MINERALOGICAL AND PETROGRAPHICAL CHARACTERISTICS OF THE ROCK FRAGMENTS IN PHYLLITES OF BAGRIKURT (KONYA) FORMATION

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ABSTRACT: Phyllite of Bagrıkurt Formations contains dark color fragments, which have variable size (long axis: 1-18 cm) but usually elliptical shape. The fragments are quartzite, quartz-phyllite, chloritoid-quartz-phyllite, phyllite and metasandstone in composition. They are composed mainly of quartz (0.3-1 mm; 35-95%), colorless chlorite (0-50%), calcite (0-20%), chloritoid (0.1-0.4 mm;% 0-15), plagioclase(0.2-0.7 mm; 0-5%), colorless-light yellow and brown colored clinozoisite (0.4 mm;% 0-5), sericite (0-5%), opaque minerals (0-40%), with accessory apatite (0.03 mm), tourmaline (0.25-0.6 mm), zircon and Fe^{3+}-riched sphene (0.1 mm). Lepidogranoblastic texture is dominant in the samples, but mortar texture also exists. Mineral assemblage of chloritoid, clinozoisite, sericite and chlorite suggest that the samples were possibly derived from a magmatic arc, and undergone a regional metamorphism together with its host formation in greenschist facies conditions

Keywords: *Mineralogy, metamorphism, phyllite, Konya.*

Bagrıkurt Formasyonu (Konya) Fillitlerindeki Kayaç Parçalarının Mineralojik ve Petrografik Özellikleri

ÖZET: Bagrıkurt formasyonundaki fillitler içerisinde farklı büyüklüklerde (uzun eksen: 1-18 cm), ve genellikle elips şekilli, koyu renkli kayaç parçaları yer almaktadır. Bu parçalar kuvarsit, kuvars-fillit, kloritoyid-kuvars-fillit, fillit ve metakumtaşı bileşiminde olup başlıca kuvars (0.3-1 mm; %35-95), renksiz klorit (% 0-50), kalsit(%0-20), kloritoyid (0.1-0.4 mm; % 0-15), plajiyoklaz (0.2-0.7 mm; %0-5), renksiz-açık sarı ve kahverengi renkli klinozoizit (0.4 mm; %0-5), serisit (%0-5), opak mineral (% 0-40) ve tali olarak apatit (0.03 mm), turmalin (0.25-0.6 mm), zirkon ve Fe^{3+}'ce zengin titanitten (0.1 mm) oluşmaktadır. Lepidogranoblastik doku örneklerde yaygın doku türü olmakla birlikte mörter doku da izlenmektedir.Örneklerdeki kloritoyid, klinozoizit, serisit, klorit mineral topluluğu, muhtemelen magmatik bir yaydan türeyen örneklerin, içerisinde yer aldığı formasyonla birlikte yeşilşist fasiyesinde bir metamorfizmaya uğradığını ileri sürmektedir.

Anahtar Kelimeler: *Mineraloji, metamorfizma, fillit, Konya.*

INTRODUCTION

The investigated area is situated about 20 km to the north of Konya (Fig. 1a), (Central Anatolia). The area is of the Anatolides and located on the central northern margin of the Menderes-Tauride Block (Sengör, 1985) based on the tectonic subdivision of the Turkey (Ketin, 1966). Sedimentary and magmatic rocks varying in age from early Paleozoic to Cretaceous are cropped out in the study area, and are suggested to be a part of the Afyon and Tavsanli Zones of the Okay (1986) or the Kütahya-Bolkardagi Zone (Fig. 1b) of Özcan et al.(1988).

The general stratigraphy of the area was summarized first by Wiesner (1968) and Göger & Kıral (1969). Kaaden (1966) suggested that these rocks underwent blueschist metamorphism in relation with Variscan orogeny. Özcan et al. (1988, 1990) showed that the rocks north of Konya exhibited different characteristics from the neighboring tectonic units. Eren (1993a, 1993b, 1996 a, 1996b, 1996c, 2001), Eren & Kurt (2000) and Eren et al., (2004) studied

stratigraphical and structural characteristics of the area and determined numerous tectono-stratigraphic units, and contained them into the Bozdaglar massif supergroup. Kurt (1994, 1996, 1997a, 1997b) also studied in detail the geochemical and petrological characteristics of the metamagmatics and metamorphic rocks from the area.

Bagrıkurt Formation represents the oldest metadetritics in the area, and includes dark colored rock fragments in phyllites with sharp contact (Fig. 2). It is aimed to determine the mineralogical and petrographical characteristics of the gravels, which have various composition and size, and are mostly ellipsoidal in shape (1-18 cm long axis).

STRATIGRAPHY

Late Silurian-Early Devonian Bozdag Formation is the oldest unit in the study area, and made up of light colored marble and dark colored (gray black) laminated fossiliferous metadolomite and dolomitic limestone (Kurt & Eren 1998). The unit originally characterized a shelf sequence with a reefal metacarbonate complex forming as distinct bodies or lenses with varying geometry. These rocks show transition laterally and vertically into Devonian-Lower Permian the Bagrıkurt Formation, which is composed of the original shallow marine, continental margin and basinal facies (Eren and Kurt, 2000). At the bottom, it begins with alternation of calcschists, phyllites, metasandstones, metaconglomerates and metacherts. The middle part of the Bagrıkurt Formation includes the metaclastic, radiolarian metachert and metavolcanic alternations with metacarbonate and metamagmatic blocks. The upper part of the formation is composed of principally phyllites, metasandstones, metaconglomerates and quartzites. The coarse-grained metaconglomerates dominantly composed of quartzite and milky quartz fragments in a cleaved matrix of greenish mud. The upper part of the formation includes locally an alternation of metacarbonate, phyllite, graphite schist and metasandstone (Eren and Kurt, 2000). All these rocks are intruded by Devonian-Lower Permian aged Kadinhani Metamagmatics, which formed as dikes, sills and stocks. The metamagmatics contain metaspilite and metatrachyandesite. All these units were overlain with angular unconformity by ?Upper Permian-Lower Triassic Bahçecik Formation, which is consisted of violet to red phyllites, metasandstone and metaconglomerates. The ?Upper Permian- Triassic aged Ertugrul Formation, composed by alternation of phyllite; metasandstones, calcschists and yellow-gray and black metacarbonates, overlain the Bahçecik Formation (Eren and Kurt, 2000).

The psammite and quartzites in the Bagrıkurt Formation have a passive continental margin setting and a quartzose sedimentary provenance is inferred (Eren &Kurt, 2000). The rocks were undergone a regional metamorphism, first in greenschist facies and later blueschist facies conditions. Consequently, the amphiboles composition changed from actinolite to sodic-calcic variation (Eren &Kurt, 2000). The metamorphic rocks in the investigated area have undergone at least four phases of deformation and ductile folding during the Alpine crustal shortening (Eren 1996a; Eren 2001), which overprinted and destroyed most Cimmerian structures of the Bozdag and Bagrikurt Formations.

PETROGRAPHY

About fifty samples were collected by field studies, from twenty of which, thin sections were made at laboratory of Department of Geological Engineering (SU). Mineralogical and petrographical characteristics of the thin sections were examined under petrographic microscope

The samples were composed mainly of quartz (35-95%), chlorite (0-50%), calcite (0-20%), chloritoid (% 0-15), plagioclase (0-5%), clinozoisite (% 0-5), sericite (0-5%), opaque minerals (0-40%), with accessory apatite, tourmaline, zircon and sphene. Lepidogranoblastic texture is dominant in the samples, but mortar texture also exists. The foliation varies from slight to moderate in the samples depending on mostly the content of the sericite.

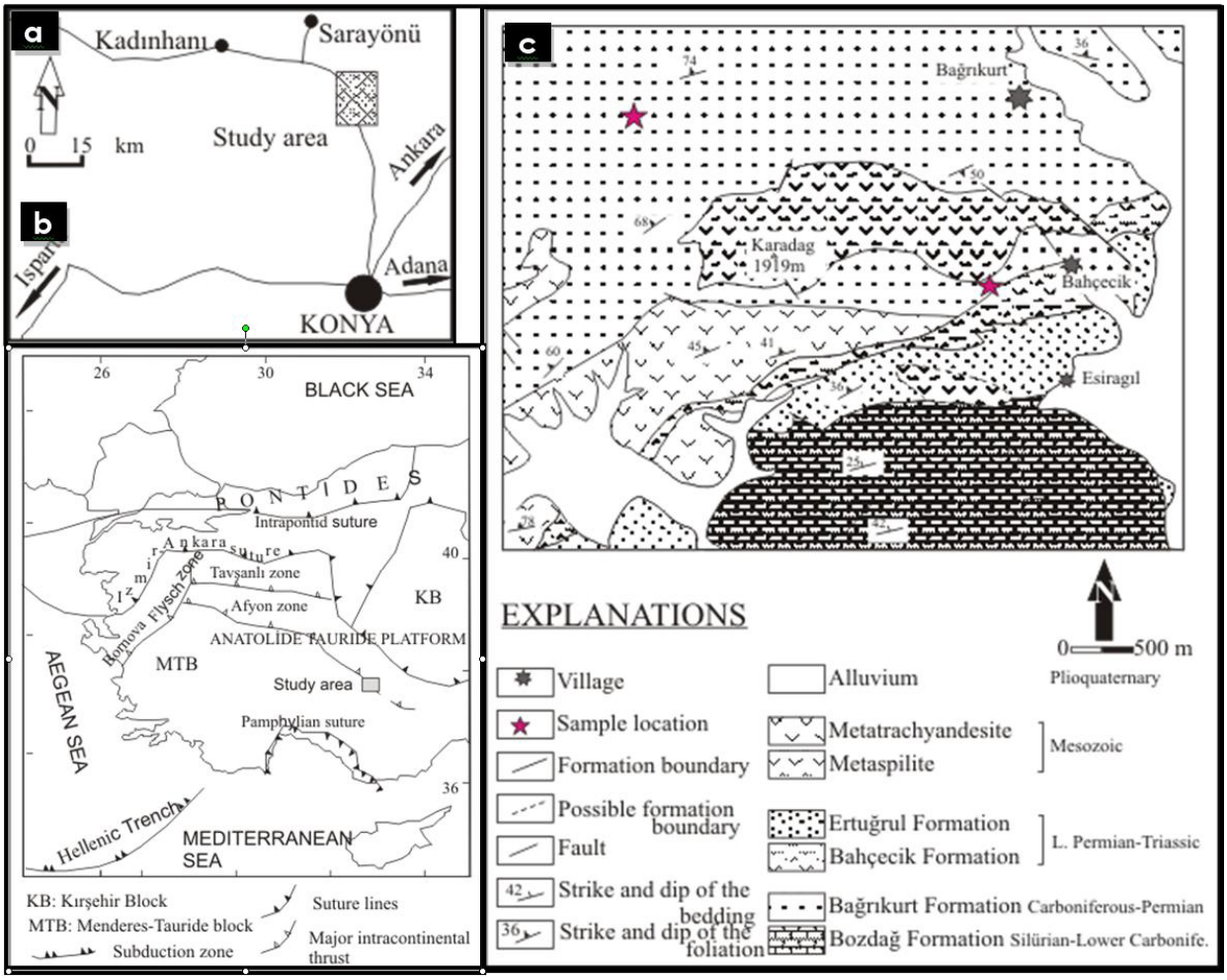

Figure 1. a) Location map b) Tectonic map of western Turkey (modified from Okay et al. 1996) c) Geological map of the study area (Hekimbaşı, 1997).

Şekil 1. *a) Yer bulduru haritası b) Türkiye'nin batısının jeoloji haritası (Okay ve dig. 1996'dan değiştirilmiştir) c)Çalışma alanının jeoloji haritası.*

Figure 2. Rock fragments with variable size within phyllite of Bagrıkurt Formations (pen:13 cm in length).

Şekil 2*. Bağrıkurt Formasyonu fillitlerinde farklı boyutlardaki kayaç parçaları (kalem 13 cm uzunluktadır).*

The xenoblastic quartz is the commonest mineral in the samples. It varies from nearly spherical to much flattened ellipsoids in shape. There are two different types of quartz in the samples. (a) The metamorphic quartz (0.3-0.7 mm) is typified by existence of pressure-shadows (Fig. 3a). Pressure induces recrystallization in large quartz crystals, producing small crystals and leading to the development of Mortar texture (Fig. 3a). (b) The volcanic quartz is characterized by idiomorphic to hipidiomorphic shape ~1 mm and water-clear internal appearance (Fig. 3b). The chlorites have no color and fine-grained. The chloritoid is hipidioblast, 0.1-0.4 mm, showing green-dark green color and pleochroism (Fig.3c) with perfect cleavage. Hipidioblast plagioclase crystals (0.2-0.7 mm) display Carlsbad twinning (Fig. 3d), and mostly altered to sericite. Clinozoisite is hypidioblast, ~0.4 mm, and show light-yellow and grey color (Fig. 3e). The tourmaline is remarkable with its purple and green color (Fig. 3f) and very strong plechroism. The hypidioblast sphene forms in Ca-riched samples (Fig. 3g, ~0.1 mm), with characteristic rhombic cross section. It shows moderate pleochroism in shade of brown color, which suggest $Fe3^{+}$-riched composition (Frost et al., 2000), > 1% (Deer et al., 1989). The apatite is prismatic-needless in shape, ~0.03 mm. Opaque iron ore form as distinct crystals or fine-grained veins. Ilmenite occurs as skeletal crystals in some samples. Mineralogical composition, structure and texture of the samples show that the rock fragments were derived from quartzite, quartz-phyllite, chloritoid-quartz-phyllite, phyllite (Winkler, 1979) and metasandstone. Quartzite rock fragments (5%) determined in thin sections of the metasandstone and quartz-phyllite (Fig. 3h).

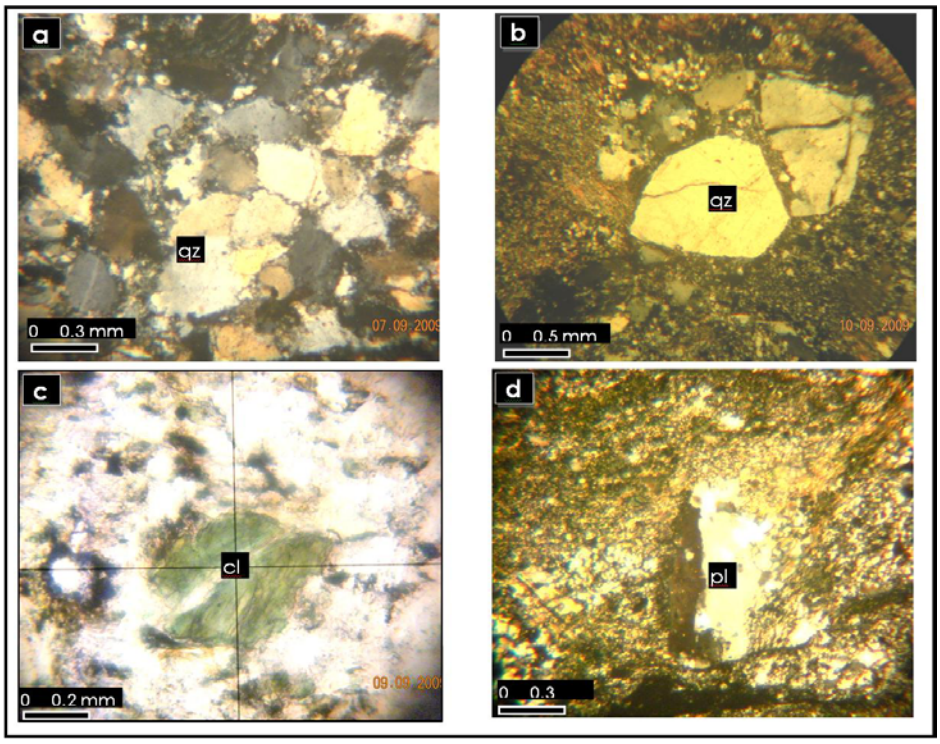

Figure 3. Digital microphotograph of the thin sections;
a) Metamorphic quartz (qz) crystals showing pressure-shadows, b) volcanic quartz (qz).
c) Hipidioblast chloritoid (cl), d) Plagioclase (pl) with twinning
"c" are in ordinary light, while others in cross-nicols.

Şekil 3. *İncekesitlerin dijital mikrofotoğrafları*
a) Basınç gölgesi gösteren metamorfik kuvars (qz) kristali, b) volkanik kuvars (qz)
c) Yarıözşekilli kloritoyid (cl) kristali, d) İkizlenme gösteren plajiyoklaz (pl)
"c" tek nikol, diğerleri de çift nikolde çekilmiştir.

DISCUSSIONS AND RESULTS

The phyllite of Bagrıkurt Formations includes some rock fragments, which are variable in size (1-18 cm) and composition; from quartzite through chloritoid-quartz-phyllite to phyllite. Eren et al. (2004) suggested that the subduction of the Palaeotethys beneath the Konya region, constructed an active continental margin and magmatic arc flanked by a fore-arc basin from the Late Devonian to the Early Permian. The magmatic arc developed above sea level during the Late Carboniferous (Eren 1996b; Kurt & Arslan 1999) and was undergone erosion supplying a source for the psammitic rocks in the Bagrıkurt formation. Thus, the rock fragments in phyllite could have been derived from a magmatic arc during Late Carboniferous. Existence of volcanic quartz crystals in the rock fragments also supports this suggestion. Si-rich composition of the rock fragments suggests a quartzose source. Accordingly, Kurt (1994) suggests that psammite and quartzite of the Bagrıkurt Formations could have a quartzose sedimentary provenance based on their bulk rock chemical analyses.

Mineral assemblage of chloritoid, clinozoisite, sericite and chlorite suggest that the samples possibly were undergone a regional metamorphism, with its host formation in greenschist facies conditions.

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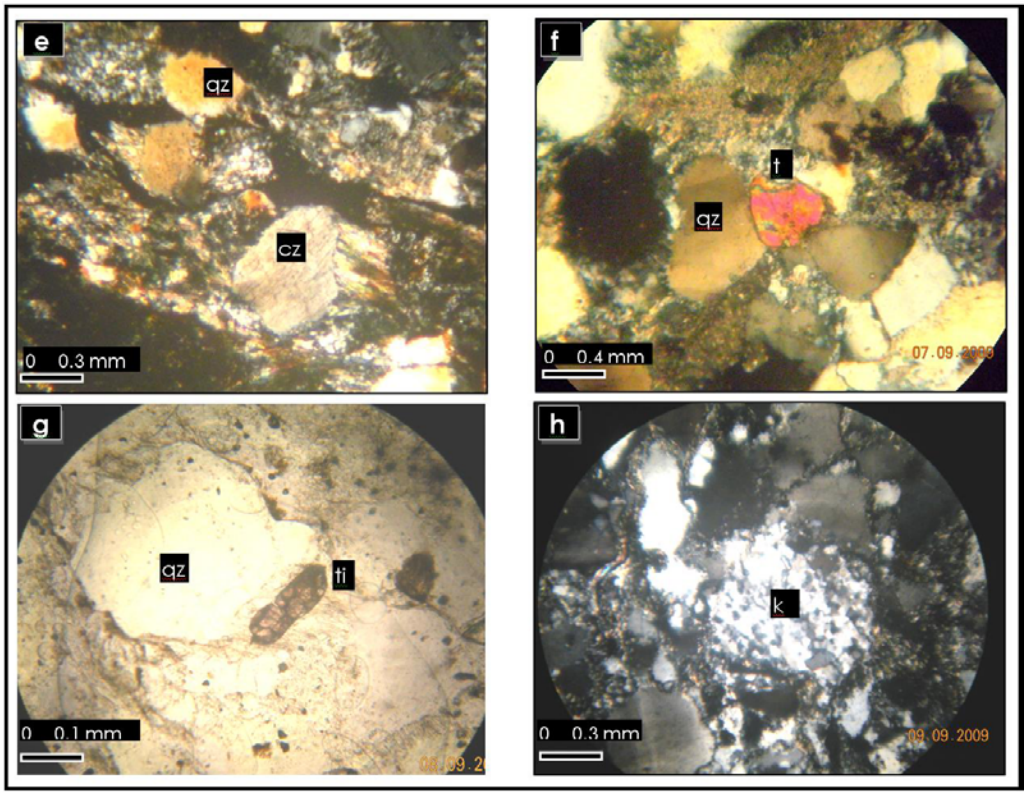

Figure 3. continue;
e) Hipidioblast clinozoisite (cz), f) Xenomorphic tourmaline (tu) crystal
g) Brown colored sphene (ti), h) Quartzite rock fragments (kp) in quartzite-phyllite.
"g" are in ordinary light, while others in cross-nicols.

Şekil 3. *devam ediyor;*
e) yarıözşekilli klinozoizit(cz), f) özşekilsiz turmalin kristali (tu)
g) Kahverenkli sfen(ti), h) kuvars-fillitteki kayac parçası(kp)
"g" tek nikol, diğerleri de çift nikolde çekilmiştir.

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