

Au-Ag-Te-Se deposits

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Gold mineralisation in hydrothermal-breccia from South Eastern part of Frasin deposit, Bucium district, Apuseni Mountains, Romania

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Abstract. The hydrothermal-breccia in the Frasin-Rodu maar diatreme complex, Bucium district, has not previously been reported in detail. After three years of exploration drilling programs we now have information that allows a description and interpretation of this medium- to high-grade gold mineralisation. There are two principal styles of gold mineralisation within the Frasin dacite: that hosted within broad zones of intense alteration; and within high-grade hydrothermal breccia style mineralisation featuring carbonate veining. The hydrothermal breccia appears to be a subsidiary zone within the larger body of intense alteration, and appears to be structurally controlled. The principal mineralised zone has a sub-vertical, NNW- to N-trending orientation and is interpreted to be most intense where it intersects NE- trending structures. The alteration type associated with mineralisation in the hydrothermal breccia was identified to be predominantly adularia-clay-carbonate-quartz. This assemblage indicated that hydrothermal alteration and brecciation occur at a temperature of 150-230°C, and in the presence of fluids of near-neutral pH.

Key words: ankerite, rhodocrosite, calcite, adularia arsenopyrite, pyrite hydrothermal-breccia, Frasin deposit

Introduction

The Bucium-Frasin deposit occurs approx. 5 km SE of the world-class Rosia Montana gold project. The Frasin deposit is interpreted as a dacitic maar-diatreme complex of Neogene age emplaced into the Cretaceous sedimentary sequence. A significant hydrothermal breccia pipe occurs at depth at the southeastern end of Frasin within the dacite body; contact breccias have a matrix of pulverised shale. To the east, the Frasin dacite is partially overlain by a later unmineralised vent breccia.

This report represents a compilation of work completed in the past four years by various authors working on the project.

Geological setting

Cretaceous sediments

The host lithology of the diatreme-intrusive complex is a Flysch sequence consisting of shale, sandstone, conglomerate and limestone beds. The grains or clasts of the sediments are made up of grains of quartz, mica and feldspar and lithic clasts cemented in a calcite or clay matrix. The sediments have been affected by a low-grade metamorphism (lower greenschist facies), with the more ductile shale units also folded and sheared in contrast to the more competent sandstone and conglomerate units.

Frasin dacite

The area of Frasin Hill is dominated by a shallow dacitic intrusive of Neogene age. The dacite body is oval in shape with the long axis orientated N-S. The dimensions are approx. 700 m long by 400 m wide (according to the most recent data). The shape and strong flow banding have been observed in outcrops and drillholes at the northern and southern ends of the dacite intrusion (Leary et al., 2004).

Vent breccia

Flanking the dacite intrusive to the west and east of the massif is an unsorted polymictic breccia of phreatomagmatic origin, which is locally interpreted as “vent breccia”. The breccia has been subdivided into two separate bodies: the Rodu vent breccia to west and the Sesii Valley vent breccia to east.

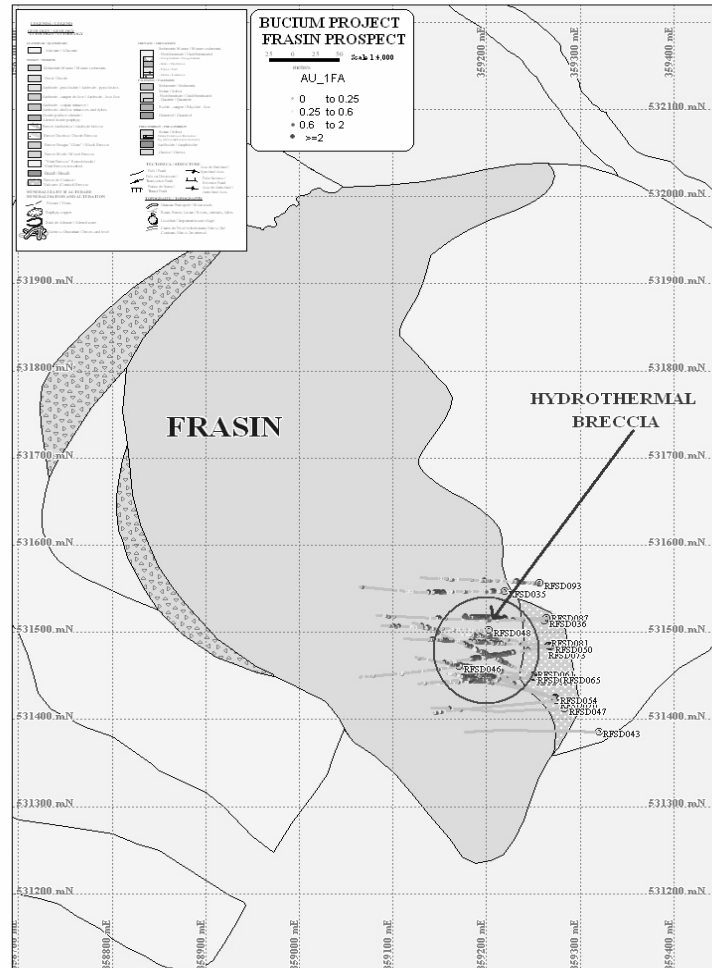


Fig. 1 Geological map of Frasin and the location of the hydrothermal breccia (update after Nadasan, 2004)

The Rodu vent breccia is mineralised and hydrothermally altered. No Au-Ag mineralisation has, however, been observed within the Sesii Valley vent breccia, which is interpreted as the product of a post mineralisation event.

Contact breccia

In many places, drilling has indicated a contact breccia peripheral to the dacite body. This is located between the dacite and the Cretaceous sediments. Clasts consist of both these lithologies within a clay matrix of pulverised Cretaceous shale. This contact breccia is better developed in northern and southeastern areas of Frasin.

Hydrothermal breccia

In the southeast part of Frasin, a hydrothermal breccia was intersected by a large number of drillholes at the interpreted intersection of the main N-N-S trend and a NE-trending structure (Leary et al., 2004). The contacts with the breccia pipe are sharp and the alteration around the pipe quickly becomes propylitic. This is one of the most important locations in which the majority of mineralisation is hosted by open space infill (breccia matrix) style mineralisation rather than by altered dacite. The breccia is characterised by large sub-angular clasts of dacite within a well-mineralised vuggy quartz-carbonate-sulphide

matrix dominated by carbonate (ankerite, rhodochrosite, calcite, siderite), quartz and adularia (Ionescu and Ghergari, 2004).

XRD analysis has shown that the carbonate vein matrix consists predominantly of ankerite with lesser rhodochrosite and calcite. The host rock for the brecciation process is the Frasin dacite body. The mineralisation formed dominantly within the matrix was studied in thin and polished sections using polarised and reflected light microscopy at Cluj University (Ionescu and Ghergari, 2004).

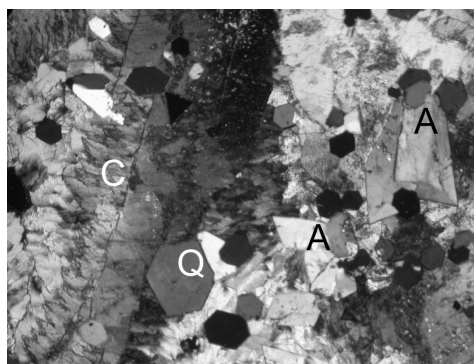


Fig. 2. Vein infill in breccia as seen in thin section, N+, 40 × magnification. Abbreviations: carbonate (C), adularia (A), quartz (Q) and opaque minerals (Cluj University determination)



Fig. 3. Core tray from hole RFSD051 (139.2-143.4 m), representative for hydrothermal breccia. The gold grade of this section ranges from 2.26 to 12.36 g/t

The mineralisation in the pipe doesn't outcrop at the surface, with the best mineralisation intersected below a depth of about 780 m RL.

Structure

Geophysics and geological mapping has identified a regional N-NNW structural trend from Baia de Aries in the north to Zlatna in the south. This main structure is interpreted as a deep-seated basement structure, which has produced the broad zone of fracturing and veining. This can be observed in the Vilcoi Corabia and Arama vein systems to the south of Frasin, as well as in the Frasin dacite and Rodu vent breccia. The majority of veins and

important fractures or faults generally strike NNW or N-S and dip sub-vertically or steeply to the west. The position of the mineralisation and the diatreme complex are both interpreted to have been controlled by the intersection of NNW- and NE-trending structures.

Mineralisation

The gold-silver mineralisation at Frasin represents the shallow level of a low sulphidation epithermal system. Mineralisation at Frasin is dominantly disseminated with associated stockwork and hydrothermal breccia matrix-hosted Au-Ag mineralisation.



Fig. 4. Image of core piece in hole RFSD051 141.7-142.0 m. Hydrothermal breccia with dacite clasts carbonate matrix and visible gold inside. Gold grade 12.36g/t

Visible gold has been repeatedly observed by the present authors within the hydrothermal breccia pipe at the southern end of the Frasin deposit. The gold generally appears within the carbonate-quartz-adularia-dominant matrix, as well as fine gold leaves within vugs.

Visible gold is sometimes observed in the dacite clasts proximal to the matrix infill. Dilation caused by the intersection between a steep northerly and a steep north-easterly trending fault has created a steeply plugging zone within which the mineralising hydrothermal fluids are believed to have ascended.

Petrology indicates that the mineralising hydrothermal fluids were near neutral pH with the gold transported as a bisulphide complex and deposited at temperatures between 150 to 220°C (White, 2003).

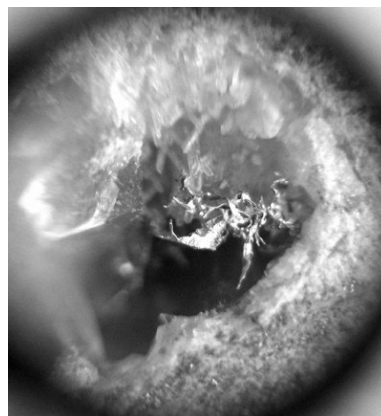


Fig. 5. Fine leaves of gold leafs in vugs from drillhole RFSD039 (82.5m) in the southeast of the Frasin deposit. Gold occurs with quartz and carbonate. Photo made within hand glass, magnification 15 ×

The dominant precipitation mechanism is interpreted to have been boiling of the hydrothermal solutions.

Alteration

Extensive zones of strong hydrothermal alteration host the Frasin deposit. The alteration surrounding the more intensely mineralised structures at Frasin display zoned alteration, which varies depending on the host lithology. Fresh dacite in the diatreme system has not been intersected in Frasin. The Frasin dacite show strong potassic and carbonate alteration (+/- silicic alteration) within the mineralised zone, with a narrow zone of phyllic alteration sometimes observed proximal to the mineralisation. Within the mineralised zone petrological investigation has identified two types or phases of alteration (White, 2003):

- a) Adularia-clay (illite-smectite)-carbonate (Mg calcite-ankerite-rhodocrosite)-silica, which usually represent the main Au-Ag mineralization event at Frasin. This has occurred at temperatures between 150-230°C by hydrothermal solutions with near-neutral pH.
- b) Later carbonate-kaolinite alteration produced by low-salinity bicarbonate fluid at slightly lower temperature (<200°C).

Resources

The latest resource update completed in December 2004 by RSG Global (Verbeek and Cossage, 2004) gives the following data:

At a cut-off of 1.0 g/t, the hydrothermal breccia contains an indicated resource of 148,664 oz Au contained, at an average grade of 6.93 g/t Au, and 80,909 oz Ag contained at 3.77 g/t average Ag, and an inferred resource

of 139,146 oz Au contained at an average grade of 6.65 g/t Au and 90,562 oz Ag contained at an average of 4.3 g/t Ag.

In this context, the entire Frasin deposit resource estimate is an indicated 491,000 oz Au at 1.91 g/t and 1,385,000 oz Ag at 5g/t and an inferred resource of 508,000 oz Au at 1.70 g/t and 1,574,000 oz Ag at 5g/t (using a 0.6 g/t Au cut-off grade).

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