

A new assessment of the Kısacık gold mineralization (Ayvacık-Çanakkale, NW Anatolia)

Yahya ÖZPINAR^{1*}, Mehmet KILIÇ², Mehmet AVŞAR³, Ramazan SARI³, Şahzet KÜÇÜKEFE³, Hrayr AGNERIAN⁴, Zafer DOYGUN², Kemal YENİGÜN²

¹Pamukkale University, Department of Geological Engineering, TR-20070, Denizli-Turkey, ²Pregold Mining Inc., Merter, İstanbul-Turkey, e-mail: mehmetk@pregold.com, ³General Directorate of Mineral Research and Exploration of Turkey (MTA), Ankara, ⁴Scott Wilson Mining, Canada.

Abstract The Kısacık gold deposit is situated within the Ayvacık-Karabiga tectonic zone of the Biga Peninsula (Western Turkey). There are indications that both fault-related control and lithological control were important for the genesis of the mineralization. Gold mineralization at Kısacık is of two types. The first one is relatively high grade gold ore associated with quartz-sulphide veins located within the units rich in pumice. The second one occurs in thick layers of pyroclastic rocks, with gold grain size ranging from 10 µm to 100 µm. The gold grains occur within quartz, as well as along fractures and in the wall rocks.

Key words: ignimbrite, gold deposits, Kısacık-Çanakkale, Biga Peninsula, Anatolia, Turkey

1. Introduction

The registered owner of Kısacık Area is Mehmet Sedat YALINKAYA, chief executive officer of Goldaş Holdings A.S. (Golaş) and president of Pregold. The Kısacık Property is accessible by paved road from Çanakkale, a city with a population of approximately 150,000, to the village of Kısacık, and then by gravel road. Historical mining on the Kısacık Property is indicated by the presence of several old adits, whose portals are partly collapsed. During the 2008 exploration program, the General Directorate of Mineral Research and Exploration of Turkey (MTA) discovered two old adits and at least four small pits, which are suspected to represent gold mining operations. One of them is situated close to the road to Ayvacık, where gold is reported to have been produced by gravity concentration (Fig. 1). All these old mining works are situated within ignimbrites. An old adit at Mağaradere is 28 m long and is driven in north-easterly direction.

Another adit, at Sudöndü Dere, is 70 m long, with similar orientation (Kılıç et al., 2009, Özpınar et.al. 2009, Agnerian, 2010). At the present time, there are no clear indications on the age of these old workings.



Fig. 1. Gold grains after panning.

The purpose of this paper is to inform about the studies related to Kısacık gold deposit as well as on some mineralogical and chemical aspects, to discuss on the alteration, deposits type and origin of gold mineralization.

¹ Corresponding author: Tel: +90-258-2963372, e-mail: yozpinar@pau.edu.tr

2. Geological background

The Kısacık area is situated within the Ayvacık-Karabiga Zone on the Biga Peninsula (Western Turkey). The Biga Peninsula comprises three main northeast-trending tectonic zones. From northwest

to southeast, these are known as the Ezine, Ayvacık-Karabiga, and Sakarya zones (Fig. 2). The study area is underlain by basement rocks of the Paleozoic Kazdağ Metamorphic Group (KMG), which have been thrust and unconformably overlain by younger Upper Cretaceous

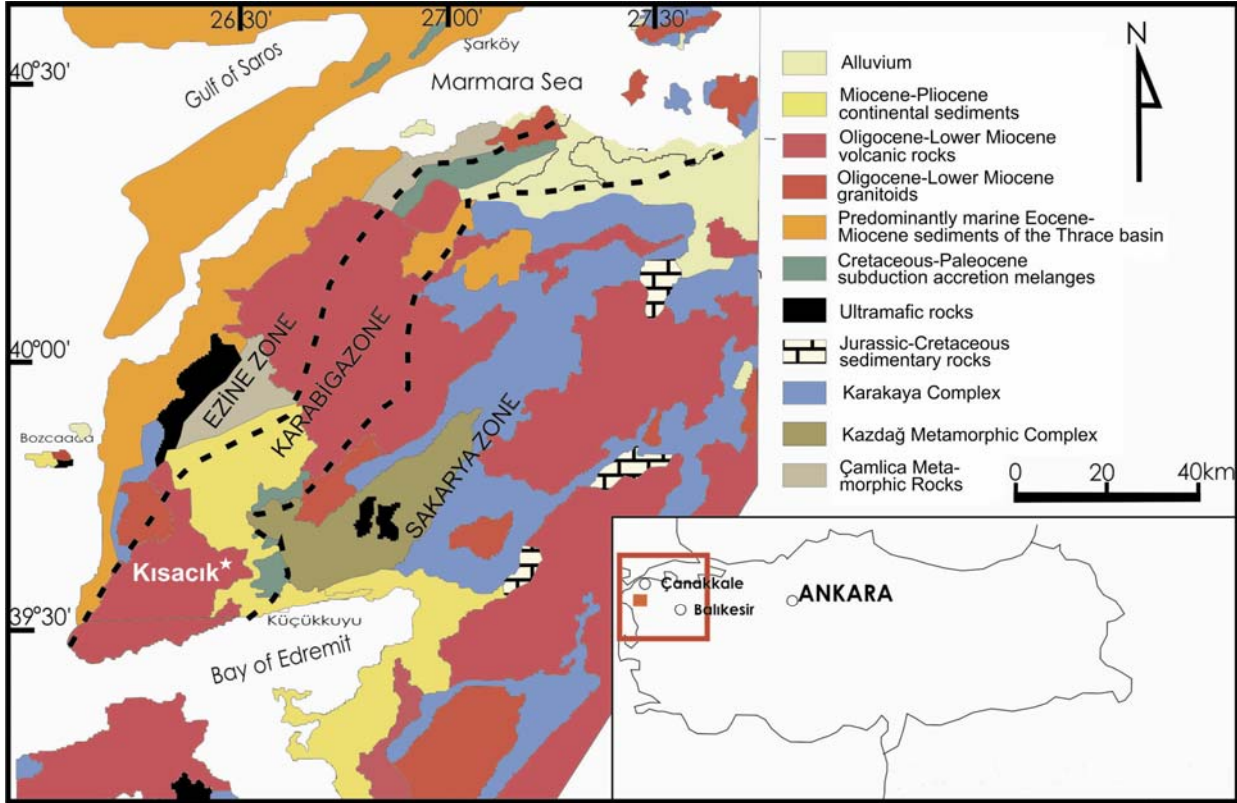


Fig. 2. Location map of study area and geotectonic map of NW Anatolia (Okay and Satır,2000).

Çetmi Ophiolitic Mélange (ÇOM), Mid-Miocene Hüseyinfakı volcanic rocks including ignimbrites, rhyolite, rhyolitic tuffs and lapilli tuffs, and clastic rocks of the İlyasbaşı Formation, with lateral, vertical transitions, volcanic intercalations, and angular disconformity over pre-Tertiary basement rocks. The Pliocene conglomerates, sandstones, and siltstones of the Bayramıç Formation unconformably overlain older rocks in the area.

3. Geology of the study area

The lithostratigraphic composition of the Kısacık Property includes several formations.

İlyasbaşı Formation (İb): Within the Kısacık area, the İlyasbaşı Formation comprises reddish brown to yellowish beige siltstone, sandstone, claystone, gravel, tuff and sandy limestone (Fig. 3), deposited in lacustrine environment (Kılıç et al., 2009).

Hüseyinfakı Formation (Kf): Hüseyinfakı Formation is represented by volcanic rocks and includes greenish-grey to purplish-grey basaltic, trachy-andesitic lavas, and pyroclastic rocks.

Ignimbrite (İg): Ignimbrite is the most common rock type on the Kısacık area. Commonly, it contains disseminations and stringers of pyrite, quartz and hematite veinlets.

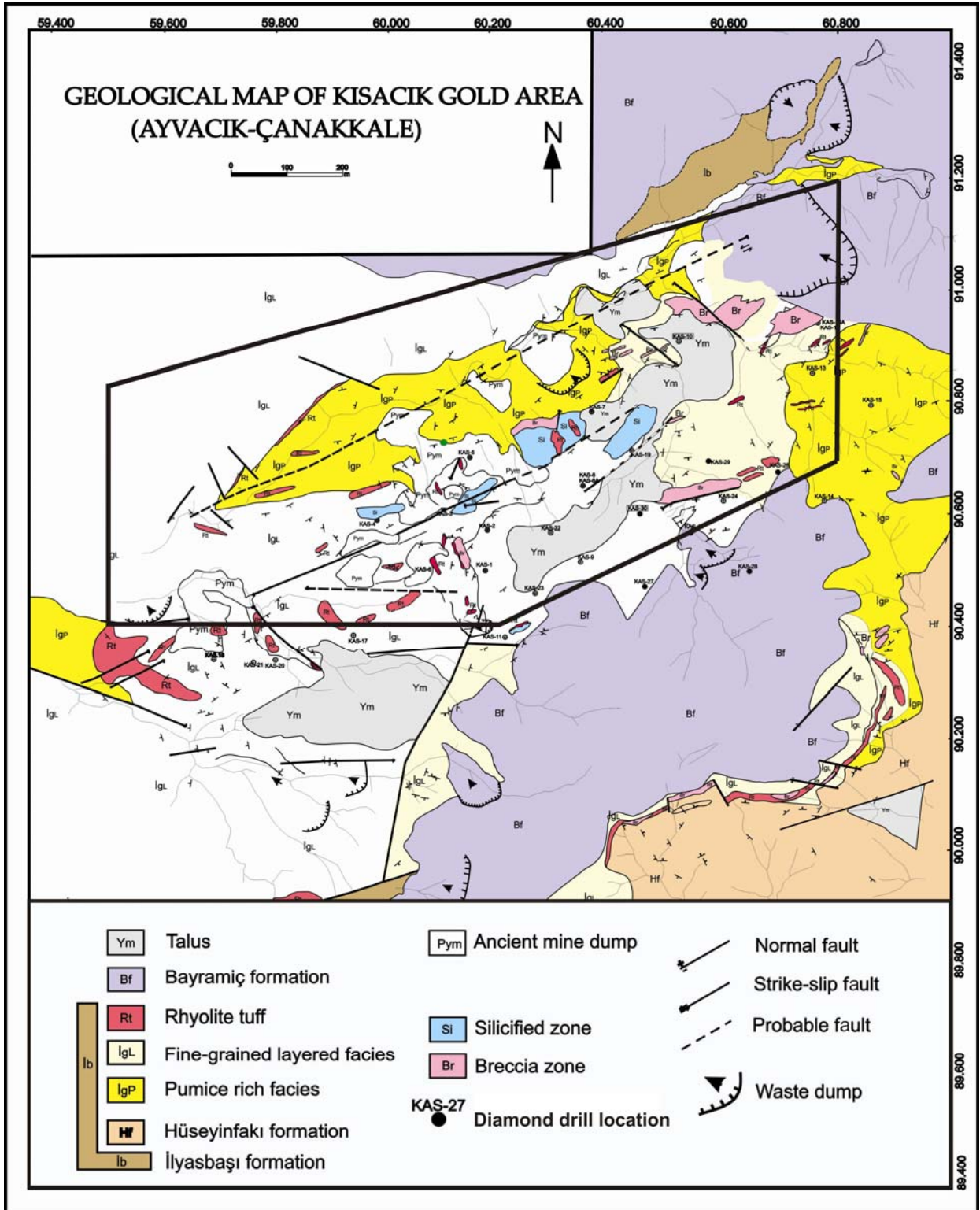


Fig. 3. Geological map of the Kısacık (Ayvacık-Çanakkale) gold district. The area inside the polygon is represented in Fig. 4.

Rhyolite and rhyolite tuff (Rt): Rhyolite and rhyolitic tuff comprise pink or grey, fine-grained rocks with porphyritic texture, and micro-crystalline quartz as matrix material. The tuff variety includes fresh biotite, sanidine phenocrysts and volcanic glass.

Bayramıç Formation (Bf): Bayramıç Formation rocks overlie all other rocks on the Biga Peninsula. They comprise poorly-consolidated Pliocene gravel, conglomerate, siltstone, and minor limestone, interpreted to have been deposited in a lacustrine environment

Alluvium: Alluvium comprises Quaternary unconsolidated material deposited in areas of depression due to faulting or other talus slope material

4. Investigation methods

This investigation has begun in 2002 and still continues (Kılıç et al., 2004, 2007, 2008 and 2009, Özpınar et.al, 2009). The detailed knowledge related to investigation is given below.

In the first stage, in 2002, in the area of 80 km², detailed geological mapping (at 1:10,000 scale) was carried out and pre-geochemical study was made and then alteration area at the

Kırantepe location of Kısacık village was determined.

In the second stage study, during the years 2003-2004, detailed geological mapping (1:2,000 scale) and detailed geochemical studies were made. According to these studies, Au-Sb-As anomalies were determined for Kısacık area. It was revealed for the first time that Au-Sb-As anomalies were caused by the gold mineralization that have been mined during the ancient periods.

From 2004 to 2006, MTA carried out systematic mineralogical and petrographic studies on diamond drill core as part of the exploration program at Kısacık. In total, 2,920 samples were analyzed by Atomic Absorption Spectroscopy (AAS) method. Some samples were also assayed by the fire assay method, while 239 samples were studied under the microscope, 92 determinations were carried out by X-ray Diffraction (XRD) method, and 42 fluid inclusion studies were carried out on samples of drill core. Afterwards, according to mineralogical data, the alteration map (Fig. 4) and geological revisions were carried out by Özpınar et. al. (2009).

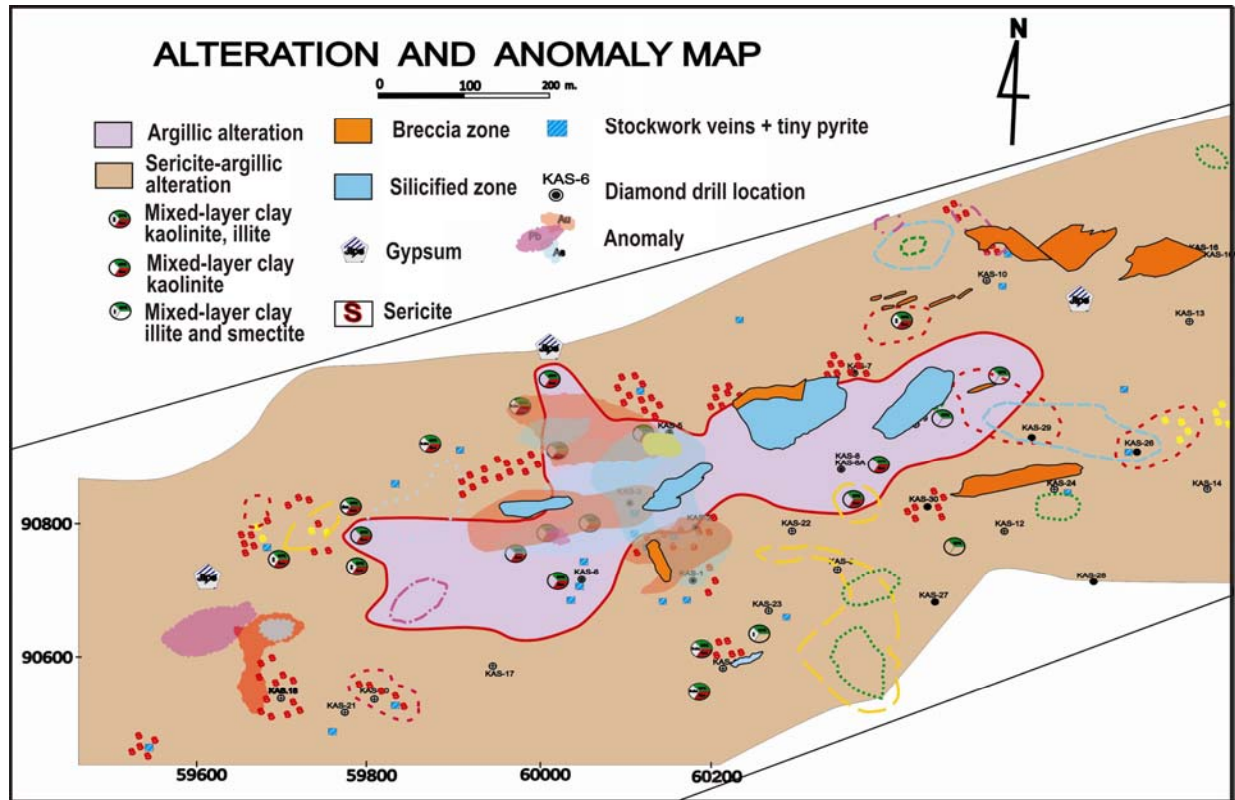


Fig. 4. Alteration map of the Kısacık (Ayvacic-Çanakkale) gold district.

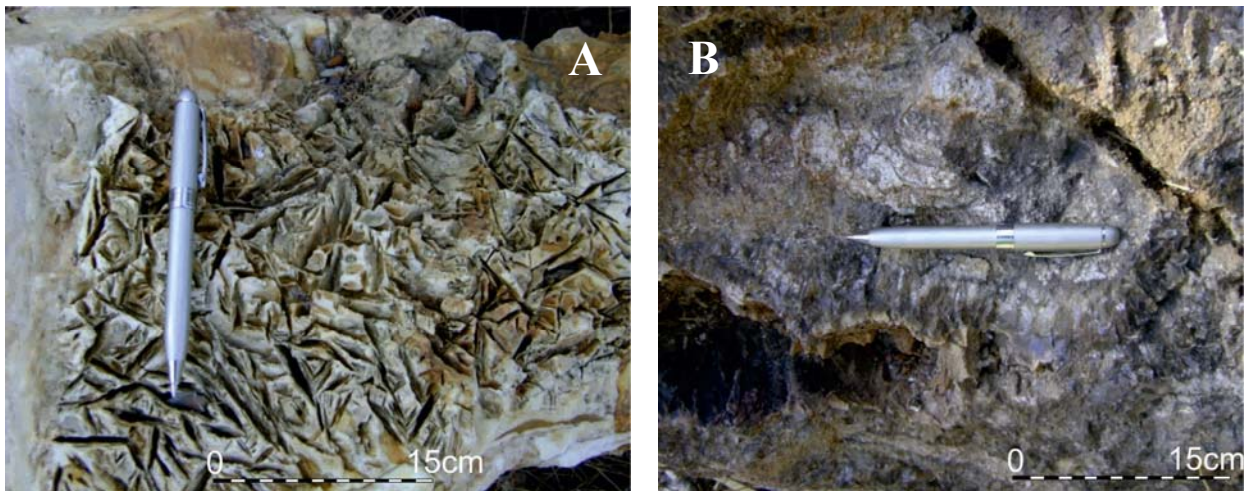


Fig. 5. Examples of quartz textures in the Kısacık area. A. Jagged quartz texture. B. Symmetric quartz texture.

5. Results and discussions

In the Kısacık area, argillic and sericitic-argillic alteration types have been identified. The results of 145 thin section specimens and 25 XRD investigations have been used to make the alteration map. The alteration zones of the study area consist of an argillic alteration zone located in the central part of the study area and sericitic-argillic alteration located around the argillic alteration (Fig. 4). Quartz is the most common mineral, since it is resistant to alteration, sometimes forming symmetric or jagged textures (Fig. 5A,B). In places, quartz mobilization has resulted in small scarps comprising of jasper. The original feldspars have been completely altered to kaolinite and illite. Occasional calcite veins are also present, and limonitic pseudomorphs of pyrite occur along fracture planes. Mineralogical studies (thin sections and polished sections) indicate that the gold mineralization at Kısacık is associated with intense silicification, sericitization and carbonate alteration.

The combined study of the alteration map and ore anomalies indicate an intense silicification located in the central part of the study area, related to a fault zone with NE-SW direction.

Gold mineralization in the Kısacık (Ayvaçık-Çanakkale) gold district is typical of high-sulphidation, quartz-clay mineral assemblage, epithermal systems, formed at relatively shallow depth, from just below the surface to a little over one kilometre deep, from acid-pH hydrothermal

fluids with temperatures ranging from less than 150°C to 300°C.

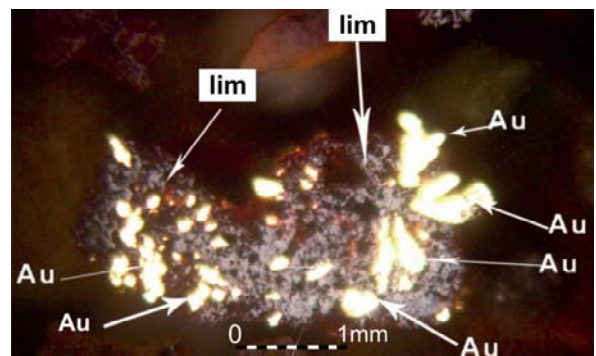


Fig. 6. Gold grains included in limonite (goethite) pseudomorphs on pyrite. Reflected light. Au = native gold, lim = limonite.



Fig. 7. Grain of native gold (Au) included in quartz crystal. Reflected light.

Based on core investigation of 5965.05 m diamond drilling carried out by MTA from 2004 to 2006, a resource volume of 56,537,693 ton (proved + probable + possible) were calculated, with an average grade of 546 ppb (0.55g/t) Au.

All elemental anomalies were located at the margin of the argillic alteration zone and in the areas with scarce silicification, and also in the sericitic-argillic alteration zones.

According to microscope investigations, gold mineralization was developed within quartz veinlets (Figs. 6 and 7) located in the sericitic-argillic alteration zones.

6. Conclusions

In the Kısacık area, argillic and sericite-argillic alterations have been determined. All ore anomalies are located at the border zone of argillic alteration, in the areas with scarce silicification, and in the sericitic-argillic alteration zones. Gold mineralization has lithological and tectonic (fault) controls. Gold mineralization was developed within quartz veinlets located within the units rich in pumice. The style of mineralization is similar to high-sulphidation epithermal gold deposits, such as Ağı Dağı on the Biga Peninsula, and other deposits in Central and South America (Agnerian, 2010).

Acknowledgements

The manuscript benefited from the constructive remarks of two anonymous reviewers.

References

- Agnerian, H., 2010. Technical Report on the Kısacık Gold Property, Turkey, Scott Wilson Mining, pp 26, (Unpublished), Canada.
- Kılıç M., Küçükkefe, Ş., Avşar, M., Sarı, R., Vural, A. ve Pehlivan, N., 2004. Preliminary geological and geochemical data on Kısacık (Ayvacık-Çanakkale) Au mineralization. 57th Geological Congress of Turkey, Abstracts, p. 101, Ankara.
- Kılıç, M., Avşar, M., Sarı, R. ve Küçükkefe, Ş., 2007. Detailed investigation report of Kısacık (Ayvacık-Çanakkale) gold area, Report No: 11107 (Unpublished), MTA-Ankara.
- Kılıç, M., Avşar, M., Sarı, R. ve Küçükkefe, Ş., 2008. Detailed Geochemical report of Baharlar (Ayvacık) – Alakeçili (Bayramiç) Çanakkale area, report No: 11119 (Unpublished) MTA- Ankara,
- Kılıç, M., Sarı, R. Avşar, M. ve Küçükkefe, Ş., 2009. The mining geology report of Çanakkale–Ayvacık-Kısacık gold area, Report No: 11195(Unpublished) MTA-Ankara.
- Okay, I.A. and Satır, M., 2000. Coeval plutonism and metamorphism in a latest Oligocene metamorphic core complex in northwest Turkey. *Geol. Mag.* 137 (5), 495–516.
- Özpınar, Y, Kılıç, M., Doygun, Z., Yenigün, K., 2009. Hydrothermal alteration and detailed geology of mining area of numbered 200805708, pp 87, (Unpublished), Pregold Mining Inc., Merter-Istanbul.