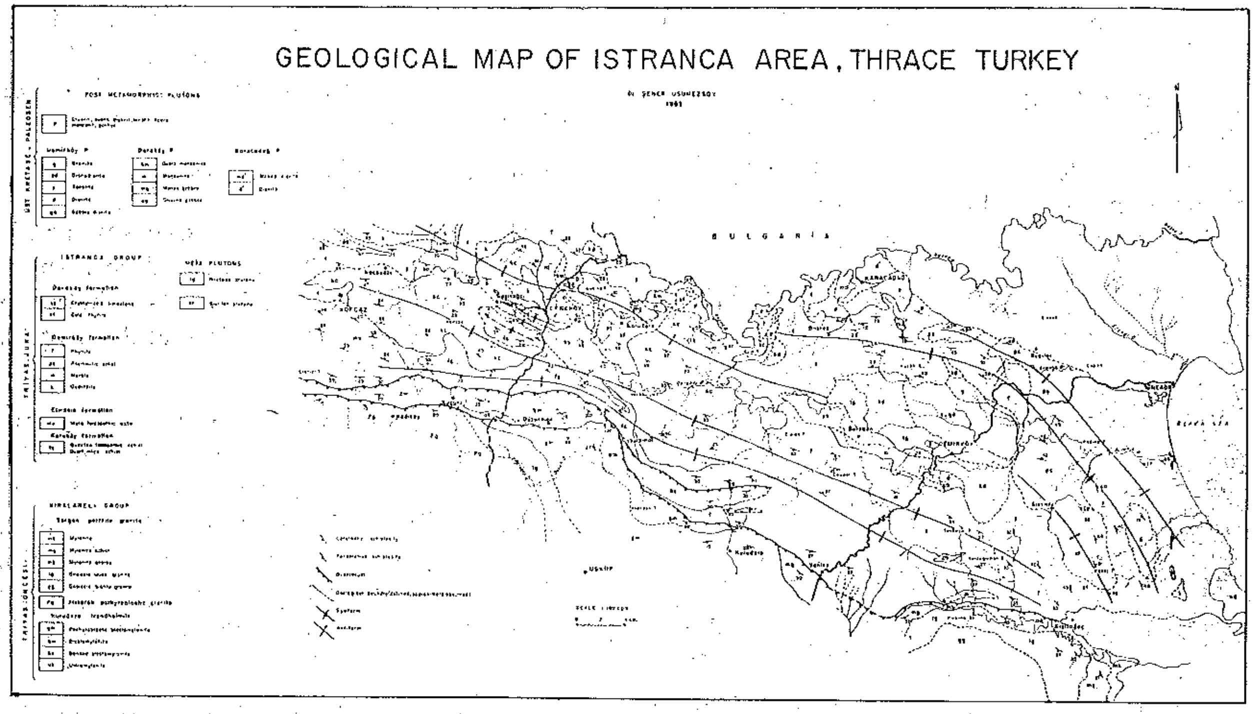
2 — Blastomylonite. (Trondhjemite)

The most notable field criterion for the subdivision of the Kurudere granitoid complex into trondjeimitic and granodioritic member is the distinctive redish coloration of the K feldspar mega cryst in contrast the trondhjeimitic rock which almost exclusively carry grey-white plagioclase megacryst.

Kurudere granodiorite are superposed by predominantly blasto mylonitic and mylonit gneissic texture. Essential minerals K feldspar, plagioclase, muscovite, epidote, biotite, quartz. K feldspar megacryst is seen as augen in blasto mylonitic matrix which is made up by recrystallized quartz and new formed muscovite epidot and biotite. (MF 1)



MF_1 Porphyroblastic blastomylonite
K-feldspar porphyroblast and mylonitic matrix, X15

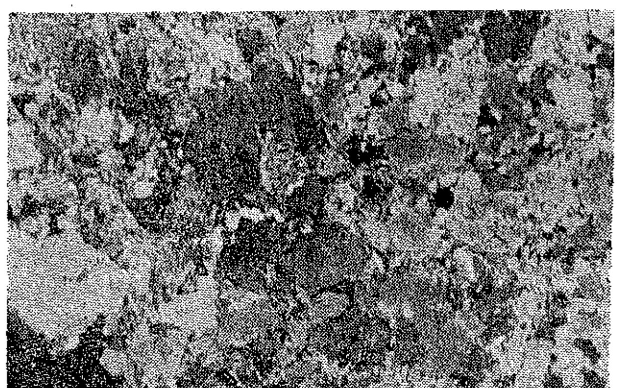


Primary igneous origin of the blasto mylonite granodiorite is represented by relic plagioclases porphyroblasts had been to muscovite. Coarse grained Quartz lenses are seen in thin section which is different from fine grained recrystallized quartz in the matrix.

Kurudere trondhjeimite is subdivided into three facies veinitic blastomylonite and blastomylonite, layer mylonite, ultra mylonite, according to increasing deformation effect of the dislocation metamorphism.

Blastomylonite is made up plagioclase porphroclast and surrounding foliated matrix which is compose of muscovite quartz, epidote biotite (MF 2). Secondary quartz, quartz - K feldspar or pure K feldspar vein is common blastomylonite. Layer mylonite is maden up by the differentiated of the mica layer from the quartz and plagioclase layer (MF 3) during the dislocation metamorphizm processes. Intrafolial folding is common in layer mylonite around the Fatma Kayalar district.

By the reducing grain size of the Porphyroclasts less than 0.5 mm blasto mylonite is transition to ultra mylonite which is wholly recrytallized chlorite, actinolite and plagioclase relict.

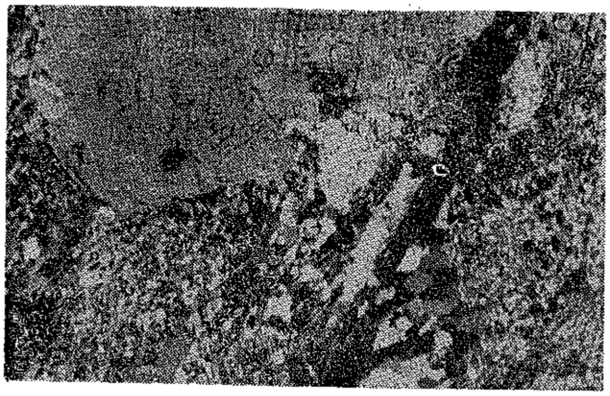


MF_2 Rlastomylonite
Plagiiclases porphyroclast and recrystallized mylonitic matrix, X15

MF'_3 Layer blastomylonite
Differentiated layer of the mica and plagioclas, quartz, X15

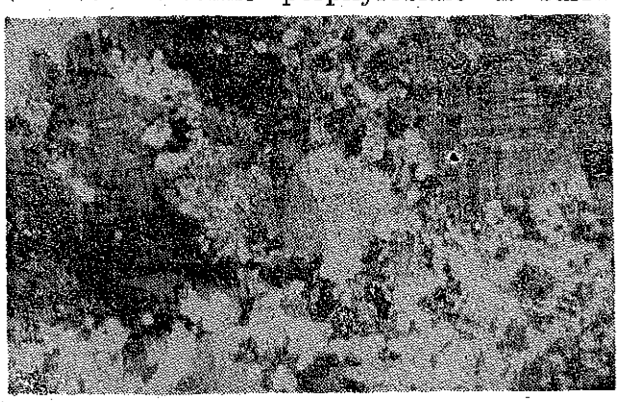
KIRKLARELİ PORHYROBLASTIC GRANITE

Porphyroblastic K feldspar bearing granite is expose northern part of the Kırklareli. Porphyroblastic granite are build up by microcline as porphyroblast (FM 4) while quartz, biotite, muscovite and microcline matrix.



MF_4 Porphyroblastic granite
K-feldspar porphyroblast and recrystallized matrix, X15

Microcline porphyroblast had began to grew as inter granuler crystallization in matrix which are represented by fine grained microcline. At the advance stage of the growing of the microcline reach up few cm diametre (MF 5) microcline porphyroblast is surro-



MF_5 Porphyroblastic granite
Growing of the K-feldspar porphyroblast, X15

unded by myrmekitic envolope Granoblastic matrix is made up fine grained quartz and microcline, coarse grain quartz lenses are grown up as secondary quartz porphyroblast during the K feldspatization.

Biotite is the principal consistent of the porphyroblastic granite. Local enrichment of the biotite or K feldspar is common. Muscovite had been produre by the extraction of iron from biotite.

SERGEN PERTHITE GRANITE

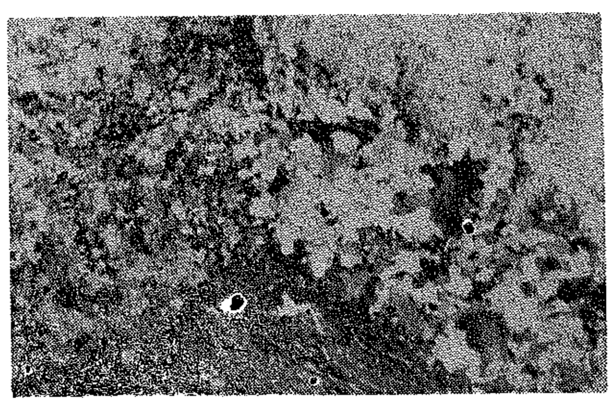
The younger granitic body exposes south of the Kızılağaç and Sergen. Relatively small body of perthite granite taken place between Kurudere granodiorite and Kırklareli granite, south of the Koruköy.

Sergen hypersolvus granite is made up essentially perthitic orthoclase and quartz. Plagioclase had occured very seldom in the subsolvus facieses of the perthitic granite. On the other hand Sergen gneissic granite subdivided to gnaysic granite, mylonite gneisses, mylonite schist and mylonite quartzite.

Sergen granite is principally leucogranite free of biotite except core of the plüton where biotite is present. Gnessic granite subdivide into two facies;

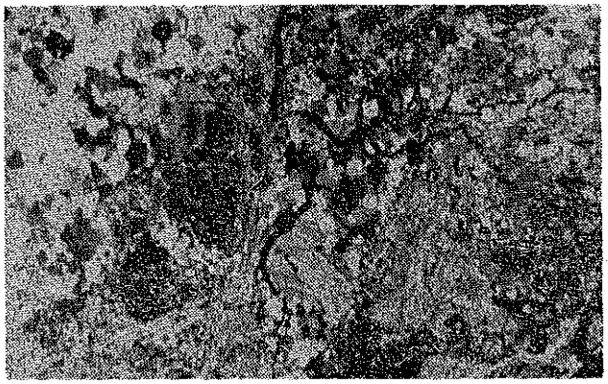
1 — Gneissic leuco granite,
2 — Gneissic biotite granite.

Gneissic biotite granite, medium grained, slightly recrystallized consist of perthite, quartz, biotite, muscovite and plagioclase Gneissic leuco granite, is made up granular texture of perthite, quartz and muscovite myrmekitic texture is common in perthite. (MF 6)



MF_6 Gneissic leuco granite
is made up by perthite and quartz, X15

Muscovite is occured by the destruction of perthite where granite subjected by the intensively cataclasis deformation gneissic granite had been convert to mylonite gneissic and mylonite schist by the influence of the progressive deformation. (MF 7)



MF_7 Mylonite gneisses derived from perthite granite. Destruction of the perthite to muscovite, X15

Main compenent of the mylonite schist and gneisses is muscovite which had been occured by the destruction of perthite and recrystallizeted quartz Ratio of the relict performing muscovite at the advance stage of thite is decreased by the inceasing of the new the cataclasisizm.

Mylonitic schist had been produced by extensively destruction of the perthite to muscovite and recrystallization of the quartz. Mylonite quartzite are made up predominantly recrystallized quartz and minor perthite and muscovite. (MF 8)

MF_8 Mylonite schist derived from perthite granite Wholly destruction of the perthite to muscovite, X15

PETROGENESİS OF THE KIRKLARELİ GROUP

Kırklareli group had been written by the granitic rocks which are sirular to precambrien terrine through over the world. The anologies of the Kurudere frondhjeimitic blasto mylonite is common in the arkeen belts. Analogies of the Kurudere blasto mylonitic trondhjeimite are called "Ancient gneisses", "Totolithic gneisses" in Barberton mountain (Viljoen, Viljoen, 1970) early orogenic "gneissic plagioclase granite" in Egyp. (Shazly, 1980) "Amitsoq gneisses" from aronud the Godthabb Nest in Greenland (Mc Gregor, 1973) "Gray gneisses" (Edwards, Hasan, 1972) "plagioclase gneisses" in Rodop massife (Dimitrov 1958, Kozhukhorov 1974).

Trondhjeimitic preorogenic ortogneisses has been interpreting as insamatic island arc (Condie, 1972, Moorbath, 1974).

Synmetamorphic Kırklareli porphyroblastic granite had been formed by the K feldspatization, migmatization and granitization of the early trondhjeimitic rocks during the ultra metamorphims.

Similiar rejeneration had been observed in Barberton mountain by Viljoen, Viljoe,n 1970 where ancient tonatitic gneisses had been rejenerated to migmatitic gneisses and granite by the K feldspatization and migmatization events. Kibarian belt (Central Africa) involves the emplacement of the early porphyroblastic granodiorite and syntectonic granitization by Potash metazomatizm (Saggerson - Turner, 1972).

Sergen perthitic granite had been emplaced during the late tectonic phase which is similiar late tectonic anatexite granite had been emplaced in Egyp. (Shazly, 1980) Sergen perthitic granite had been subjected progressive cataclastic metamorphism similiar condition as Rhode island (U.S.A.) hypersolvus granite (Day - Brown, 1980).

Trondhjeimitic older granidoitic mass had been K feldspatized by the cause of late tectonic perthitic granite intrusions. K feldspatization had been occured as porphyroblast or pegmatitic veins by the alkali metasomatism. Compose of Trondhjeimite had been convert to granodiorite by the K feldspatization. Gradual transition have been observed by the naked eyes from trondhjeimit to granodiorite by the increasing frequency and grain size of the K feldspar mega cryst. K feldspar megacryst and pegmatitic veins had emplaced along the foliation plane of the blastomylonitic trondhyjeimit.

Feldspatization of surrounding rocks by the cause of post tectonic alkali granite intrusions is common in Egyp. (Shazly, 1980) Bweeden (winklader, 1974) Norwey (Smitson, 1963).

ISTRANCA GROUP

Peripherial metamorphic belt of the Kırklareli group camprises fram bose to top. Quartzo feldspathic schist (Koruköy fm) metagreywake (Elmacık fm) phillite which is involved meta arkose, Quartzite marble lenses (Demirköy fm) jurassic schistose limestone and dolomite are taken place top of the meta sedimentary succession. Meta sedimantary formation had been intruded by the metamorphic concordant plüton namely a Sivriler plüton and a İkiztepeler plüton.

KORUKÖY Fm
(Quartzo feldspathic schist)

North of the Koruköy which is the type area foı this formation is completely build up of microcline bearing arkose. All the transition type from arkoze to feldspathic quartz mica schist is observed in the field by the increasing metamorphic grade in general. Microcline and elongated quartzo pebbles and coarse grains are covered by recrystallized muscovite, quartz. Bu the intensively destruction of the feldspar to mica the rock should then be regarded as a series of parellel mica layer seperated by layer of quartz.

Koruköy formation is overlain by Elmacık meta greywake at the west and phyillite (Demirköy fm) at the north of the Armağan köy.

ELMACIK META GREYWAKE

Elmacık formation is build up meta feldspatic wake which is underlain by Koruköy fm. Feldspathic wake is lateral transition to (Demirköy fm) phyillite north of the Elmacık village. Both of this formation is overlain by jurassic recrystallized limestone (Dereköy fm).

In this section meta greywake is comprises quartz, muscovite, chlorite biotite, epidote, calcite, albit and relict plagiclase and apatite. Relict plagioclase grain is covered by muscovite, recrystalized quartz, chlorite and biotite.

Epidote and biotite is occured post tectonic phase. Albito is seen as porphyroblast. The rock is convert to calcschict by increasing proportion of the calcite.

DEMİRKÖY FORMATION

The most extensive litohologic units of the peripherial metamorfic belt is Demirköy formation which is build up mainly phyillite, meta psamit, quartzite and marble taken place in the phyillite as lenses.

Phyllite

Varied type phyllite is sub divided its content as follow;

1 — Mica phyllite
2 — Quartz phyllite
3 — Phyllite
4 — Calc phyllite
5 — Chlorite schist

Psammitic Schist

Meta psammitic schist is derived from feldspathic sandstone principally arkose. Foliation is developed by the increasing of the recarystallization. Orthoclase, quartz, and plagiclase is covered by recrystalized muscovite, quartz.

Quartzite

Quartzite is transition to quartz phyllit by the decreasing of the grain size. Quartzite is composed of quartz and minor muscovit, primary quartz grains are granulated and recrystalized.

Marble:

Calc schist and marble lenses is interlayer with phyllite on both large and small scale marble is made up by well recrystallized coarse grained calcite and minor amount quartz, muscovite with granoblastic elongate texture.

DEREKÖY FORMATION

Dereköy formation is orginated from calcareaus sedimentary rock mainly limestone, dolo stone and calc pelite which are subjected by low grade recrystallization.

By the concequence of these recrystallization of the original calcareous sediment had been converted to schistoze limestone, recrystallized limestone, recrystallized dolostone and calc sleyt that had been mapped in two unit. 1. Schistoze lime stone, recrystallize lime stone, recrystallize dolestone 2. Calc sleyt.

Schistoze lime stone, is made up calcite quartz, serisite with foliated texture.

Recrystallized limestone, content of weakly recrystallized fine grained calcite without foliation mainly massif and intensively fractured light coloured.

Recrystallized dolestone, is build up coarse grained dolomit with minor amount quartz and calcite.

Calcsleyt is orginated from inter layered pelitic and calcareous layer. Calcareous layer had been convert to schistoze limestone while pelitic layer was converting to sleyt or phyllites.

CATACLASIZM and METAMORPHIZM

Kırklareli group had been subjected by the cataclastic deformation simultaneously, regional metamorphism of the peripherial belt. (Istranca group)

New formed metamorphic mineral paragenesis is suggested that the same metamorphic degree both of Kırklareli group and Istranca group.

Sergen gneissic granite transition to gneissic granite, mylonite gneiss, mylonite schist, blastomylonite, and quartzite. Kurudere trondhjeimite had been convert to Augen mylonite gneisses or Augen mylonite schist, blasto mylonite, layer mylonite and ultra mylonite schist.

The common metamorphic processes during the metamorphism are destruction of the plagioclase to muscovite, epidote or albite recrystallization of the quartz.

Primary magmatic biotite had transition to secondary metamorphic biotite or muscovite. Orthoclase had recrystallezed as microcline during the deformation or cataclasis. Most of the microcline had recrystallized as porphyroblast.

The plütonic body that emplaced in the peripherial belt are also subjected cataclastic metamorphism same Kırklareli group as. Primary plagioclase had been convert to muscovite, epidote, albit, calcite, and hornblend altered to biotite and chlorite. Well developed cataclastic texture and foliation superposed on the pre plütonic mass in the peripherial metamorphic belt.

Meta sedimentary rocks subjected by intensively recrystalization same metamorphic degree as cataclastic rocks of the Kırklareli group plütonics. New formed minerals are biotite, muscovite, epidote, albite, chlorite, serisite, purpose that regional metamorphism and cataclasism had been ensued by the same P.T. condition during the recrystalization.

Cataclastic texture had been developed basing on physical properties of the primary rocks which are subjected by the regional metamorphism in the intensively sheared terrain. Granitic rocks easly granulated and mylonitized in the contrast of sedimantary rock during the shearing.

A number of recent reports indicate that mylonitic rocks make up surprisingly high percentages of many crystaline basement terrains. (Sutton, Watson, 1959; Brown, 1962; Christie, 1963; Hobbs, 1966; Theodore, 1970; Bobyarchich, 1979; Kerrich, 1980; Üşümezsoy, Öztunalı, 1982).

Zones of mylonitic rock have long been recognized as areas of intense deformation and commonly have been inferred to present important tectonic boundaries, like continental sture zone, major transform fault or overthrust belt.

Nominclatur of mylonite;

Mylonitization is divided two main catefories on the basic of whether cataclasis was dominant over neo mineralization recrystallization or vice versa. (Spry, 1969; Higgens, 1971).

The rock on which cataclasis is dominant that are protomylonite, mylonite and ultra mylonite. The other categories in which recrystallization and neomineralization is dominant which are called by the progressive deformation effect, blastomylonite (Spry, 1969), mylonite gneisses or schist to blastomylonite series (Higgens, 1971).

Cataclastic granite had been subdiviided as gneissic granit, mylonite gneiss, blasto mylonite, mylonite schist, banded mylonite schist, ultra mylonite schist and mylonite quartzite series basing on increasing progressive cataclastic metamorphism in the green schist facies conditions. (Üşümezsoy, Öztunalı, 1981)

Although many mylonites of the other zone which are formed under low grade metamorphic condition (Christie, 1960; Johnson, 1960; Snook, 1965; Nurchi, 1966; Bobyarchick, 1979; Kerrich, 1980).

Other have developed at high grade P.T. conditions (Hsu, 1954) describes amphibolite facies mylonitization at previously metamorphosed granülüte facies rocks in the eastern San Gabriel mountain. 1959, Sutton, Watson listed amphibolith facies assembleges in the pre cambrien shear belt KungweBay Tanganika. Sakar (1966) cites textural evidence for continued stability of Kyonite during deformation in a well-faliated shear zone in precambrien metamorphic rocks in India. Sillimanite-K feldspar ruscovite quartz assemblages remained stable or recrystalized (or both) during mylonitization at Coyete mountain (Theodore, 1971).

In the Light of these are known that Istranca region are subjected regional metamorphism intensively sheared and strained conditions. Therefore the granitic rocks in the basement and peripherial metamorphic belts. Both of them had been superposed by intensively cataclastic texture with recrystallization and new forming minerilezation same metamorphic grade as meta sedimentary units during the regional metamorphism.

PLUTONIC RCCKS

META PLUTONS

Two metamorphic plütonic masses have been observed with in the peripherial metamorphic belt namely Sivriler Plüton and İkiztepeler plüton. Both of the plütons are foliated which are parellel to the foliation in the adjacent meta sedimentary rocks these two plüton must have been emplaced before or during main period of the metamorphism of the meta sedimentary (Demirköy formation) rocks relatively less deformed and metamorphised. İkiztepeler plüton must be younger than intensively metamorphised Sivriler plüton. Teherefore Sivriler plüton is being interpreted as pre or syn metamorphic plüton while İkiztepeler plüton syn or late metamorphic plüton.

SİVRİLER PLUTON

The characteristic rock of the Sivriler tonalite is well developed mylonitic leuco quartz diorite, and tonalite with great amount of metamorphic dark minerals such as biotite, cholcrite and epidote. Itis exposed as elongated body N-NW to S-SE direction in the core of the antiform and surronded by concordantly cholorite schist and biotite schist which are orginated from meta volcanic comagmatic with Sivriler tonalite.

The rock comprises plagioclase, porphyroclasts as relict minerals and metamorphic minerals biotite, epidote, muscovite, cholorite, calcite. (MF 9) All the transition type of the texture can be observed in thin section from igneous texture to blastomylonite. Plagioclase crystals are broken and granulated, relict plagioclase porphroclasts are covered by muscovite and quartz.

Matrix is made up by elangated quartz, oriented muscovite, biotite along the foliation plane. Idiomorf and subidiomorf epidote and calcite is common together. Cholorite and

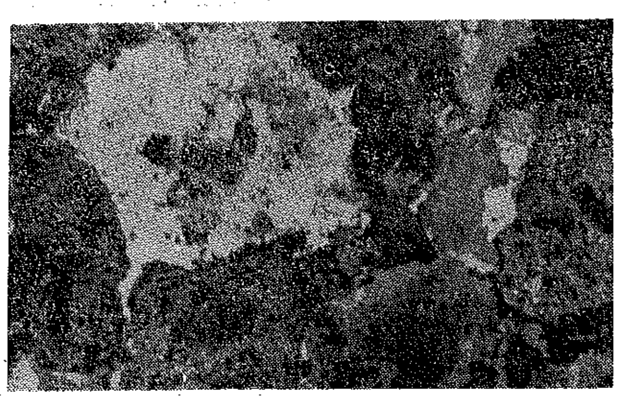
MF_9 Sivriler tonalite, cataclastic texture of the plogioclase, X15

epidote had been occured by the destruction of igneous hornldend.

İKİZDERE PLUTON

İkiztepe plüton are exposed south of the İkiztepe and north of the Balaban village which are intruded by the Demirköy plüton. It lies north-west trend of the Sivriler plüton. Very wide speared intensively hydrotermal alteration and mylonitization is the most characteristic feature of the plüton. Both are principally quartz dioritic compositions had been convert to granodioritic and granitic composition, bü the occuring of the hydrothermal orthoclase during the hydrothermal alteration processes mainly potassium metasomatizm.

Hydrothermal orthoclase porphyroblast replaced to plagioclase, and involve plagioclase inclusion at the advance stage of the orthoclase porphyroblastesis. (MF 10)



MF_{10} İkiztepeler granite, replaceing of the plagioclase by the hydrothermal orthoclase, X15

Plagioclase are intensively seritized during these proceses. Secondary quartz veins are common as fracture filling with K feldspar. The other alteration minerals are chlorite and biotite occured by the destruction of the primary mafic minerals.

Epidote and amphibole are seen in the same instance of the thin section İkiztepe stock work type molibdenum deposit had been occured result of these hydrothermal alteration processes.

POST METAMORFİK PLUTONS

Istranca group had been intruded by the post tectonic plütons. The extent of the emplacement of these plütons are parellel to major structure. The largest one Demirköy plüton is elingate parellel to the regional trend. Relatively small plütons Karacadağ, lie at the north east and Dereköy, occupy west of the main Demirköy plüton. Preplutonic formations had been subjected by termal metamorphism all around of the plütons. The larger Demirköy plüton is geneticly linked with Panayır plüton, Karanlıkköy plüton, and Şükrüpaşa plüton which are extended same direction with Demirköy plüton. These plütons are formed by three different plütonism which are subdivided base and crystalization trend. Each plüton are concentricly zoned which has basic sheell is transition to silicic core in general.

DEMİRKÖY PLUTON

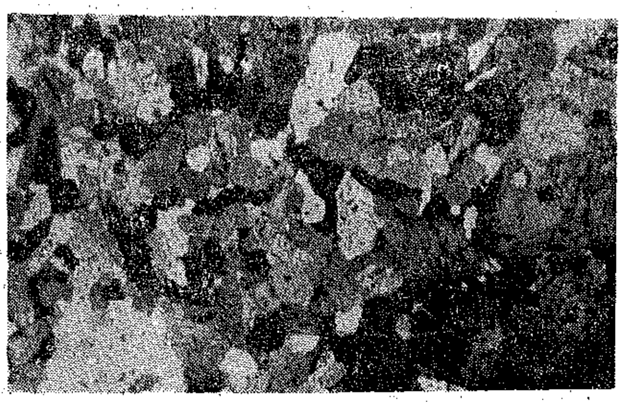
The largest plütonic body in the Istranca batholite is Demirköy plütons, which are genetically linked with Panayır plüton, Karanlıkköy plüton, Şükrüpaşa plüton. The plütonic bodies must be related each other beneath the coveror roof pedant. The outer contac with the wall rock is sharp. Well developed contact aurle is circumscribed these plütonic body.

The most basic facies is occupied along the south contact of the plüton where the main rocks unit are gabbro and basic pyroxen diorite which are transition to hornblend diorite and quartz diorite towards to north to core of the plüton. Tonalite and granodiorite are occupied in core which compose of more silicic. Grrano dioritic facies is transition to granite by increasing of K feldspar contenent of the rocks along the north eastern contac of the plüton. Plütonic body where is bounded by asimilation granite at the north east boundry.

The main tonalitic or Quartz dioritic facies is continued towards to the cogenetic smaller plüton namely Panayır at the south east, Karanlık, Armutveren and Şükrüpaşa at the north west of the main body.

GABBRO :

Very dark coloured and fine grained pan idiomorphic augite and basic plagioclase. (M F 11) Made up the marginal gabbroic facies of the Demirköy pluton.



MF_{11} Demirköy pluton fabbroic facies panidiomorphic augite and plagioclase, X15

DIORITE :

Diorite is subdiveded into three facies base on minerological content;

A) Pyroxene diorite,

B) Hornblend diorite,

C) Quartz diorite,

Pyroxene diorite is comprises of complex twined idiomorphic plagioclase and idiomorphic plagioclase and idiomorphic augite. Ratio of the augite is less then gabbro.

Hornblend diorite is distinct from pyroxene diorite by the crystalization of hornblend around pyroxene as corone and plagioclase of the first generation is surronded by second generation matrix.

Quartz diorite is formed by the crystalization of the intergranüler quartz and disappearing augitic core of the hornblend.

TONALITE:

Quartz diorite is transition to, tonalite by the increasing of quartz ratio and formation of the biotite coexsist with hornblend. Second generation of the plagioclase mantle is more developed around the first generation plagioclase.

GRANO DIORITE

Formation of the xenomorphic orthoclase is the main distinctive feature from tonalite to grano diorite and second generation plagioclase is surrounded by third generation plagioclase.

GRANITE

Granite I is formed by the increasing the proportion of K feldspar in granodiorite. Demirköy plüton had bounded by granite type II which is different from differentiating granite. Granite type II ise formed by the assimilation and partial melting of the pelithic hornfelses. The relict hornfelsic feature can be observable in the same thin section with the quartz and potassium feldspar content of the granitic type II.

KARACADAĞ PLUTON

Karacadağ plüton occupies at the north of the Demirköy plüton, as a circular body which is comprises plütonic and subvolcanic rocks both of comagmatic.

Karacadağ plüton surrounded by well developed hornfelsic aurole and invole hornfelsic wall rocks xenolith. Most of the hornfelsic rocks had been folding in minor scale by the intrusion of the plüton.

Subvolcanic body had intruded into plütonic rocks along the weak zone as dyke which are extended as a stok towards to top and cavered on the main plütonic body.

The northern outer most of the plütons are pyroxene diorite that transition to amphibol diorite toward the inward. Fine grained dark diorite had been intruded by K feldspar bearing monzodiorite which is transition to monzonic by the inceasing of the K feldspar ratio. Microporphyric sugvolcanic bodies is build up microdiorite porphyry micro quartz diorite porpyhry and tonalite porphyry.

DIORITE

Diorites are occupied northen boundry of the Karacadağ plüton. Three type diorite distinquisable base on dark mineral contents;

a) Pyroxene diorite,
b) Pyroxene amphibole diorite,
c) Amphibole diorite,

Pyroxene Diorite;

Pyroxene Diorite, is made up by fine grained panidiomorphic plagioclase and augite. Both of these compenent are idiomorphic, plagioclases shows combined twins.

Pyroxene hornblend Diorite;

Pyroxenehornblend diorite compose of Plagioclase, pyroxene hornblend. Coronas of hornblend are circumscribed early formed pyroxene. Pyroxenehornblend and biotite are found to coexist in this unit. First generation plagioclase is thinly covered second generation plagioclase.

Hornblend Diorite;

Diagnostic mineralization changes to hornblend diorite is disappearing of the pyroxene. These unit is exactly free of pyroxene which is show panidiomorfic texture. The main constituens is hornblend and plagioclases. The plagioclases had grow up in two stage. Pyroxene core is not seen in this type of hornblends.

MONZO DIORITE

Diorite facies had been intruded by K feldspar bearing pinkish coarse grained monzo diorite. Fine grained dioritic anclav is common in monzo dioritic facies.

Hypidiomorphic and coarse grained monzo diorite is comprises plagioclases, pyroxene, hornblend, biotite, K feldspar and quartz.

Allotriomorphic K feldspar phenocryst is occupied in granülar space of other constituents.

Plagioclases in grow up in two stages of crystallization idiomorphic combine twined core and mantle. Idiomorphic or ksenomorphic hornblends are surrounded by K feldspar phenocryst. Minor amount of quartz is formed earlier then K feldspar.

DEREKÖY PLUTON

Dereköy pluton had emplaced western trend of the main Demirköy pluton. The Dereköy pluton is build up principally monzonitic to quartz monzonitic plutons although. The most basic body such as olivin gabbro are ocuppied very locally southern edge of the plutons body. The main monzonitic and quartz monzonitic facies and basic border are exposed beneath the south edge the Şükrüpaşa pluton which is made up micro tonalite porphyry.

Dereköy is surrounded by the hornfelses and marble skarnifcated marble are seen as a roof pedant on the Dereköy pluton:

Dereköy pluton is build up compositionally contrast two extreme facies namely monzonitic quartz monzonitic facies and olivin bearing gabbroic facies.

The former is exposed very locally around the contact. Monzonitic facies is dominant rock type of the Dereköy pluton. The transition facies from gabbroic to monzonitic rocks is represent by monzo gabbroic rocks.

GABBRO

Gabbroic facies is formed as early crystalized rocks of the Dereköy pluton. These darker plutonic rocks are subdivided into two types base on minerological content;

a) Olivin gabbro
b) Gabbro

Olivin Gabbro:

The most basic rock unit is made up by olivin, plagioclase, pyrexen and biotite which shows panidiomorfic ophitic texture. Idiomorphic olivin crystals is usually altered which are sorrounded by idiomorphic plagioclases that shows ophitic texture. (MF 12) Pyrexen is represented by titan augite small biotite flake are accompenied with pyroxene.

MF_{12} Dereköy pluton Olivine bearing facies ophitic texture, X15

Gabbro:

Olivin bearing gabbro is change to gabbro by disappearing of olivin.

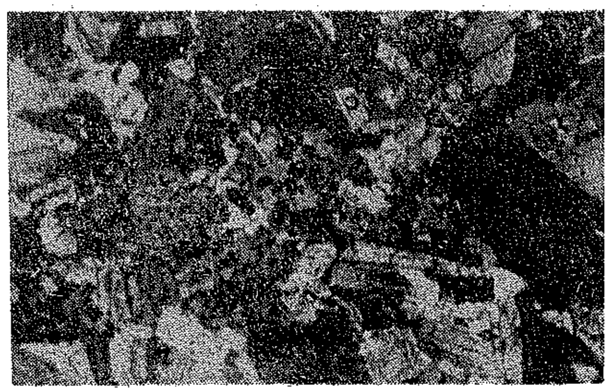
MONZO GABBRO

This facies is represented transition rock type from gabbroic to monzonite. Therefore these units show both of this facieses feature. Monzo gabbro had been formed by the occuring of the K feldspar crystalls in the gabbroic facieses. This made up by pyroxene, plagioclase, K feldspar and biotite. K feldspar had developed inter granular space of plagioclases by the replace of the plagioclases.

MONZONITE

The dominant rock type of the Dereköy pluton are monzonite and quartz monzonite coarse grained monzonite is made up by K feldspar plagioclase Pyroxene, hornblend and biotite.

The main of K feldspar phenocrysts are shown karlspat twins and irregular border Plagioclase inclusion is common in K feldspar phenocrysts plagioclases are seen as inclusion or phenocryst which are both of them grew up in two crystalization stage. (MF 13)



MF_{13} Dereköy pluton monzonitic facies K-feldspar megacryst which is involve plagioclase, X15

Augite is surrounded by coranas of hornblends. Biotites is common as regular crystals.

KUVARS MONZONITE

Monzonitic facieses is transition to quartz monzonite by the increasing of quartz ratio in the monzonite.

POST PLUTONIC SUBVOLCANICS

The plutonic bodies had been cut by subvolcanic micro porphyries which are diorite, quartz diorite, tonalite, grandiorite, quartz monzonite micro porphyries. Grain size of the micro porphries matrix is increasing toward the deep from volcanic porphyric texture to hypidiomorphic texture.

DIORITE PORPHYR

This unit is made up plagioclase and hornblend phenocrysts in the microlithic matrix.

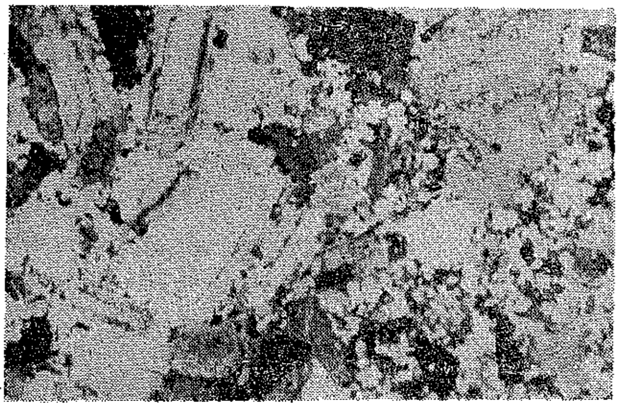
QUARTZ DIORITE PORPHYR

Quartz diorite microporhyr is comprieses quartz phenocrysts with plagioclase hornblend and biotite. Matrix is made up microlithic plagioclases.

TONALIE PORPHYR

Quartz plagioclase, hornblend biotite

phenocryst is surrounded by relatively coarse grained matrix which is made up by quartz and plagioclase. (MF 14)



MF_{14} Tonalite porphyry, plagioclase phenocryst and matrix, X15

GRANADIORITE PORYPHYR

Tonalithic micro porphyr is transition to granodiorite micro porphyr by the forming of the K feldspar in the matrix.

QUARTZ MONZONITE PORPHYR

The K feldspar phenocrysts bearing this units is more alcalic. The others is made up K feldspar and plagioclase phenocryst in the fine grained quartz-K feldspar matrix.

EMPLACEMENT

Three of the plutons had cross cut the pre plutonic rocks where very wide hornfelsic zone is circumscribed the plutons which are involve wall rocks xenohths. Relict of the hornfelsic texture in granite and monzonite is evided assimilation proceses of the pelithic rocks.

These evidence suggested that passive emplacement of the magma. Only minor folding of the wall rocks around the Karacadağ plutons show active emplacment proceses. Although there are no protoclasis along border of the plutons which is supported force full injection or intrusion of the consolidated body.

CONTACT METAMORPHISM

The proceses of thermal metamorphism have transformed rocks to hornfelses for distances as much as one mile from the plutonic contenents.

This wide contact zone involve pelithic hornfelses, calcsilicate hornfelses and calc-pelitic hornfelses which are subdivided into four zone from inner contact to outer.

Pelithic hornfels zones

a) Orthoclase sillimanite-biotite zone,
b) Andolosite-cordierite zone, MF 15
c) Andolusite-biotite zone,
d) Muscovit-biotite zone.

MF_{15} Andalosite cordierite hornfels, X15

Calc-silicate hornfelses zones,

a) Skapalite-diopsite-wallostonite zone,
b) Garnet-diopsite zone,
c) Calcite-epidote-garnet zone,
d) Calcit-epidote zone,

Banded calc-phyllite had been convert to banded hornfelses which are comprieses pelithic hornfels and calc-silicate hornfels banded.

CRYSTALLIZATION OF THE POST METAMORPHIC PLUTONS (Table I)

Relatively different three magmatic mass had emplaced and crystallized as individual plutons namely Demirköy, Karacadağ and Dereköy. Crystallization trend and solidification stages is differ from the each other.

Dereköy pluton crystallized from relatively more silicic magma masses, rfom basic margin to silicic inward (Dawis at all, 1965; Bateman, Champpel, 1979; Shmit at all, 1979)

Karacadağ pluton crystallized at the two stage, early one dioritic, the younger one monzodioritic stage. (Bateman, 1963) Dereköy pluton comprises olvin bearing gabbroic small masses and monzonitic dominant facies. The more basic gabbroic facies is preserved as relict bodies of the pre emplacement stage (Bateman, 1963; Mack, at all, 1979) Of the major monzonitic magma mass. The post plutonic silicic subvolcanic rocks had orginated from residual of the plutonic stages (Smit, at all 1979) which are cut the plutons. (Gilluly and Gates, 1965) Subvolcanic bodies are younger that plutonic bodies contrast to Hamilton and Myer's models. (Hamilton, Myer, 1967).

STRUCTURE OF THE ISTRANCA REGION OVER THRUST (Fig I)

The basement granitoids had over thrusted on folded peripherial metamorphic belt. Over thrusted face is lie W-NW — E-SE direction which is parellel to major folding axes. Over thrusting had been accompaning with main (F_1) folding and metamorphic phase.

F_1 (S_1) Penetrative foliation and (S_2) Stran slip cleavage.

Intensively cataclastic texture and structure had been superposed and overthrusing basement granites and under thrusting periphrial metamorphic. Therefore over thrusting contact between granites and quartzo feldspathic schist had been hidden by these cataclastic texture which are develop on both of these rocks groups. Also synfolding overthrusting plane had been folded to during the progressive deformation.

MAJOR FOLDING (F_1)

The major structure of the Istranca masif is represented by antifrom and synform which are W-NW — E-SE trend. The principel structural unit penetrative schistosity and slayt cleavage had been developed during this folding phase as axial plane patye cleavage. Penetrative schistozity and claty cleavage that are superposed on meta sedimantary roks is parellel to cataclastic cleavage which are develop on granitic rocks.

Cataclastic cleavage and penetrative schistozity undistinguisable along the overthrusting line.

MINOR FOLDING (F_2)

Earlier folding axial plane schistosity planes had been folded by the younger folding phase.

S_2 Strain, slip cleavage had developed parellel to F_2 minor folding axes. (F 1)

GEOTECTONIC EVOLUTION (Fig II)

Istranca group had been sedimented on the northern edge of the Kırklareli group as Atlantic type continental margin sedimentary prizm prizm from triassic to liassic age.

Atlantic type continental regime of the northern boundry of the Kırklareli group had been transition to cordiller type orogeny belt (Dewey, 1970) by the south facing subduction from upper liassic to tithonian interval. Syn metamorphic plutons had been emplaced in Istranca group as continental margin pluton like cordillerian arc. Orogenic front and metamorphism had moved to the continent ward which aie subjected continental margin sedimentary prizm and syn metamorphic plutons. (Dewey, 1970; Erns, 1974)

Kırklareli group and its peripherial cover had been collided with moesian platform as continental collition type (Dewey, 1970) at the terminal stage of the subduction Basement (Kırklareli group) had been subjected by the cataclastic metamorphism during this collition. Basement had been overthrusted on the peripherial metamorphic belt by the synfolding overthrusting.

Post metamorphic plutons had been emplaced in peripherial metamorphic belt by the result of continental collition. Like Tibetian type magmatizm. (Dewey, Burke, 1973)

MINERALIZATION

İkiztepe Mo-Cu-W mineralization:

İkiztepeler mineralization had been taken place in highly sheared and altered İkiztepe pluton as stokwork molybdenite-chalcopyrite veins. Scheelite mineralization occured in the skarn zone that closely contact with pluton. Molybdenite bearing pegmatitic vein are also observed in the Yudadere.

Stokwork molybdenite and chalcopyrite mineralization may be subdivided in to three types base on mineralogical contents of the veins.

a) Quartz-K feldspat-molybdenite-chalcopyrite and pyrite veins,
b) Quartz-chalcopyrite and pyrite veins,
c) Molybdenite in K feldspat Quartz.

Skarn type mineralization

Mainly scheelite mineralization had occured in the skarn zone which is surrounded the veinitic type mineralization. Mineralization which is linked with skarnification may be up divided into three zone.

a) Inner contact skarn
Garnet-diopsit skarn which is contain fine grained scheelite with chalcopyrite and magnetite.
b) Chalcopyrite mineralization in pelithic hornfels or epidot fels.
c) Galenit-Sfalorite veins in the auter marble zone of the skarnfication.

Hydrothermal alteration is the most important phenomen is K feldspathization in the İkiztepeler pluton. Primary Quartz dioritic composition of the İkiztepeler pluton is convert to granodioritic and granitic composition by the eddition to considerable amount of Potas and silis during the hydrothermal alteration. Metasomatic events are clearly seen in thin section. Hydrothermal orthoclose is replaced primary igneous plagioelase. Hydrothermal quartz veins occupied a long the fracture plane during the Hydrothermal proceses. Replacment of the quartz veins is accompanied with hydrothermal K feldspat blastesiz.

K feldspar and quartz veins are seen as pegmatitic apearance a long the cheared plane or fracture.

Biotitic alteration in the İkiztepeler mineralization are represented by the secondary hydrothermal biotite which are occompanied with secondary orthoclase. The spurtial overlag of these two alteration suggest that the two events may have been closely related in time orthoclase biotite zone transition to orthloclase cholorite zone. Occurance of chlorite instead of biotite is convert to rock, grey-green colour. Serisite become dominant mineral with quartz outer zone of the hydrothermal alteration by the destruction of the plagioclases.

The genesis of the İkiztepeler mineralization

Porphyry and stokwork type molybdenite mineralization subdivided base on the chemistry of the cource pluton.

Porphyry and stokwork copper molybdenite system subdivided into three group by Ney, Hollister, 1976.

1 — Calcalcaline porphyry copper deposit

2 — Alcalic porphyry copper deposits (Cu-Au)

3 — Calcalcaline molybdenite deposit

Mutschler (1979), subdivide molybdenium stokwork deposits into

1 — Granodiorite system,

2 — Granite system.

Sillitoe (1980) distinguished subduction related molybdenium deposits and rift related deposit.

Alcali-calcic and alcali-molybdenium, deposits are subdivided into three types westal and Keith (1981)

1 — Transitional deposits associated with high K calc-alcalic.

2 — Climax type deposits related to alcali-calcic magmas.

3 — Alcalic-molybdenium deposits associated with alcali-calcic and alcalic magma.

In the light of these clasifications İkiztepeler deposits had orginated from calcalcalic İkiztepeler pluton.

Most of the porphyry stockwork deposits show a potassic core and a quartz-serisite-outer and upper (Sillitoe, 1973; Patton, 1973; Woodcock and Hollister, 1978; Hollister, 1978; Mutschler, 1981; and Westral, 1981).

The core of the hydrothermal system may consist of a stockwork of paragenetically early barren Quartz K feldspar veins (Kitsault) or a zone of barren potassic alteration (Hall). Climax type molybdenium deposits differ from calc-alcaline type include abundance of fluorite in all and topaz in some deposits.

The deep igneous phases show greisen alteration along fracture.

İkiztepeler hydothermal alteration similar calc-alcaline molybdenite deposits rather than climax type and Applachian type molybdenite deposits. Neither gresnification nor flourite enrichment can be observable in the deeply eroded İkiztepeler deposits.

A close spatial relationship between molybdenite mineralization and potassium enrichment is found of climax, Urad-Hersorson-Questo, Mount Emmans, Redwell (Westra-Keith, 1981) and also İkiztepeler deposits generally calc-alcaline molybdenium stockwork deposits contain a central (Buckingham, Campaccha, Peru) or annular (Kitsault, Hall) Molybdenium zone may ve surrounded by a chalcopyrite zone like as İkiztepeler. Anomalaus tungsten concentration occurs as scheelite at Kitsault and Boss mountain, and as povellite at Adonac (Soregaruh and Sutherland, Brown 1976).

Skarn associated with calc-alcaline molybdenium deposits at Carnvon, Gulch, Thompson, greek may contain economically scheete concentrations.

At the consequent of these are knowns that İkiztepeler Mo-Cu-W mineralization is accepted as calc-alcaline stokwork type molybdenium, deposits which is surrounded by a chalcopyrite zone and associated with scheete bearing skarn.

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