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Geology

New Data on the Dzama-Gudjareti Ore Knot (Georgia)

David Bluashvili[*], Keti Benashvili[**], Giorgi Mindiashvili[*], David Makadze[§]

[*] *Georgian Technical University, Faculty of Mining and Geology, Tbilisi, Georgia*
[**] *RMG Group*
[§] *A.Tvalchrelidze Caucasus Institute of Mineral Resources, Tbilisi, Georgia*

(Presented by Academy Member David Shengelia)

The Dzama-Gudjareti ore knot is located in the central part of the Adjara-Trialeti structural zone. The Dzama, Gharti, Gudjareti and Tskarostavi (Khachkovi) ore manifestations spread in the Dzama-Gudjareti ore knot are the object of the study. The authors have conducted a comprehensive geological, geochemical and petromineralogic research. Hydrothermally altered zones are distinguished and the model related to fault structures is presented here. The remote sensing method based scheme, as well as images showing distribution of copper, molybdenum, lead, zinc and gold anomalies, and a map of schlich testing are offered in the article. The accomplished works corroborate that the Dzama-Gudjareti ore knot is a very prospective section. *© 2020 Bull. Georg. Natl. Acad. Sci.*

Dzama-Gudjareti ore knot, ore mineralization, remote sensing

The Dzama-Gudjareti ore knot is situated within the Adjara-Trialeti anticlinorium type folded system between the Georgian and Artvin-Bolnisi blocks [1]. The folded system, according to some researchers [2, 3], emerged at the end of the Cretaceous, in the central part of the Transcaucasian Median Massif, in the form of a sub-latitudinal trough and was distinctly outlined in the Early Paleogene. In the Adjara-Trialeti structure, the Dzama-Gudjareti ore knot occupies central and southern subzones of the central segment.

Materials and Methods

In the region under study with the participation of the Geological Survey of Turkey, ore mineralization survey with remote sensing method was accomplished for the first time. Our research significantly reduces the financial expences of ore exploration and significantly increases the reliability of our work. At the initial stage of the study, the following methods were applied: 3 types of ASTER spectral range: VNIR (15m visible near-infrared), SWIR (30m short-wave infrared) and TIR (90m thermal infrared). The next stage of the research was performed by the

Decorrelation Stretch method, which is a color enhancement method for a multilayer image. In addition, Spectral Index (SI) and Principal Component Analysis (PCA) methods have been used to identify replacement zones. The petro-mineralogical research was conductedt in the Microanalytical Laboratory of the Depart-ment of Earth, Oceanic and Atmospheric Sciences of the University of British Columbia. The research methodology was based on refractive and reflective light microscopy, powder X-ray diffraction analy-sis, and scanning electron microscopy. Also geochemical and schlich testing surveys were accomplished.

Petro-mineralogical studies accomplished within the Dzama-Gudjareti ore knot established four types of rocks: andesite-porphyry, skarn, basalt-porphyry and carbonate sedimentary rocks. Andesite-porphyries are uniform in composition, but are characterized by a wide range of transformation types and their quality. In the main mass chlorite, sericite and feldspar minerals are observed. Accessory minerals are apatite, titanium, rutile, zircon and monazite. Andesite-porphyries are characterized by index minerals characteristic of weakly argillitic alterations (quartz, sericite, calcite, chlorite, epidote and clay minerals (Figs. 2, 3). Substitutions are often quite intense.

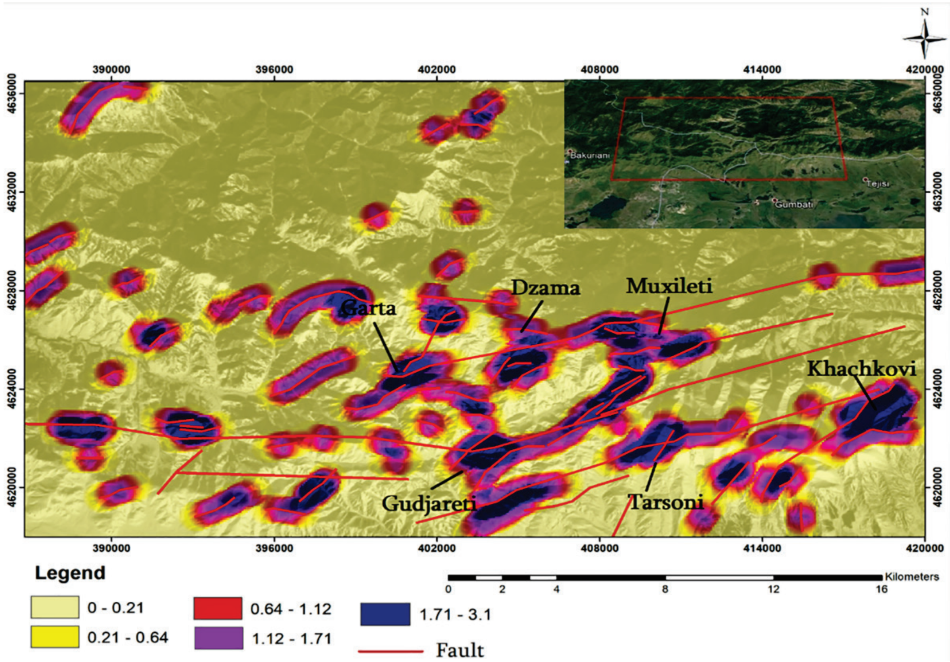

Fig. 1. Complete picture of the survey conducted by the remote sensing method.

Results and Discussion

Using remote sensing method, hydrothermally altered zones were distinguished and the areas of geochemical anomalies were contoured (Fig. 1).

The data obtained by this method literally repeats the contours of the existing ore manifestations. It is important that several substantial new ore manifestations were revealed by this method.

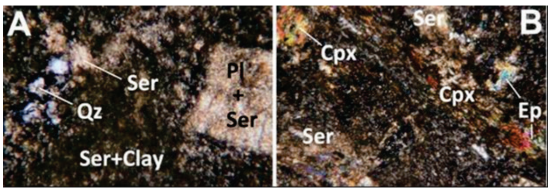

Fig. 2. Microphoto with the images of (A) associations of alterations, mainly in mass and plagioclase, (B) a replacement of amphibole or clinopyroxene; in + Nicole X 40. The mineral symbols here and below are given according to Donna L. Whitney and Bernard W. Evans [4].

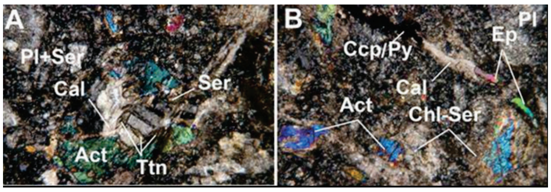

Fig. 3. Microphotos (XP) with the images of (A) replacement of actinolite by calcite-prehnite-titanite association, and (B) the calcite-epidote veins with Fe- (Cu-) sulfides cutting strongly sericitized and chloritized main mass; in + Nicole X 40.

The main mineral of skarn is represented by a solid compound of grossular-andradite (grossularite, Fig. 4, 5). Other rock-building minerals are calcite, epidote, diopside, titanite, chlorite, prehnite, pumpellyite, vesuvian and zeolites.

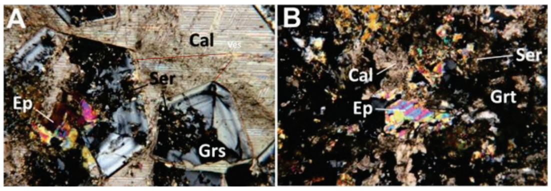

Fig. 4. Microphoto (XP) with the images of (A) idiomorphic zonal grossularite (with partially overgrown epidote and sericite) in a coarse-grained calcite, and (B) strongly altered part of the sample; in + Nicole X 40.

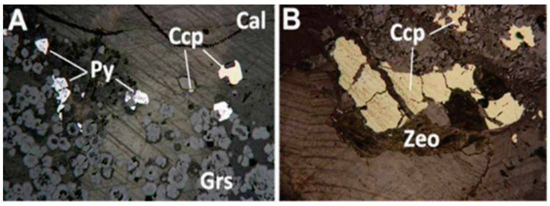

Fig. 5. Microphotos with the images of (A) a sample with grossularite, (B) more massive chalcopyrite surrounded with zeolite and calcite; in + Nicole X 40.

Basalt porphyrite consists of mafic phenocrystals (hornblende, olivine, orthopyroxene) and small amount of felsic phenocrysts (Fig. 6). The opaque phase is represented by (Ti)-magnetite, pyrite and chalcopyrite. They are presumably genetically related to andesite-porphyry and represented a mafic phase of the magmatic suite intruded at a relatively late stage of system evolution.

Sedimentary carbonate rocks consist mainly of calcite, small amounts of clay minerals, and iron oxides and iron sulfides (Fig. 7). The rock is intact in general, with little manifestation of hydrothermal alteration. Iron oxides and sulfides, as well as clay minerals, are probably of diagenetic origin.

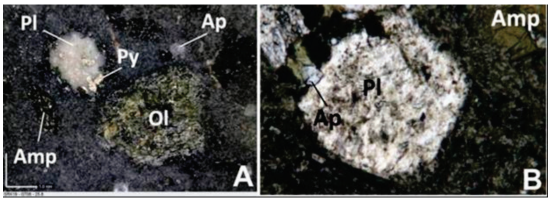

Fig. 6. On microphoto (A) in binocular olivine phenocrys-tal and pyrite mineralization of plagioclase grains is depic-ted. In sample (B) on the microphoto of thin section (PPL) weakly altered plagioclase is depicted; in + Nicole X 40.

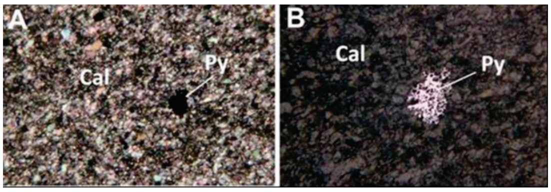

Fig. 7. Microphotos (XR) reflecting (A) pyrite mineralization in calcite main mass; (B) pyrite mineralization.

Mineralogical characteristics – In addition to the definition of general mineralogical composition, the main emphasis is on copper mineralization and mineral associations characteristic of alterations. Minerals of the initial phase are represented by quartz, plagioclase, K-feldspar, a group of amphiboles, pyroxenes and garnet. The second phase minerals are represented by sericite, illite, chlorite, a group of epidote, zeolite and clay minerals. Pyrite, chalcopyrite and iron sulphides were crystallized from the opaque phase. Accessory minerals include apatite, titanium, prehnite, zircon, rutile, monazite, etc. The type of alteration is represented by sub-propylitic, propylitic, phyllite, phyllite to argillitic and skarn formations.

Below the results of geochemical and schlich testing of the elements distribution anomalies are given.

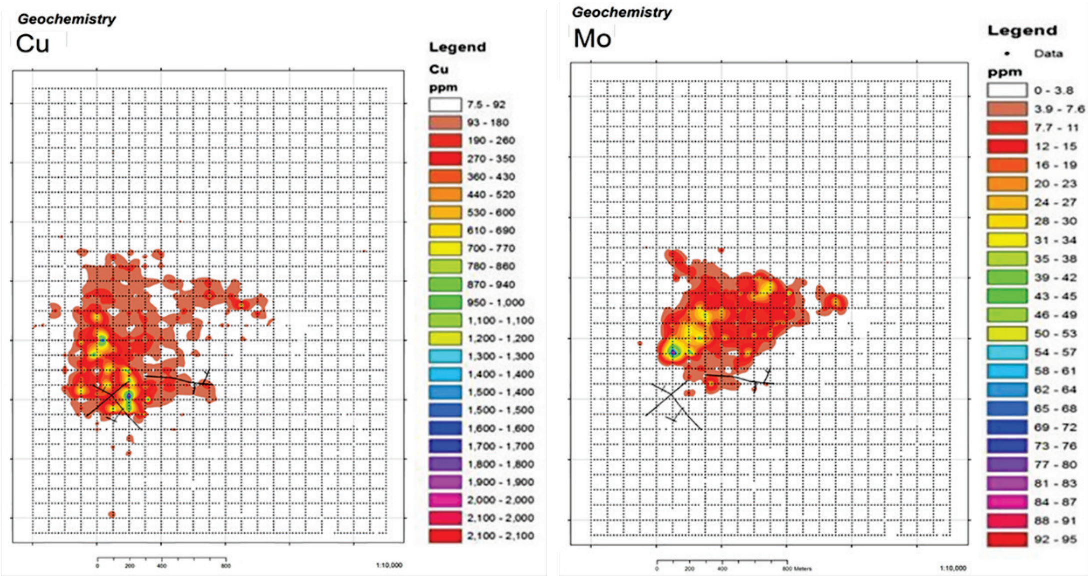

Fig. 8. Copper and molybdenum distribution anomaly.

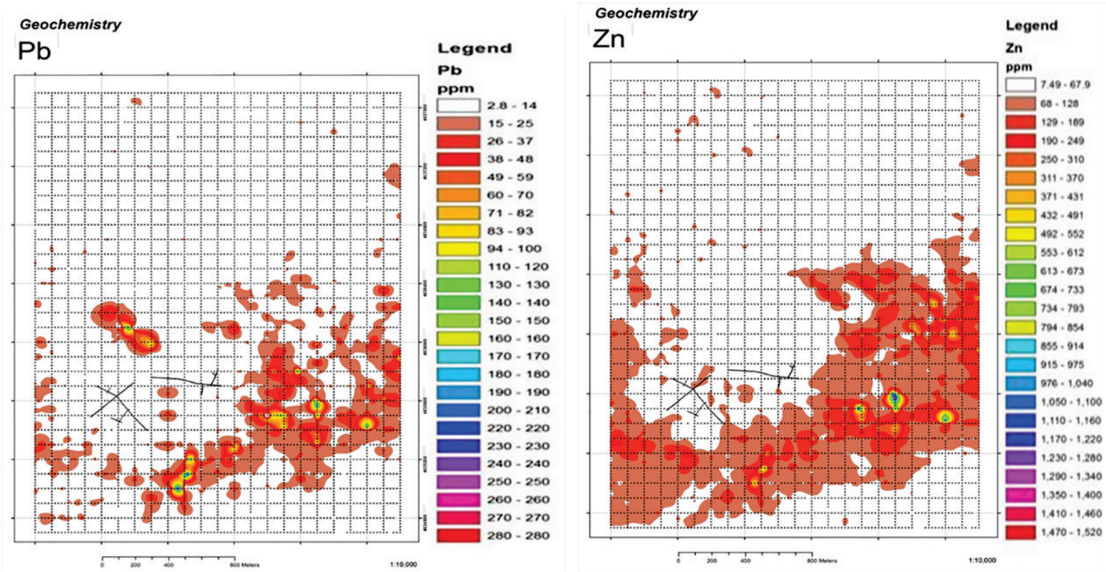

Fig. 9. Lead and zinc distribution anomaly.

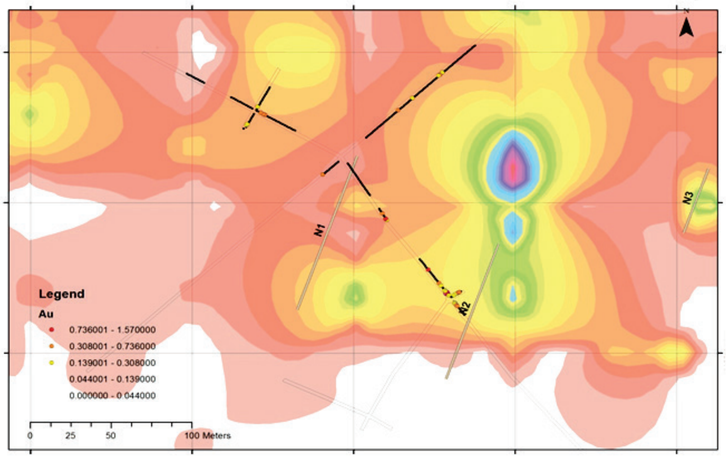

Fig. 10. Gold distribution anomaly.

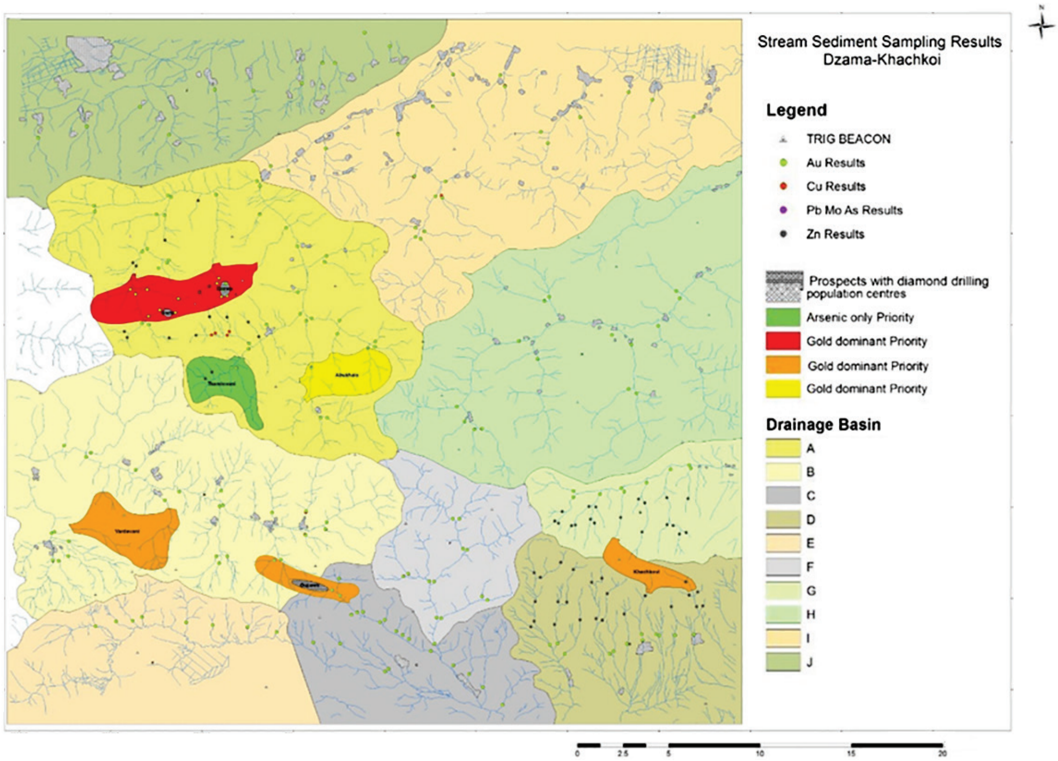

Fig. 11. Map of the schlich testing.

The distribution areas of Au, Cu, Pb, Zn and Mo, raised metal contents, character of geochemical anomalies, dimensions, quantities and peculiarities of the geological structure clearly indicate the activity of the endogenous hydrothermal system. All the above indicates the probability of presence of thick ore bodies in the depth. The distribution areals of the above elements clearly indicate the perspective potential of ore mineralization.

Conclusion

Thus, the accomplished comptehensive geological and analytical work corroborates that the Dzama-Gujarati ore knot is a product of a single magma chamber activity and it is one of the important and promising objects in the Adjara-Trialeti folded system.

გეოლოგია

ახალი მონაცემები ძამა-გუჯარეთის მადნიანი კვანძის შესახებ (საქართველო)

დ. ბლუაშვილი*, ქ. ბენაშვილი**, გ. მინდიაშვილი*, დ. მაქაძე§

* *საქართველოს ტექნიკური უნივერსიტეტი, სამთო-გეოლოგიური ფაკულტეტი, თბილისი, საქართველო*
** *RMG Group*
§ *კავკასიის მინერალური ნედლეულის ინსტიტუტი, თბილისი, საქართველო*

(წარმოდგენილია აკადემიის წევრის დ. შენგელიას მიერ)

ძამა-გუჯარეთის მადნიანი კვანძი მდებარეობს აჭარა-თრიალეთის სტრუქტურული ზონის ცენტრალურ ნაწილში. კვლევა მოიცავს ძამა-გუჯარეთის მადნიანი კვანძის ფარგლებში განვითარებულ ძამის, ღართის, გუჯარეთისა და წყაროსთავის (ხაჩკოვი) მადანგამოვლინებებს. საკვლევ ტერიტორიაზე პირველად ჩატარებული მადნიანი მინერალიზაციის დისტანციური ზონდირების მეთოდით, გეოლოგიური, პერტომინერალოგიური და გეოქიმიური კვლევების შედეგად, გამოვლინდა ძამა-გუჯარეთის მადნიანი კვანძის როგორც რღვევითი სტრუქტურები, ასევე მადნიანი მინერალიზაციის გავრცელების ანომალიები. პეტრომინერალოგიური კვლევები განხორციელდა ბრიტანეთის კოლუმბიის უნივერსიტეტის დედამიწის, ოკეანისა და ატმოსფეროს შემსწავლელი მეცნიერებების დეპარტამენტის მიკროანალიტიკურ ლაბორატორიაში. გამოკვლევების შედეგად განისაზღვრა მინერალოგიური შედგენილობა, მოდალური შემცველობა, შეცვლის ხარისხი და ტიპი. მადანგამოვლენის უბნებზე განვითარებულია ქანთა ოთხი ტიპი: ანდეზიტ-პორფირი, სკარნული ქანები, ბაზალტ-პორფირი და კარბონატული დანალექი ქანები. ნაშრომში მოცემულია დისტანციური ზონდირების მიხედვით შესრულებული სქემა, ასევე შლიხური და გეოქიმიური დასინჯვის შედეგად დასინჯვის გავრცელების ანომალიები. ჩატარებული სამუშაოები ადასტურებს, რომ ძამა-გუჯარეთის მადნიანი კვანძი მეტად პერსპექტიულ უბანს წარმოადგენს, სადაც შემდგომი გეოლოგიური სამუშაოების შედეგად შესაძლებელია გამოვლინდეს სამრეწველო მნიშვნელობის საბადო.

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