A CONTRIBUTION TO THE GEOLOGY OF THE REGION BETWEEN SİRYA AND ARDANUÇ

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INTRODUCTION

This geological investigation of the central part of the province of Artvin was carried out between May and August, 1960. The general geological map of this area is based on the topographical map of Ardanuç 1 : 42,000. This mountainous area—a part of the central region of the province of Artvin—is located eastwards of the city of Artvin. It belongs to the block - faulted area of the eastern Pontides. The mountainous character of this area is represented by a WNW-ESE section; the altitude is changing from +200 m till +2000 m at a horizontal distance of about 7.5 km. The whole area is thinly forested, mostly with pine trees.

I. GEOLOGIC STRUCTURE OF THE AREA BETWEEN SİRYA AND ARDANUÇ

Rock formations in the area under investigation can be subdivided into:

9. Young basic extrusive rocks.
8. Young albite dacites.
7. Old Eocene series.
6. Upper Cretaceous limestone series.
5. Spilites.
4. Old albite dacites.
3. Old spilites.
2. Albite granodiorites.
1. Regional metamorphic rocks of Paleozoic age.

1. Regional metamorphic rocks of Paleozoic age.— The oldest formation consists of early Paleozoic rocks. This regional metamorphic series is characterized by sericite-schists, biotite-schists, gneisses, augen-gneisses and quartzites.

This formation is strongly folded. The general strike of the formation is NE-SW. The dip is SE or NW with an angle varying between 30° and 40°.

The regional metamorphic formation is outcropping in the western part of the area, viz. in the valleys of Çoruh and İmerhevi Rivers.

2. Albite granodiorites.— Coarse-grained albite granodiorites are intruded in the regional metamorphic formation. These albite granodiorites arc characterized by xenomorphic quartz, hypidiomorphic albite and kalifelspar. Kalifelspar

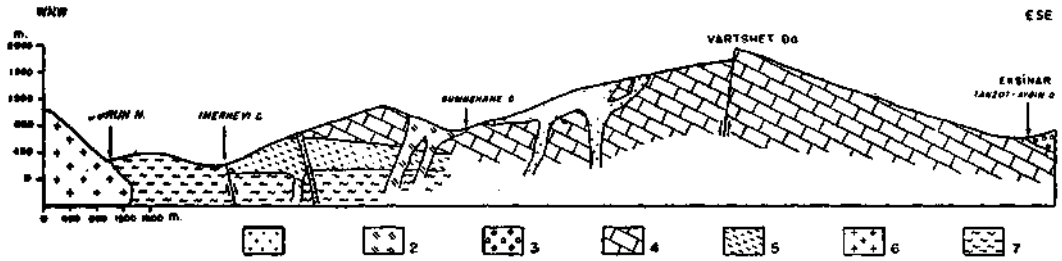


Fig. 1 - Geological section between Çoruh River and Ekşinar

1 - Partly albitized andesites; 2 - Young albite dacite; 3 - Old Eocene; 4 - Upper Cretaceous series; 5 - Albite dacite; 6 - Albite granodiorite; 7 - Metamorphic series.

is represented by microcline, microperthite or orthoclase. Other minerals include a subordinate amount of muscovite, sericite, chlorite and hornblende. Albite granodiorites occur in the northwestern part of the area, viz. west of the valley of Çoruh River and north of the valley of İmerhevi River. North of Şurtum they are covered unconformably by old albite dacites.

Albite granodiorites contain sometimes quartz veins. The population utilizes this quartz material for flint stones.

3. Old spilites.— Old spilites occur only in the vicinity of Kivit, eastwards of the fault zone of Çoruh. They are intruded in the regional metamorphic series. They are natron - keratophyre - spilites, characterized by albite phenocrysts and albite laths in the groundmass. The glass groundmass contains numerous small cavities filled with chlorite or zeolite.

4. Old albite dacites-— The area east of the fracture line of the Çoruh River, south of the fracture line of the İmerhevi River and the vicinity of Bertaham consists of old albite dacites.

These coarse-grained albite dacites are characterized by quartz phenocrysts, albite phenocrysts and sometimes hornblende phenocrysts, which are lying in a quartz-rich groundmass which may contain albite and sometimes a subordinate amount of chlorite, sericile and ore grains. Old albite dacites are not mineralized in contrast with old dacites of the Murgul area. Only albite dacites of Şurtum contain traces of magnetite, pyrite and chalcopyrite, but this mineralization is negligible.

5. *Spilites.*— Spilites are outcropping in the vicinity of Sakut and SW of Kadişiyurman. They contain albite phenocrysts, hypersthene phenocrysts lying in a glassy groundmass containing albite laths and numerous cavities filled with calcite and chlorite.

6. Upper Cretaceous limestone series.— This Upper Cretaceous series consists of limestones and is about 600-1400 m thick. The age of this formation is proved by fossils such as Inoceramus and by microforaminifera (Orbitoides, Globotruncana, Oligostegina, *Globigerina* cf. *cretacea* d'Orb.).[1]

This limestone formation occurs in the central and eastern part of the area. Features of karst morphology are common in this region, including caves, dolines and sink holes.

In the vicinity of Kildestaf, Vartashef occurs a large fracture line running in NE-SW direction, in the vicinity of Goroskara occur fracture lines running in W-E and NE-SW directions. Between Vartshet Dağ and Künye is a large fracture line running in NW-SE direction and north of Vartshet Dağ a big fracture line is running in NE-SW direction. Along these large fracture lines of Vartshet Dağ are intruded in post-Cretaceous period the young, partly albitized andesites, basalts and spilites, which have covered an extensive part of this Upper Cretaceous formation.

A general strike of rockbeds could be determined; it varies between N-S and NE-SW (except in the area NW of Ardanuç, where an anticlinal axis running in NE-SW direction occurs). The average dip angle is about 20°-25° and rockbeds are dipping in E or SE direction.

7. *Old Eocene series*-— The old Eocene series consists of a succession of well-layered thin limestone beds and marly slates, resembling a «flysch» facies. This Eocene formation is outcropping NW of Ardanuç, east of Tanzot-Aydın River in the vicinity of Ekşinar and as erosional remnants it occurs south of Kadişiyurman and in the vicinity of Kildestaf.

Old Eocene age is proved by microforaminifera *(Miscellanea miscella, Discocyclina* sp. ex gr., *Discocyclina archiaci, Globorotalia* sp., *Globigerina* aff. *pseudobulloides)*[2]

This Eocene series covers mostly with an angular unconformity the underlying Upper Cretaceous limestones. The general strike is NE-SW and the rockbeds are dipping with an average dip angle of 40°-50° in SE direction.

8. Young albite dacites.— Young post-Eocene albite dacites are outcropping along the Gümüşane River in the vicinity of the small village of Gümüşane.

These albite dacites are intruded in the adjacent Upper Cretaceous limestones. Albite-dacites are silicified and contain sometimes an accessory mineralization of pyrite; the contact-metasomatic altered limestones contain also an unimportant mineralization of sphalerite, chalcopyrite and pyrite. This subordinate mineralization of albite dacites and limestones is caused by hydrothermal action of the further differentiated acid magma.

9. Young basic extrusive rocks-— Post-Eocene basic extrusive rocks are finally intruded in older geological units and are extruded over them.

To these young basic extrusive rocks belong : andesite porphyries, diabases, partly albitized andesites, basalts and spilites.

a. Andesites and their porphyries.— They occur SW of Kadişiyurman, west of Gioshana, in the vicinity of Goroskara and as large dike in the vicinity of Sakut.

b. Diabases. — Augite-diabases, are intruded in albite dacites eastwards of Şurtum; biotite-augite-diabases of the region SE of Dvori Karakolu are intruded in the Upper Cretaceous limestones.

c. Partly albitized andesites. — Large areas situated between Gümüşane and Ferhatlı, SE of Goroskara, north of Agara consist of partly albitized andesites.

These partly albitized andesites of Ferhatlı are partly intruded along the large fracture zone north of Vartshet Dag and have covered an extensive part of the underlying Upper Cretaceous limestones.

The distinguishing feature of these rocks is that andesine phenocrysts are partly albitized. Under the microscope these albitized andesites are characterized by partly albitized andesine phenocrysts, hornblende phenocrysts or calcite-chlorite pseudomorphs after hornblende lying in a holocrystalline or glass-bearing groundmass containing albite, ore grains and sometimes secondary quartz.

The fact that andesine phenocrysts are partly albitized indicates that these rocks may have been formed from ordinary andesites by metasomatism and thus be regarded as partly albitized andesites.

d. Basalts and spilites. — Basalts and spilites occur in the SE part of the area and in the vicinity of Boselt. Especially the former are intruded along the large fracture line Vartshet Dağ - Künye and are extruded over a large part of the underlying Upper Cretaceous limestones.

Basalts are characterized by occurrence of labradorite phenocrysts, augite phenocrysts, hornblende phenocrysts or chlorite-calcite-quartz pseudomorphs after olivine lying in a holocrystalline or glass-bearing groundmass containing laths of labradorite and ore grains.

Spilites and natron-keratophyre-spilites are tnacroscopically characterized by dark-green color and by typical pillow structure, in which the lava exhibits the appearence of piles of rocks in the shape of pillows, bolsters, sacks and cushions.

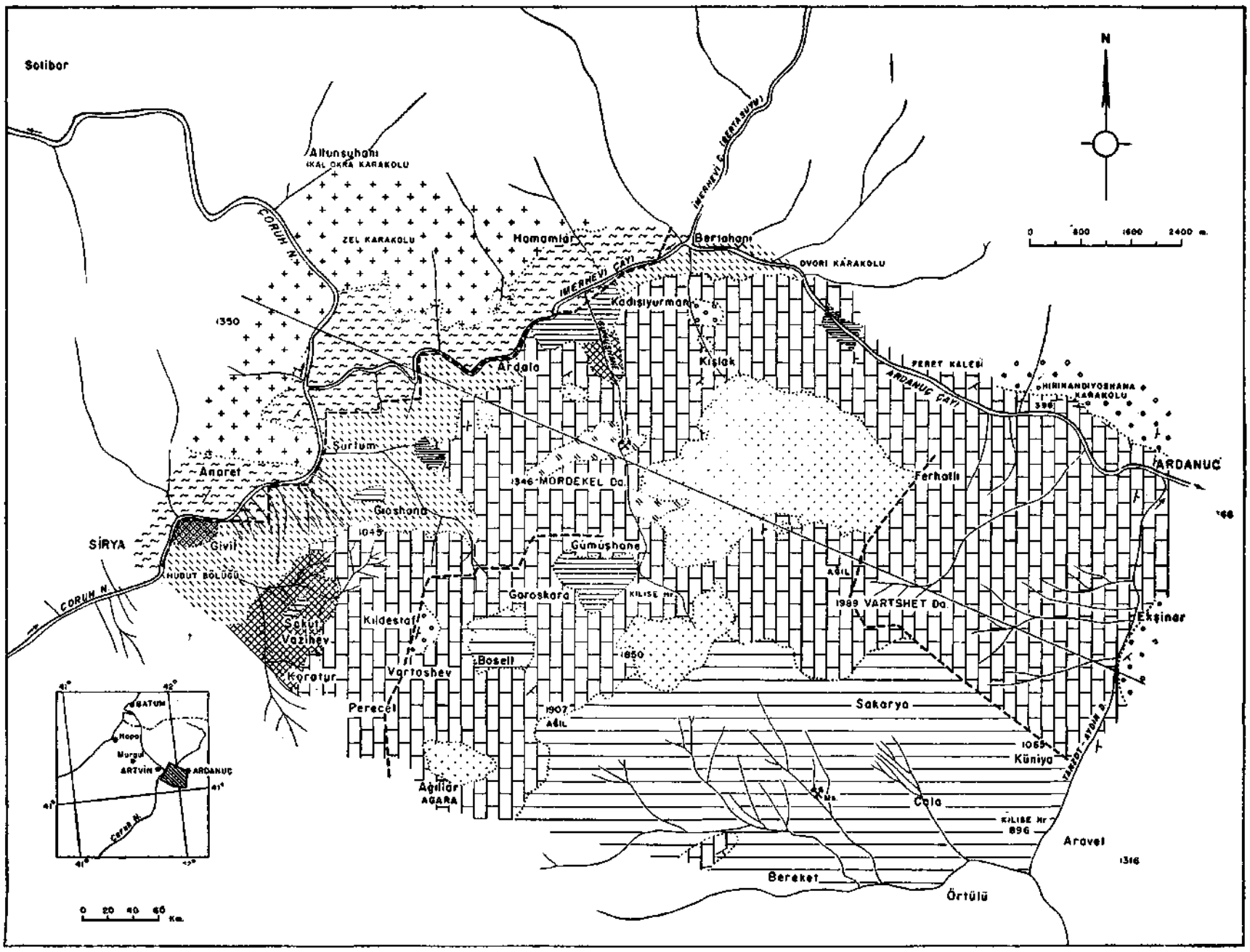
The characteristic feature of these extrusive rocks is the occurrence of albite as phenocrysts and as crystal laths in the groundmass.

We can consider these spilites and natron-keratophyre-spilites as amygdaloidal albite basalts.

II. MAGMATIC CYCLES AND TECTONICS

The first taphrogenetic tectonical (=block-faulting) movements occurred after the formation of the Paleozoic regional metamorphic series. These movements continued during every younger geological period and gave rise to form horsts and grabens, which are typical for the whole eastern Pontides region.

This germanotype (horsts and grabens structure) is also confirmed by other geologists in other parts of the eastern Pontides, viz. H. Zankl in Harşit Valley, H.H. Schultze-Westrum in Giresun-Aksudere region, A. Pollak, Z. Barut,



2 3 4 5 6 7 8 9 10 11 12 13 14.

GEOLOGICAL MAP OF THE REGION BETWEEN SİRYA AND ARDANUÇ

1 - Young basalts and spilites; 2 - Young partly albitized andesites; 3 - Young diabases; 4 - Young andesite porphyries; 5 - Young albite dacites; 6 - Old Eocene series; 7 - Upper Cretaceous limestone series; 8 - Spilites; 9 - Albite dacites; 10 - Old spilites; 11 - Albite granodiorites; 12 - Regional metamorphic series; 13 - Fracture line; 14 - Section line.

C. Kahrer, A. Kraeff, L. Klay, H. Pötter and H. Zankl in the Murgul-Hopa region.

Magmatic cycles play an important part in the geologic history of this area.

The first magmatic cycle is here characterized by acid differentiations (albite granodiorites).

The second magmatic cycle is characterized by basic and acid differentiations. To the basic differentiation of the 2nd magmatic cycle belong old spilites, to the acid differentiation of the 2nd magmatic cycle belong old albite dacites.

The partial silicification of old albite dacites can be considered as hydrothermal action of further differentiated acid magma of the 2nd cycle.

The third magmatic cycle is characterized first by pre-Cretaceous basic differentiation products (spilites) and later by post-Eocene acid differentiations (young albite dacites).

Upper Cretaceous and Eocene sediments are formed between the basic and the acid differentiation products of the 3rd magmatic cycle.

Tectonics	*Igneous rocks*	*Magmatic actions*	*Sediments*
TAPHROGENESIS	Basalts, spilites, partly albitized andesites, diabases, andesites	Basic differentiation (4th magmatic cycle)	
	Partly silicified, young albite dacite + very small mineralization	Hydrothermal action of further differentiated acid magma	Small contact-metasomatic mineralization in Upper Cretaceous limestones
	Young albite dacite	Acid differentiation (3rd magmatic cycle)	
			Eocene series
			Upper Cretaceous limestones
	Spilites	Basic differentiation (3rd magmatic cycle)	
	Partly silicified old albite dacite	Hydrothermal action of further differentiated acid magma	
	Old albite dacite	Acid differentiation (2nd magmatic cycle)	
	Old spilite	Basic differentiation (2nd magmatic cycle)	
	Albite granodiorite	Acid differentiation (1st magmatic cycle)	
			Paleozoic series

Characteristic for the 3rd magmatic cycle, especially for its acid differentiation, is the very insignificant mineralization. This mineralization is caused by hydrothermal action of further differentiated acid magma of the 3rd magmatic cycle which caused also a very small contact-metasomatic mineralization in Upper Cretaceous limestones.

The fourth magmatic cycle is only characterized by basic differentiation products : andesites, diabases, partly albitized andesites, basalts and spilites.

All igneous rocks of the 1st, 2nd, 3rd and 4th magmatic cycles (except some extrusiva of the 4th magmatic cycle) belong to a kindred which essential character is the great relative abundance of soda, which results in albite being the typical felspar of this kindred.

In the above schedule these facts are summarized.

III. MINERAL DEPOSITS

1. *Description of the mineralization of Şurtum.*— At a distance of 0.5 km east of the small village of Şurtum a zone of old silicified dacites is outcropping. There occurs a dump of 10 m length and 0.25 m thickness. An average sample of these old albite dacites shows under the ore microscope a subordinate impregnation of magnetite, pyrite and traces of chalcopyrite. This silicification and mineralization is caused by hydrothermal action of further differentiated acid magma of the 2nd magmatic cycle. This mineralization is negligible and therefore economically unimportant.

2. *Description of the mineralization of Gümüşane.*— At a distance of 1 km north of the small village of Gümüşane, along the Gümüşane River occurs the mineralization zone of Gümüşane. It consists of a small zone of Upper Cretaceous limestones which is somewhat contact-metasomatically altered by intrusions of young albite dacites. Crystalline limestones contain locally an unimportant contact-metasomatic mineralization of pyrite, chalcopyrite and sphalerite. Average samples of these above-mentioned rocks contain 0.04% - 0.28% Cu, 1 gr/t Au, 10-37 gr/t Ag.

Crystalline limestones contain sometimes garnets.

Young albite dacites of this mineralization zone are silicified and contain locally a subordinate amount of pyrite. Average rock samples are assaying 0.05% Cu, 8 gr/t Ag, and 0.5 gr/t Au.

This mineralization in albite dacites and limestones is due to hydrothermal action of further differentiated acid magma of the 3rd magmatic cycle. The mineralization of Gümüşane is negligible and economically unimportant.

3. Description of manganese ore deposits of Bereket.— At a distance of about 1.5 km NE of the small village of Bereket a small manganese deposit is known.

In spilitic rocks of this region a small manganese ore pit occurs, extending in NE-SW direction with a length of 4 m, a width of 2.5 m and a depth of 1.20 m.

Manganese ore consists of pyrolusite, limonite and siliceous matrix. An average sample of this siliceous manganese ore assays 33.39 % MnO. The genesis of this manganese ore is probably due to volatile fraction of the spilitic magma (belonging to the basic differentiation of the 4th magmatic cycle) which was shed into sea water.

The quality of these manganese ores is inferior and the reserve is very small, so that this deposit is economically unimportant.

IV. GEOLOGY OF THE REGION SİRYA-ARDANUÇ COMPARED WITH THE GEOLOGY OF THE REGION MURGUL-HOPA

If we compare the geology of the region Sirya-Ardanuç with that of Murgul-Hopa we find similarity.

Concerning geological details of the region Murgul-Hopa the reader is referred to M.T.A. report of geologists Z. Barut, G. Kahrer, A. Kraeff, L. Klay, H. Potter and H. Zankl (1959).

There are however some small differences, which are mentioned below. The oldest geologic units (regional metamorphic series and old albite granodiorites) are only outcropping in the Sirya-Ardanuç region; in the Murgul-Hopa region they are absent.

Old albite dacites of the Murgul-Hopa region are rich in copper-bearing deposits (viz. Murgul, Akarşen), in Sirya-Ardanuç region they are almost barren.

The young albite dacites which are sometimes a little mineralized in the Murgul-Hopa region (viz. Petek, Operlemet), contain some unimportant mineralization in the Sirya-Ardanu9 region (viz. Gümüşane). Further there occurs in Gümüşane an unimportant contact-metasomatic mineralization in Upper Cretaceous limestones caused by young albite dacitic intrusions.

The young albite granodiorites, albite tonalites, which occur in the Murgul-Hopa region, are absent in the Sirya-Ardanuç region.

But further there is a large similarity between these two regions. All igneous rocks (except some young basalts) of both regions belong to a kindred which essential character is the great relative abundance of soda which results in the occurrence of albite.

Both regions are from tectonical point of view good examples of block-faulting.

Manuscript received December 17, 1962

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