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Review Article

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The Role of Geodynamıc Condıtıons ın the Formatıon of Pıcrıtes of the Talysh Zone

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ABSTRACT
It is known that as a result of partial melting of the upper mantle basement, the transportation of the relatively heavy fraction of the olivine basalt magma, mild alkaline picrite alloy, to the upper horizons of the earth's crust becomes much more difficult. As a result of the inability of the picrite alloy to be transported to the upper horizons, this heavy fraction forms intrusives of various shapes and sizes of Paleocene and Eocene age in the form of separate intrusives, which are found in layered, sill-like, stock-like and irregular forms.

The diversity of the picrites of the Talish zone is a result of differences in the upper mantle material and the degree of melting. In addition, the geological-geodynamic conditions of melting and crystallization of picrites are also factors affecting the process.

Keywords: Talysh Zone, Picrite, Geodynamic Conditions, Rift Zones, Crystallization.

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Introduction

Picrites, unlike other igneous rocks, characterize the composition of the first mantle sources. The formation of picrites, in turn, depends on specific geodynamic conditions that facilitate high melting of the mantle material. The petrological differences of picrites depend on changes in the composition of the initial sources and the degree of partial melting of these sources. Considering all this, the study of the geological-geodynamic conditions of the picrites of the Talysh zone is one of the important issues.

Methods

Microprobe, chemical and X-ray diffraction methods were used to determine the reliability of the presented geochemical element analyses. Microprobe analyses of geochemical element were carried out by using an internal standard in electron probe microanalysis (JEOL, JSM-6610 LV, Oxford Instruments, X- MAX). All microprobe, X-ray diffraction and chemical analyses of elements were carried out at the analytical center of the Institute of Geology of the Azerbaijan National Academy of Sciences.

Geological and Petrological Peculiarities of Formation of Picrites of the Talysh Zone

The Talysh zone is the northwestern extension of the Alborz folded zone, starting from the valley of the Seyfirud (Aghchay) River and being observed in the direction of the general Caucasus to Germi settlement of the Islamic Republic of Iran (Figure.2). From here, the structures of the zone are observed along the latitudinal circle to the Garadag ophiolite outcrop, changing the stretching direction [1,2]. Here, the picrites have subalkaline composition and are mainly of Upper Eocene-Lower Oligocene age. Subalkaline picrites

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form thin (2-4 m) layered outcrops alternating with Paleocene and Eocene flushoid sandstones in this zone.Besides these, their limited outcrops of low thickness (2.5-3 m) are observed in the places where picrites are distributed. But subalkaline picrites are full crystalline, being phenocryst-like. The coarse inclusions consist of monoclinic pyroxene 0.3x1.2 cm, olivine with relatively little chrysotile content, as well as phlogopite and fine chrome spinel grains. The main mass of the rock is completely crystalline and consists of clinopyroxene grains. Subalkaline picrites are involved somehow in serpentinization and amphibolization processes (Figure. 3).

Picrites are intensively chloritized in contact zones. They are poor in silica from a petrochemical point of view, and are assembled in the region of normal picrites on the classification diagram (Table 1, Figure. 1).

Table 1: Chemical and normative mineralogical compositions of picrites of Talysh zone

an. Komp.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
SiO_2	41,4	41,50	41,82	41,57	41,62	41,88	41,9	42,8	42,6	43,47	43,64
TiO_2	0,53	0,59	0,5	0,4	0,37	0,44	0,69	0,4	0,55	0,61	0,78
Al_2O_3	6,32	6,31	5,65	5,53	5,63	5,91	7,92	9,39	12,16	12,40	12,26
Fe_2O_3	4,35	3,18	3,96	3,37	3,09	2,46	3,23	3,16	3,21	3,78	2,36
FeO	7,45	7,64	6,7	6,23	6,4	7,72	6,56	6,32	4,12	6,20	6,16
MnO	0,14	0,18	0,2	0,18	0,18	0,19	0,19	0,18	0,16	0,24	0,24
MgO	24,76	25,6	26,5	25,75	26,01	24,75	20,34	16,55	16,25	14,20	14,10
CaO	5,45	5,94	5,21	7,8	8,79	7,98	10,32	11,34	11,9	10,23	11,16
Na_2O	1,46	1,56	1,46	1,52	1,24	1,52	1,86	1,91	1,46	1,38	1,38
K_2O	1,72	1,78	1,69	1,63	0,92	1,1	1,2	1,79	1,26	1,46	1,64
P_2O_5	0,21	0,15	0,2	0,21	0,18	0,14	0,15	0,18	0,12	-	-
LOİ	5,7	5,46	5,94	5,6	5,42	5,35	5,55	5,88	5,64	5,68	6,20
∑	99,49	99,89	99,83	99,79	99,85	99,44	99,91	99,9	99,43	99,65	99,92
Ap	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,1	-	-
Il	0,9	1,1	0,9	0,8	0,6	0,9	1,4	0,8	0,9	1,1	1,5
Mt	6,3	4,6	5,9	4,9	4,4	3,5	4,6	4,6	4,6	5,1	3,5
Or	10	10,6	10,0	4,2	4,2	6,7	3,3	4,5	7,2	8,3	9,5
Ab	5,0	0,9	4,7	-	-	0,7	-	-	1,4	10,0	4,6
An	4,3	5,0	3,3	3,6	7,0	5,8	9,7	11,7	22,8	23,6	22,5
Ne	4,1	6,7	4,3	2,7	5,7	6,7	8,5	8,8	6,0	0,8	3,8
Le	-	-	-	4,1	1,1	-	3,1	5,3	-	-	-
Wo	8,6	9,8	8,2	14,3	14,9	13,7	17,0	18,2	14,7	11,4	13,7
En	6,6	7,4	7,1	11,2	11,6	10,3	12,9	13,6	11,8	8,4	10,0
Fs	1,1	1,3	0,9	1,5	1,6	2,0	2,2	2,9	1,2	1,8	2,4
Fo	38,6	39,5	41,2	37,0	37,2	35,9	26,4	19,4	20,0	18,9	17,6
Fa	6,6	7,2	6,5	5,3	5,6	7,6	4,9	4,5	2,3	3,3	4,5

1, 2, 3, 4 – subalkaline olivine picrites, porphyritic; 5, 6, 7 - subalkaline olivine-clinopyroxene picrites, porphyritic; 8, 9 - subalkaline olivine-clinopyroxene-plagioclase picrites, porphyritic; 10, 11 – subalkaline clinopyroxene-plagioclase picrites

However, the weak increase of sericitization and calcitization in pyroxene picrites led to partial increase of diopside in their normative mineralogical composition.

The chemical and normative mineralogical composition of picrites is given in table 1.

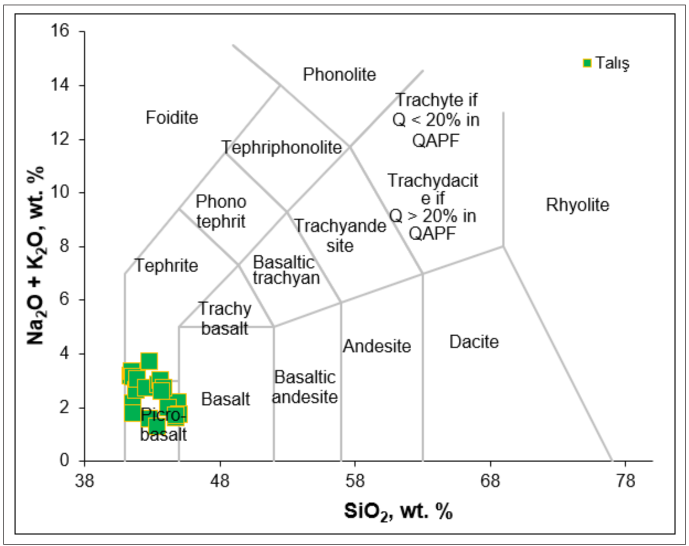


Figure 1: Position of the chemical compositions of picrites of the Lesser Caucasus and Talysh zone on the TAS classification chart [3]

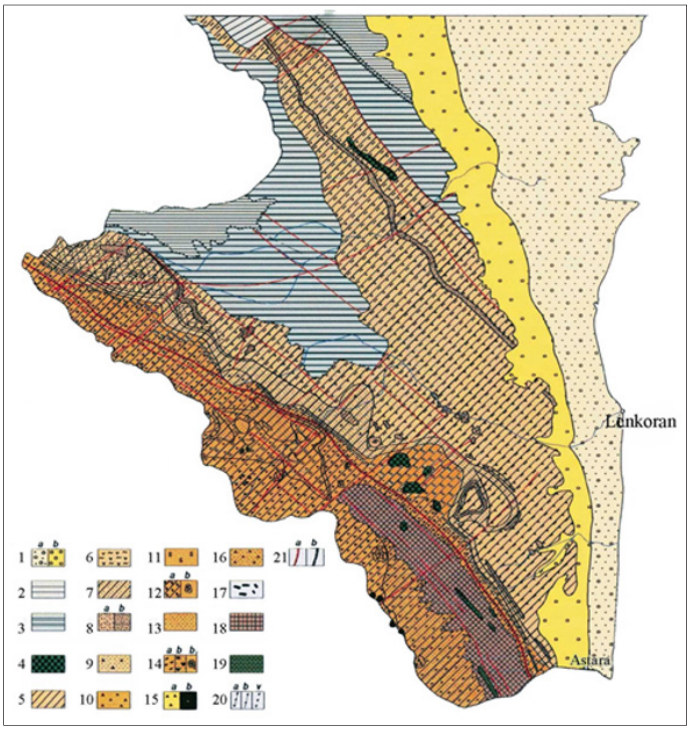


Figure 2: Structural-formation map of Talysh zone [4]

1 - Quaternary sediments: a) Holocene sediments, b) Pleistocene sediments; 2 – Upper mollas sediments(Middle and Upper Pliocene); 3 – Lower mollas sediments (Oligocene and Upper Miocene); 4 – Subalkaline ultrabasic formation (Upper Eocene-Lower Oligocene); Eocene trachybasalt-trachyandezibasalt-phonolite formation; 5 – Trachybasalt-trachyandezibasalt (latite)-phonolite complex (Upper Eocene); 6 – Layer of tuffaceous sandstones; 7 – Leucitic phonolite layer; 8 – Subalkaline trachybasalts, layer of trachydolerites: a) lava, pyroclastic facies, b) subvolcanic facies; 9 – Plagioporphyric trachyandezibasalt (latite) layer; 10 – Absarocite-shoshonite-alkaline basalt complex (Lower – Middle Eocene); 11 – layer of sedimentary sandstones with flysch tuff; 12 – Alkaline basalts layer: a) lava, pyroclastic facies; b) subvolcanic facies; 13 – Layer of tuffaceous sedimentary sandstones; 14 – Layer of absarocites and leucite tephrites: a) lava, pyroclastic facies, b) subvolcanic facies, b1) subvolcanic gabbro-techenites; 15 – layer of trachybasalts;16 – layer of trachyandezibasalt tuffs; 17 – Dikes of trachybasalt, leucite tephrites and absarocites; 18 – Layer of flysch-tuffaceous sandstones (Paleocene); 19 – Limestone layer (Upper Cretaceous); 20 – Fractures bordering structural floors: a) Eocene age; b) Oligocene age; v) Miocene age; 21 – Magma-carrying and emplacement faults; a) connecting; b) separating

Under the microscope, the structure of these picrites is porphyritic, the main mass is phenocryst [figure.3]. Phenocrysts consist of equal amounts and relatively smaller amounts of phlogopite (2-4%) and chrome spinel (0.5-1%) olivine (Fo20-25), clinopyroxene (Wo44, En44, Fe12) [5]. In the bulk mass, small prisms of clinopyroxene are dominant [6,7].

The mildly alkaline pyrites of the Talysh zone are of late Eocene and early Oligocene age. Later, as in the tuffogenic sedimentary complex of the Oligocene, they were deposited in the form of vertical and sometimes needle-shaped layers within the flysch. Here, like other analogues, the mildly alkaline picrites have a black color. Large clinopyroxene phenocrysts (up to 0.5x2.5 cm) stand out from the others [8].

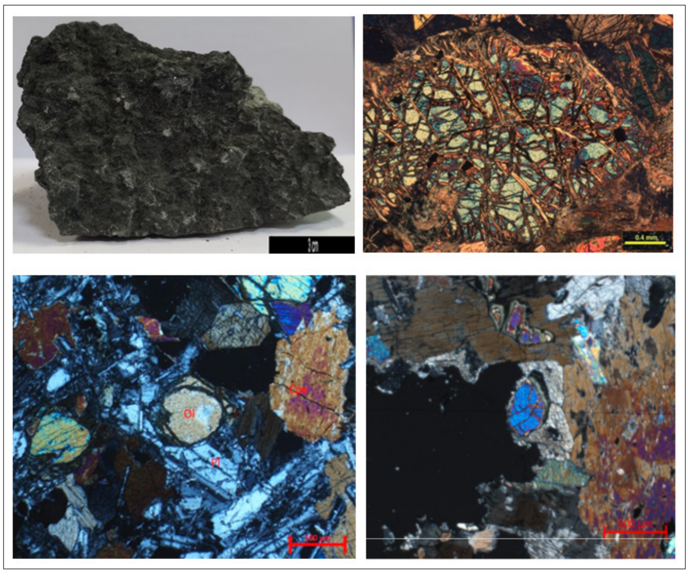
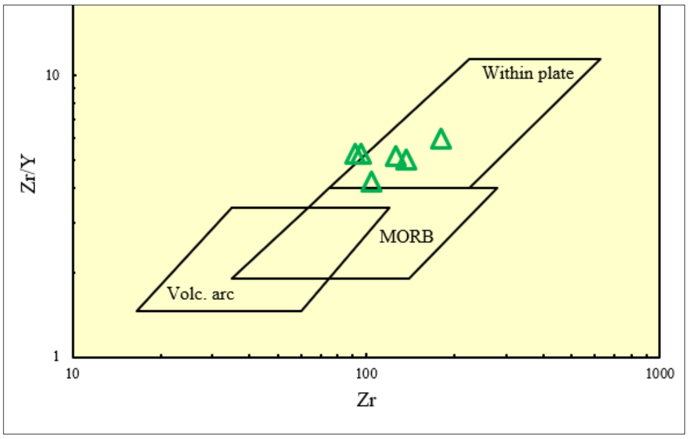


Figure 3: Macro and microscopic images of picrites of the Talysh zone (Cpl (Cross Polarized light), 5x 10)

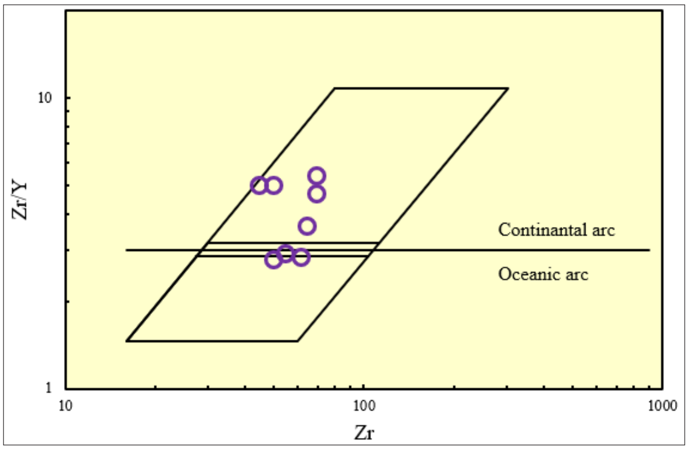
Here, the amount of olivine, chromic diopside and chrome spinel changes gradually along the vertical section in the composition of moderately alkaline picrites. Directly because of this, their plagioclase types are observed in the apical parts of picrites.

Geodynamic Conditions

Since the development of the Eocene stage is accompanied by the formation of various structures, the volcanism and sedimentation processes of the Talysh zone replace each other in time. However, if we analyze the development of volcanism and sedimentation, we can see the existence of various geological breaks in the Eocene period. The lower and middle Eocene stages of this break correspond to the absarokit-shoshonite-alkaline basalt complexes in terms of volcanism, and the upper Eocene volcanism corresponds to the trachyandesibasalt-phonolite complexes. The development of the region is associated with the replacement of volcanism and sedimentation, depending on the rift-like geological conditions [figure.4]



(a)



(b)

Figure 4: a b Diagrams reflecting the conditions of formation of picrites of the Talysh zone [9,10].

In the Talysh zone, sedimentary and volcanogenic rocks of this formation are more widespread than rocks of other formations. The picrites, which are the object of our research, were formed in the upper Eocene and lower Oligocene [11].

It is known that as a result of partial melting of the upper mantle basement, the transportation of the relatively heavy fraction of the olivine basalt magma, mild alkaline picrite alloy, to the upper horizons of the earth's crust becomes much more difficult. As a result of the inability of the picrite alloy to be transported to the upper horizons, this heavy fraction forms intrusions of various shapes and sizes of Paleocene and Eocene age in the form of separate intrusions, which are mainly composed of rocks of tuffogenic-sedimentary origin. These intrusions are found in layered, sill-like, stock-like and irregular forms. They were formed within rock complexes of various ages of the geological development of the Talysh zone. Examples of these complexes include the following: Nudus-galası, Dilmadı, Pelikesh, Hamarat-Aliabad, Motalayatag, Alshar-Yelagach, Velikand and Rishov intrusions. Of these, the Nüdus-galası, Pelikesh and Dilmadı intrusives are located within the Danish-Paleocene tuffaceous-depositional complexes.

Conclusion

The picrites of the Talysh zone were formed under the control of crystallization differentiation under riftogenic conditions as a result of the activation of graben-type structures during the Eocene stage of the region's geological development.

Thus, the difference in the picrites of the Lesser Caucasus and Talysh zones is the result of differences in the upper mantle material and the degree of melting. In addition, the geological-geodynamic conditions of melting and crystallization of picrites are also factors affecting the process.

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