Gold Metallogeny of Turkey – A Quantitative Assessment

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Inasmuch as Turkey is a major gold producer on the doorstep of Europe, annual gold production reached more than 1 Moz in 2013 and continues to increase. Changes in the mining law in mid 80’s were a significant milestone, allowing foreign direct investment for mining, while a second milestone was the initiation of full production in Turkey’s first gold mine in 2001, Ovacık. Modern gold exploration by multinational companies started after the changes in the mining law. Encouraging results of gold exploration and mining efforts mainly in last decades have revealed the gold exploration and mining potential of the country. Gold endowment of the country has increased more than 2.5 times in the last decade. Now there are many active gold mines in the country, e.g., Kışladağ, Çöpler, Efemçukuru, Ovacık, Çukuralan, Mastra, Kaymaz, Himmedede, Bolkardağ, Sart and Midi. There are many ongoing feasibility and development gold projects, e.g., Mollakara, Öksüt, Yenipazar, Ağrı Dağı, Kızıltepe, and Altıntepe. Turkey is well-equipped to become one of the major gold producers of the future.

Gold metallogeny of Turkey forms one of the most prolific sectors in the Tethyan Metallogenic Belt (TMB). This quantitative assessment of the gold metallogeny of Turkey is based on the author’s proprietary Geographic Information System (GIS) dataset containing 540 gold deposits and prospects at the time of evaluation, which is a subset of the author’s Turkish Mineral Deposit Database (TMDD). The gold data set consists of any deposits or prospects containing gold regardless of the nature of the gold occurrences in the system from gold-only to gold-rich base metal systems with by product gold.

Gold deposits and prospects in Turkey are mainly clustered in three different areas; namely northwest Anatolia (including the Biga Peninsula), northeast Anatolia, and east central Anatolia (Fig. 1). The lack of gold deposits and prospects in the other areas of the country may not be due to unfavorable geologic settings, but insufficient exploration activity. The majority of the gold deposits and prospects are, in the order of decreasing abundance, epithermal, porphyry, volcanic-associated massive sulfides (VMS), orogenic gold, and skarn systems. These five major deposit types form more than 91% of the known gold deposits and prospects and dominate the gold metallogeny of the country (Fig. 2). Other gold deposit and/or prospect types include placer, carbonate replacement, iron oxide Cu-Au, Carlin type, manganese-hosted Au, distal-disseminated Au-Ag, and detachment-fault related Au (Fig. 1).

Though there are 540 gold deposits and prospects in the database, out of these only 120, corresponding to 22%, have current calculated gold reserve and/or resources, containing a total of 72.5 Moz Au [2256 tonnes] (Fig. 3). In terms of these deposits and prospects with...
Figure 1. Thematic map showing spatial distribution of the gold deposits and prospects in Turkey with background DEM overlain by major rock types, Lambert Conformal Conic Projection for Turkey, scale accurate for the location’s latitude (n=548).
calculated gold reserve and/or resources, the most important economically are porphyry, epithermal, VMS including Kuroko and Cyprus styles as well as metamorphosed, Carlin type and orogenic gold deposits including mesothermal and listwanite-hosted systems. These deposit types, in the order of decreasing reserve and/or resource, contain more than 99% of all known gold endowment of the country (Fig. 4A and B). Only two deposit types, porphyry and epithermal contain almost 80% of the gold endowment of Turkey.

Out of this total gold endowment, gold reserves of the country are currently 23.5 Moz Au [729 tonnes] constituting 32% of the total gold resources, of which 16.4 Moz Au [510 tonnes] are contained in five deposits, each with more than 1 Moz gold reserves. Out of these 120 deposits and prospects, just 37 contain significant gold reserve and/or resources [defined as equal to or more than 0.32 Moz or 10 tonnes Au], and contain 92% of the total gold endowment of the country (Fig. 5A and B).

Only 17 of the gold deposits and prospects in Turkey contain more than 1 Moz gold as a reserve and/or resource, which are, in the order of decreasing gold content, Kışladağ, Çöpler, Mollakara, Halilâğa, Çukuralan, Efemçukuru, Hot Maden, Konak, Ağı Dağı, Yenipazar, Akbastepe, Cevizlidere, Öksüt, Körudanlık, Cerattepe, Taç, and Turplu. These deposits with 1 Moz or more are labeled in Figure 3.

Kışladağ porphyry gold deposit with more than 10 Moz Au [311 tonnes] reserves and Çöpler porphyry/epithermal gold deposit with more than 4 Moz Au [128 tonnes] reserves are the two largest gold deposits in Turkey at the moment. Only these two oxidized intrusion-related gold deposits, Çöpler and Kışladağ, can be classified respectively as world-class [defined as equal to or more than 3.2 Moz or 100 tonnes Au] and giant [defined as equal to or more than 9.6 Moz or 300 tonnes Au] gold deposits in global standards. Unfortunately or fortunately perhaps, there have been no super-giant gold deposits found in the country yet.
Modern gold exploration with limited expenditures has shown that large areas in Turkey are still underexplored, especially outside of the known districts. While a few new districts have been generated, the exploration maturity of Turkey suggests that the country has potential to generate new prospects or districts through reconnaissance exploration in greenfield areas. It should be kept in mind that there are gold ounces remaining to be found in incompletely delineated deposits and/or prospects in brownfield areas as well.

**REFERENCE:**
- For further discussion and details of the gold metallogeny of Turkey see;