NEOGENE GOLD MINERALIZATION TYPES IN ROMANIA

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Abstract: The Romanian Neogene primary gold mineralizations have been classified especially, into following types: a) Au-and Au-Ag (LSE); b) Au-Ag-Te (Bi)(LSE); c) Au-Cu-As (HSE); d) Au-Ag-Pb-Zn-Cu (LS-Mesothermal) and e) Cu-Au(Mo) (porphyry). All these types of mineralzations had the same source and represent the products of the same metallogenetic processes. The epithermal mineralizations are younger then porphyry Cu-Au (Mo) mineralizations.

Key words: Typology, Neogene gold mineralizations, epithermal, Romania.

During the last 2000 years Romanian territory was one of Europe's main gold producers. The cumulative production is estimated to be 60-64 M ounces from which, roughly, more than 75% proceeded from Neogen primary gold deposits situated in South Apuseni Mts (SAM)-the Metaliferi Mts. (Fig. 1) and 15-20% from East Carpathians (EC)-the Oas and Gutiai Mts deposits (Fig. 2); the rest returned probably from fossil and actual auriferous placer deposits and the others pre- Neogene gold sources. In this brief review and synthesis, we highlight the general characteristics of the main Neogene gold mineraliztion (NGM) types.

The main gold deposits from Romania are related with Neogene volcanism from Oas -Gutai-Tibles Mts. (OGTM, Fig. 2), in East Carpathians, and Metaliferi Mts. (MM, Fig. 1), in South Apuseni Mts. (SAM). The volcanism manifested on the interval Badenian and Sarmatian, until Pannonian (~15-7.4 Ma, Rosu et al., 2001, Kovacs, 2001). The recent geological data point out the presence of some gold occurrences in Calimani Gurghiu- Harghita Mts. (Seghedi & Szakacs, 2001), Voia and Zarand Mts. (Berbeleac et al., 1986). According to Rosu et al., (2001) and Udubasa et al., (2001) the Neogene gold mineralizations (NGM) from SAM are associated, in general, with calc-alkaline intermediate to phelsic magmatites, products of a trend evolution from normal to adakite-calc-alkaline magmas. It is important to underline that fact that the samples of the rocks considered as adakite composition generally proceed from areas without NGM, are younger than auriferous metallogenese.

The Neogene magmatism occurs in relations with crustal extension, of the subsequent Alpine subduction processes. In SAM and Oas-Gutai Mts. (OGM) the mineralizations follow the WSW-ESE, NE-SW and NW-SE geotectonic alignments.

Radiometric age data (K-Ar, Ar-Ar) have emphasized a gap of 0.5-2.0 Ma between magmatic and metallogenic events (Kovacs, 2001). The mineralizations appear as veins which sometime pass 1 km length, in Gutai Mts (GM), the vein systems, usually are no more than 1km length, sometimes with aspect of “Blätter Gang”, breccia pipes, and stockworks (auriferous volburas), in MM. They are genetic related with subvolcanic intrusions. The following types of NGM can be distinguish: a) Au-and Au-Ag; b) Au-Ag-Te (Bi); c) Au-Cu-As; d) Au-Ag-Pb-Zn-Cu; e) Cu-Au(Mo) (porphyry).

a) The Au and Au-Ag mineralizations belong to LSE deposits.

b) Au-Cu-As high sulphidation epithermal (HSE) occurrences and deposits, are economic lesser important. They are known in MM. Intense argillic alteration and pyrte-enargite assemblages are characteristic for these mineralzations (Coasta Mare, Bucium, Rosia Poieni)

c) Within the Au-Ag-Te (Bi) epithermal mineralizations, the native gold is presents especially as micronic grains, rare as “free gold” (macroscopic invisible), like Sacaramb, Cordurea, Fata Baii-Zlatna, Bucium Contu and Baia de Aries deposits (Fig. 1). In these deposits the Au-Ag tellurides are frequently. A new occurrence with very reach native tellurium and Au-Ag tellurides has been discovered in Musariu mine (Brbeleac & David, 1982).

d) The gold concentrations associated with gold bearing base metal sulfide deposits can be considered as meso-epithermal mineralizations in which, usual, the upper parts of the veins have been exploited for gold and / or silver. In these veins the gold is frequently associated with chalcopyrite, and / or sphalerite and pyrite, while Ag minerals, with galena and Sb sulfosalts. In some deposits, like Nistru-Baiut in GM (Fig. 2), the chalcopyrite-pyrite-gold sequence comprises Bi minerals (Damian, 1998), or as in Larga deposit (Fig. 1), where the Bi- and Ag-tellurides / sulphotellurides has been identified (Cook et al., 2001).

e) The native gold in Neogene subvolcanic intrusions appears, on aside, associated with copper minerals and magnetite of Cu- Au (Mo) porphyry system mineralizations, as in Deva, Bolcana, Rosia Poieni, Voia etc, deposits, and on the other side, as subsequent gold epithermal veins, like Valea Morii, Musariu, Muncaceasca etc, deposits). This fact can indicate a common source for the both types of mineralizations.

In gold deposits the gold can appears as "free gold", either in grains or crystal aggregates, visible macroscopic (Musariu, Rosia Montana etc), either as micronic grains, microscopic visible, associated with the other metallic and gangue minerals as in GM. (Sasar, Dealul Crucii, Valea Rosie, Fig. 2) or in MM (Hanes, Valea Morii, Baita-Craciunesti, Voia, etc, Fig. 1) (Ghitulescu & Socolescu, 1941, Berbeleac et al, 1986), and either microscopic invisible gold is present in arsenious pyrite lattice (Suior) and / or arsenopyrite, as Baia de Aries (Cioflica et al., 2000). The paragenetic sequence of silver minerals shows a larger development in Au-Ag deposits from GM (Valea Borcutului, Valea Rosie, Dealul Crucii) and in some veins from Tarna Mare, Ilba, Suior and other deposits; the Ag minerals are lesser frequently in MM deposits where they are known in Rosia Montana, Cainel, Draica, and Baita-Craciunesti deposits. The quantitative analyses on the native gold grains show a large variation of Ag content for different type of gold mineralizations. The most lower Ag values have been obtained on the gold grains from porphyry Cu-Au (Mo) mineralizations in Deva and Bolcana deposits (Fig. 1): 1.4-4.24% at Deva deposit and 3.8- 6.8 % in Bolcana deposit (Berbeleac et al., 2000). Also, a low silver content seems to have the gold grains associated with tellurides from Sacaramb deposit, while the greatest silver values have been detected in "gold" grains from Au-Ag Rosia Montana (MM), Sasar (GM), Baile Turtului (Oas Mts.; Jude, 1986) and other mineralizations. In epithermal deposits the Ag content of gold grains ranges, generally, between 20-40%, sometimes exceeding 50% in some Au-Ag veins. In fact, this shows that the presence of Au-Ag alloy (Cioflica et al, 2000). In some gold grains from Deva and Bolcana have been detected the presence of Fe, Cu, Bi, Hg and S (Berbeleac et al., 2000). The differences between the chemical composition of gold grains, respective "electrum" must to put in connection with different chemical mobility of the gold in porphyry, in comparison with the modality of gold transport in epithermal mineralizations.

Conclusions.

The geological data, the fluid inclusion studies and the isotopic composition data support idea that the gold and as well as other metals from Oas- Gutai Neogene epithermal deposits had a magmatic source. As regards the Metaliferi Neogene epithermal deposits, can assumption that the gold had a mixed source Neogene magmas on aside, and as mobilized product from pre-Neogene basement formations in particular from Mesozoic ophiolites rocks (Udubasa et al., 2001). Similar data led to idea that the gold from porphyry Cu-Au (Mo) mineralizations had a common origin with the gold and as well as other metals from adjacent epithermal mineralizations. In the ordinary sense for the word the both types of mineralizations representing two stages of the same metallogenetic processes.

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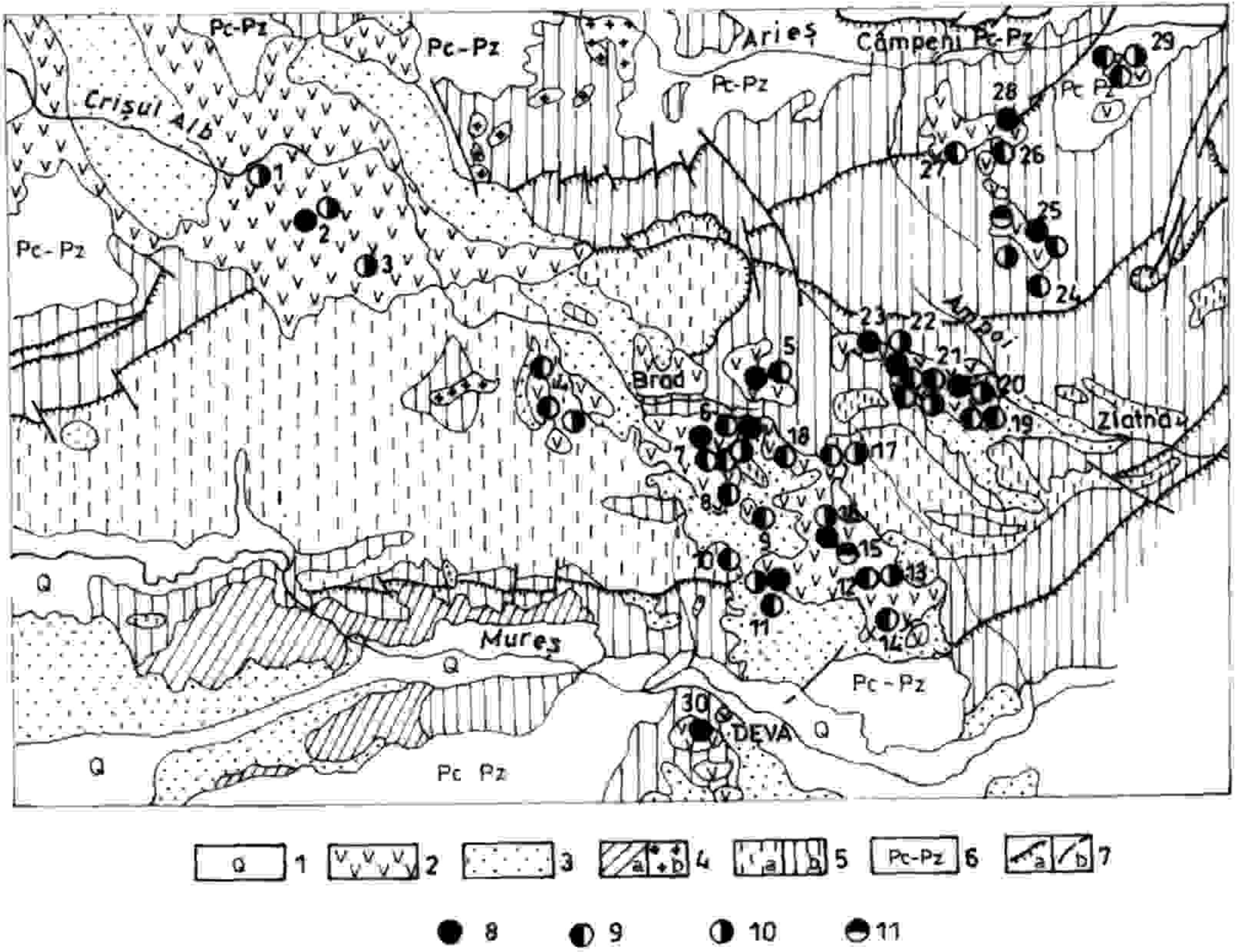
Fig. 1. Distribution of the Neogene gold mineralizations in Apuseni Mountains (Compilated data after Geological map of IGR).

1. Quaternary; 2. Neogene volcanics; 3. Tertiary molasse; 4. Upper Cretaceous-Eocene magmatic rocks (banatites) – (a) volcanics, (b) intrusions; 5. Mesozoic basic eruptive complex (a) and sedimentary rocks (b); 6. Precambrian-Paleozoic metamorphites; 7. Overthrust plane (a) and fault (b); 8-11. Mineralizations: 8. Cu-Au(Mo) porphyry system; 9. Epithermal Au, Au-Ag, Te+Au+Ag and Au+As mineralizations belonging to the low sulfidation type and related to Sarmatian shallow intrusions; 10. Epi-mesothermal gold-bearing base metal mineralizations associated with Sarmatian shallow intrusions; 11. Cu+As+Au mineralizations belonging to the high sulfidation type and related to Sarmatian shallow intrusions

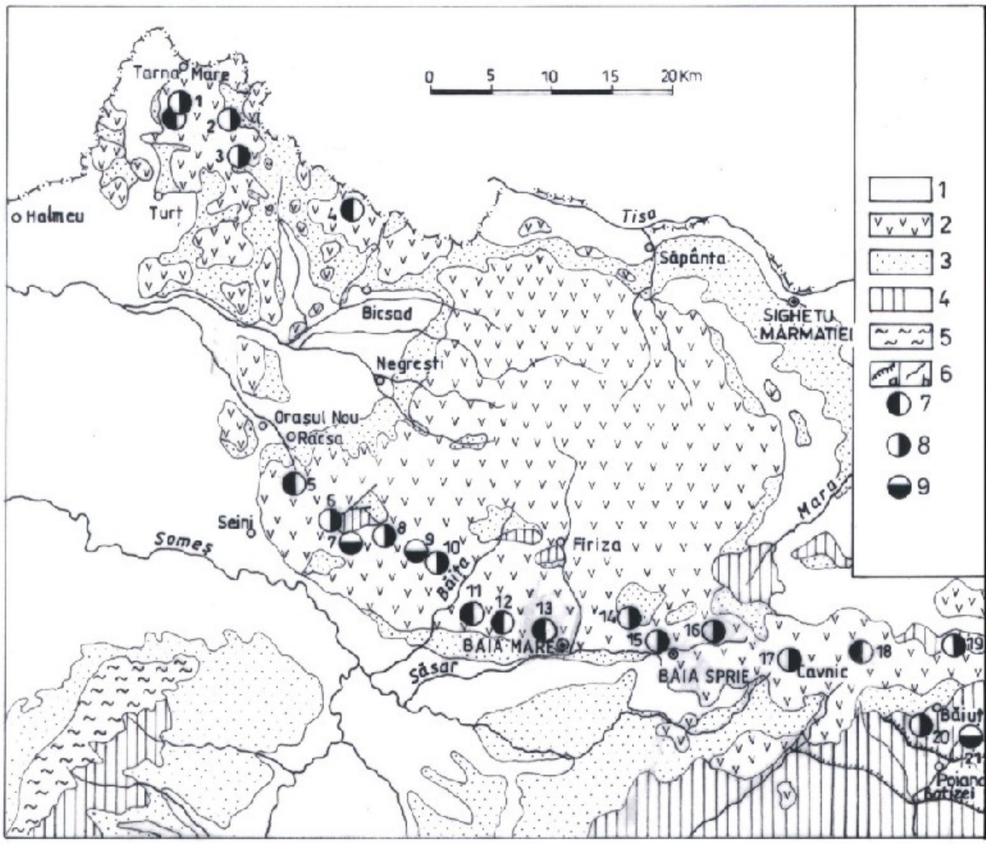
1. Rastoci; 2. Talagiu; 3. Bratosin; 4. Caraci; 5. Rovina-Bucuresci; 6. Valea Morii-Barza; 7. Musariu-Bradisor; 8. Cainel; 9. Draica; 10. Baita; 11. Troita; 12. Hondol; 13. Coranda-Bocsa; 14. Sacaramb; 15. Coasta Mare; 16. Voia; 17. Valisoara; 18. Cordurea; 19. Breaza; 20. Fata Baii-Trampoele; 21. Hanes-Almas; 22. Muncaceasca-Stanija; 23. Valea Calului-Stanija; 24. Botes; 25. Bucium-Tarnita; 26. Bucium Sasa-Izbita; 27. Rosia Montana; 28. Rosia Poieni; 29. Baia de Aries; 30 Deva.

Fig. 2. Distribution of the Neogene gold and gold-bearing sulfide mineralizations in Oas and Gutai Mts. (geological data after IGR, with modifications)

1. Quaternary; 2. Neogene volcanics; 3. Neogene sedimentary rocks; 4. Paleogene-Upper Cretaceous sedimentary rocks; 5. Metamorphic Precambrian basement; 6.a. Overthrust; 6.b. Fault; 7-9. Mineralisations: 7. Epithermal Au+Ag mineralisations belonging to the low sulfidation type; 8. Epi-mesothermal Pb+Zn±Cu(Au,Ag) mineralisations; 9. Cu+Py±Bi(Au) mineralization.



Pc-Pz
Crișul Alb
Arieș
Câmpeni
Ampoi
Zlatna
Brad
Mureș
DEVA
Q
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Q 1
2
3
a b 4
a b 5
Pc-Pz 6
a b 7
8
9
10
11



Ore Deposits

1. Viezuri;
2. Socea-Batarci;
3. Penigher;
4. Bixad;
5. Racsa;
6. Valea Colbului;
7. Ilba-Handal;
8. Nistru;
9. Nistru E;
10. Baita;
11. Sasar
12. Valea Rosie;
13. Dealul Crucii;
14. Herja;
15. Baia Sprie;
16. Suior;
17. Cavnic;
18. Cavnic-Roata;
19. Jereapan;
20. Baiut;
21. Valea Botizei.