*Asian Journal of Chemistry* Vol. 17, No. 4 (2005), 2098–2104

# Evaluation of Gold Content in Coruh Placer Deposits

YILDIRIM GUNGOR* and ILGIN KURSUN†
*Geology Department, Engineering Faculty, Istanbul University, Avcilar-Istanbul, Turkey*
*E-mail: gungory@istanbul.edu.tr*

The aim of this study is the investigation of the Coruh region's geological and minerals engineering properties, especially gold content.

**Key Words: Pontids, Kaçkar Granitoid, Placer, Heavy minerals.**

## INTRODUCTION

Placer deposits provided early man with the first samples of gold and since that time have accounted for a large production of the metal. If the Witwatersrand and other quartz-pebble conglomerates as fossil placers or modified fossil placers is included, then the placer type of deposit has provided more than two-thirds of man's store of gold. Before proceeding further certain terms with respect to placers should be defined. The term 'placer' is evidently of Spanish derivation and was used by the early Spanish miners in both North and South America as a name for gold deposits found in the sands and gravels of streams. Originally, it seems to have meant 'sand bank' or a place in a stream where gold was deposited[1]. While many other terms have been coined for deposits in weathered residuum and alluvium, none is quite as succinct and expressive as 'placer'. The terminology of the zone or stratum containing an economic concentration of gold in eluvial and alluvial placers is varied. We shall use the miner's term 'pay streak', which is commonly used in Canada and the United States. Other English terms in use include 'pay gravel', 'pay sand', 'pay dirt', 'pay wash', 'pay channel', 'pay lead', 'run of gold', 'gutter' and 'wash dirt'[2].

Placers have been variously categorized, but here we shall use a simple nomenclature based upon whether the placers are formed by concentration of gold *in-situ* over or in the immediate vicinity of primary deposits, namely, 'residual' or 'eluvial placers' or by agencies that have concentrated the gold in the near vicinity or at some distance from the primary source. In the latter category we recognize 'alluvial', 'beach' and 'aeolian placers'. The terms 'saprolite' or 'saprolitic placer' were formerly used for certain types of eluvial placers, mainly in the eastern United States[3].

Placers occur when a heavy, resistant mineral is mechanically and graviationally sorted by natural processes into a recoverable deposit. Placers occur in river bends or behind river obstacles and in ocean shoreline sand deposits where slower water currents allow the heavier minerals to settle. Placer deposits often contain both rutile and ilmenite and there are enough of these deposits around the world to supply us with titanium for decades if not centuries. Heavy mineral sands are primarily deposited and concentrated by the intense action of wind and waves in shallow

† Mining Department, Istanbul University, Engineering Faculty Avcilar-Istanbul, Turkey
E-mail: ilginkur@istanbul.edu.tr

sedimentary basins, as dunal deposits, and a placer deposits along the margins of existing coastlines. The mineral grains in these deposits are generally discrete and liberated. Mining in relatively simple and there is no need for either crushing or grinding operations[4].

In recent times, significant improvements have been made in traditional process equipment employed in the recovery of heavy minerals. At the same time, new items of process equipment, offering superior performance, have been developed by various manufactures. Improvements have been made to such items of standard equipment as spiral concentrators and hydraulic classifiers. New developments have included the Kelsey jig and various magnetic separators based on rare earth magnetic technology. The combined results have been to provide process engineers with more alternatives to evaluate when undertaken the development or optimization of metallurgical flowsheet for Greenfeed Project[5]. Over the past 50 years, the heavy minerals industry has evolved from small inexpensive mining and separation plants, treating beach deposits on the east coast of Australia, to large industrial installations representing investments of more than $ 1 billion in single operations. Over this period, as the grade of ore mined has decreased, as the complexity of the mineral assemblages has increased and as mining conditions have become more onerous, the mining and processing plants have become larger and more complex. Mineral processing technology has evolved in parallel with the demands of the industry to meet the challenges posed by these trends[6].

## EXPERIMENTAL

Maps of the investigations sites are given on pp. 2102–2103. The Coruh district is located in the north-eastern part of the Pontides[7], the amalgamated tectonic entity representing the segments of Tethys system in Turkey. The studied area mainly consists of plutonic and volcanic rocks. Volcanics, aged from Lias to Plioquarterner, ranges from basalts and andezites through spilites and dasites to riyodasites and riyolites.

The Kackar Granitoid is the main plutonic rock in the district and crops out a widespread body that intruded the volcanics. The granitoid has a composite character comprising diyorite, quartz diyorite, monzo diorite, quartz monzonite, granodiorite, granite and adamellite types of magmatics. The Cu, Pb and Zn deposits arising from the intrusion of granitoids into the Upper Cretceous volcanics are commonly observed and some of them are being utilized. Especially the alteration zone's presence due to the hydrothermal alteration in the young volcanics is worthy of detailed investigation as a target area for the epithermal gold deposits.

In order to concentrate the sand, a representative sample weighing about 500 kg was obtained and this amount was reduced to relevant amounts by coning-quartering and other sampling techniques. The sample was separately prepared for chemical and mineralogical analysis, particle size distribution and concentration tests. Mineralogical investigations and XRD analysis revealed that the representative sample contained quartz diyorite, monzo diorite, quartz monzonite, granodiorite ilmenite, hematite and tourmaline as gangue minerals.

### Shaking Table Experiments

Experimental studies contain shaking table tests. All these experiments were done by Wilfley concentrating tables designed to carry out wet gravity separation tests on minerals and other granular materials. Two models are available: 13A

(18″ × 40″ deck) and 13B (24″ × 50″ deck). A choice of two decks with either "sands" or "fines" riffling is available. Both are supplied complete with fibreglass feed box, eight fibreglass product launders and variable speed drive system. The decks are made of polyester resin-reinforced fibreglass and are easy to clean, requiring little maintenance. The head motion is of rugged construction and requires minimum maintenance. Its internal mechanism is splash lubricated from an integral oil sump.

Shaking table experimental conditions:

| | |
|---|---|
| Table speed | 250 rpm |
| Angle | 2°, 3°, 4° |
| Water debbie | 3.7 L/min |
| Wash water debbie | 6.2 L/min |

## RESULTS AND DISCUSSION

According to the mineral processing experiments, Kafkasör deposits has included best amount of gold content (Fig. 1). Ore deposits ontent is approximately 1 ppm Au and concantrate has 3 ppm gold content. And also according to the experimental results after the shaking table tests, approximately 70% Au in the ore was transferred to the concentrate. Coruh area has 600 ppb gold content (Fig. 2).

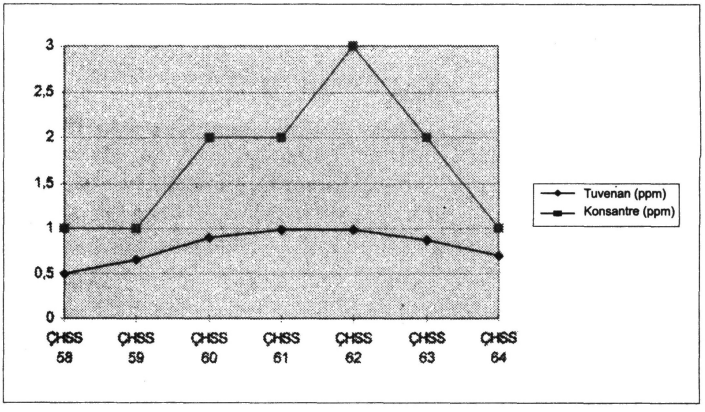



Fig. 1. Kafkasör region ore and concentrate Au content

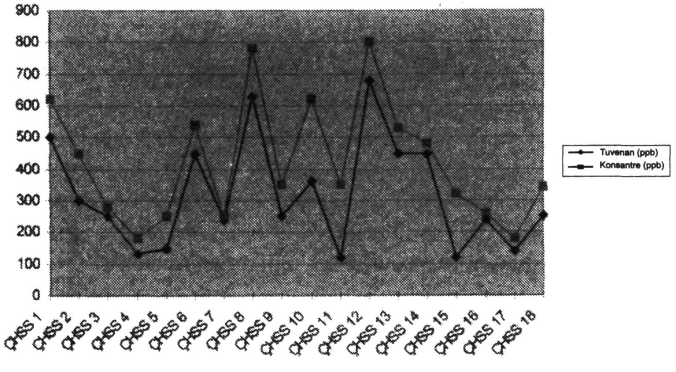



Fig. 2. Coruh river's ore and concentrate Au content

After the mineral processing test, concentrate content reached 800 ppb. Unfortunetely, in these tests recovery values were unexpected. The 3rd and 4th areas, Savsat region and Ardanuc, have content 350–450 ppb Au after the mineral processing tests (Figs. 3, 4). In Yusufeli region the concentrate has 950 ppb Au (Fig. 5)

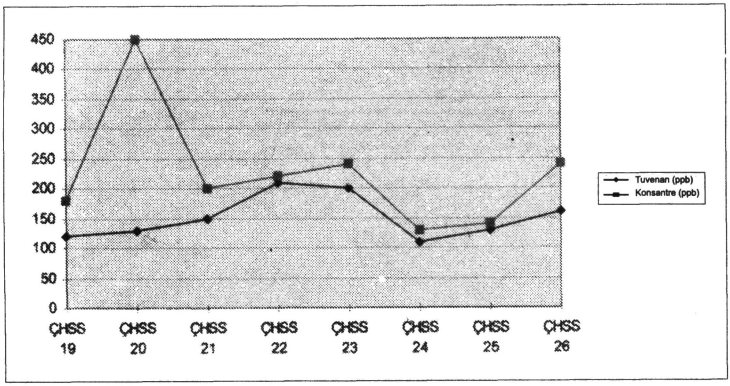



Fig. 3. Savsat region ore and concentrate Au content

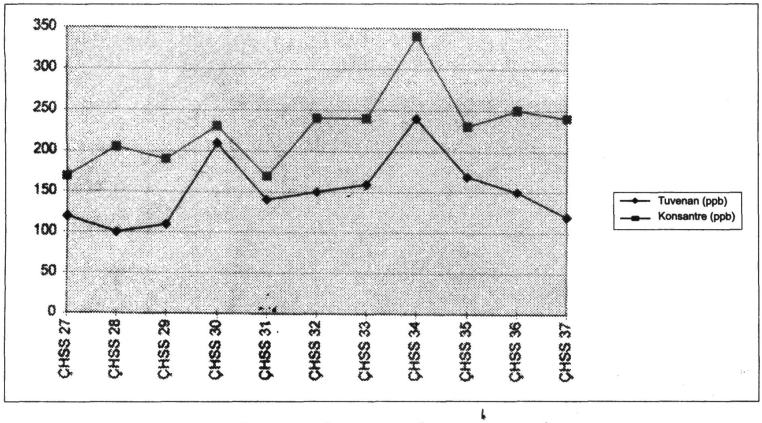



Fig. 4. Ardanuc region ore and concentrate Au content

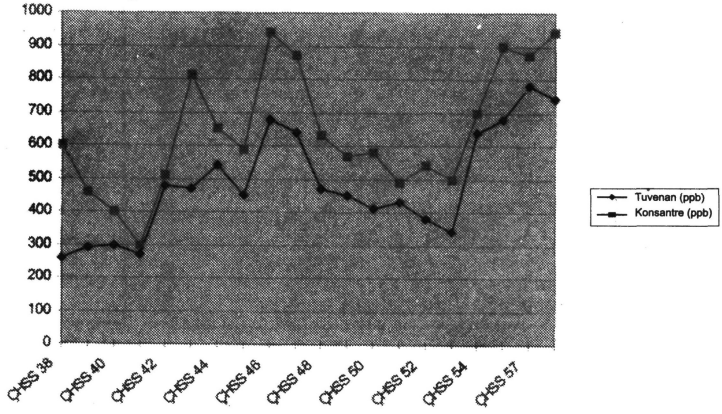
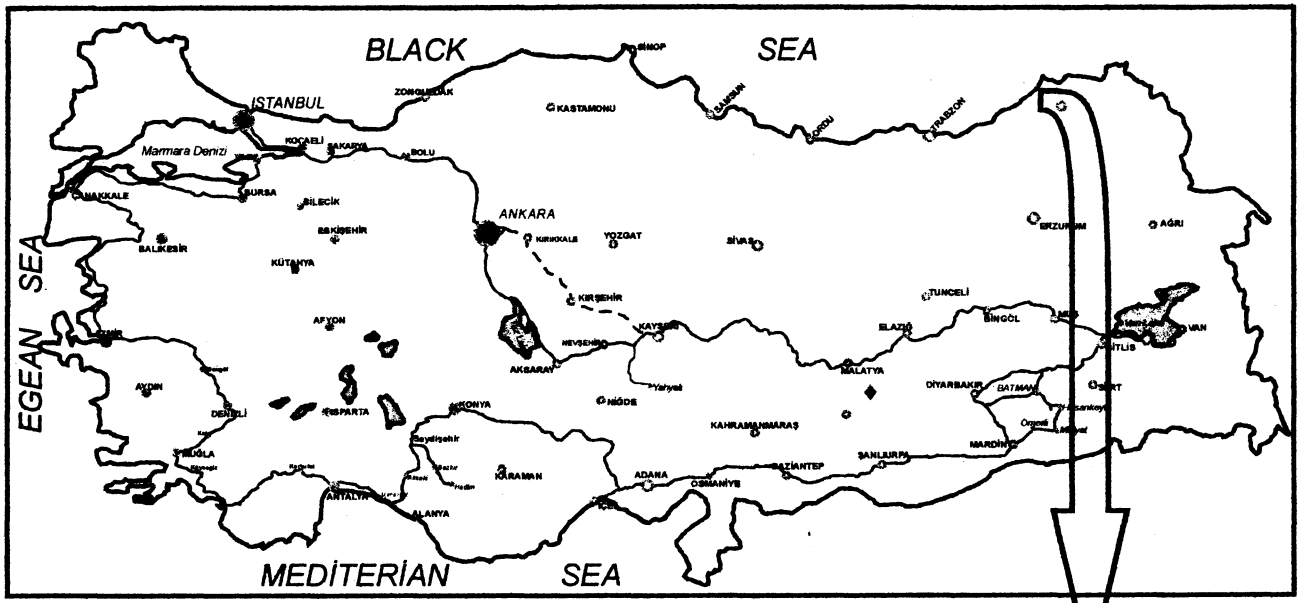
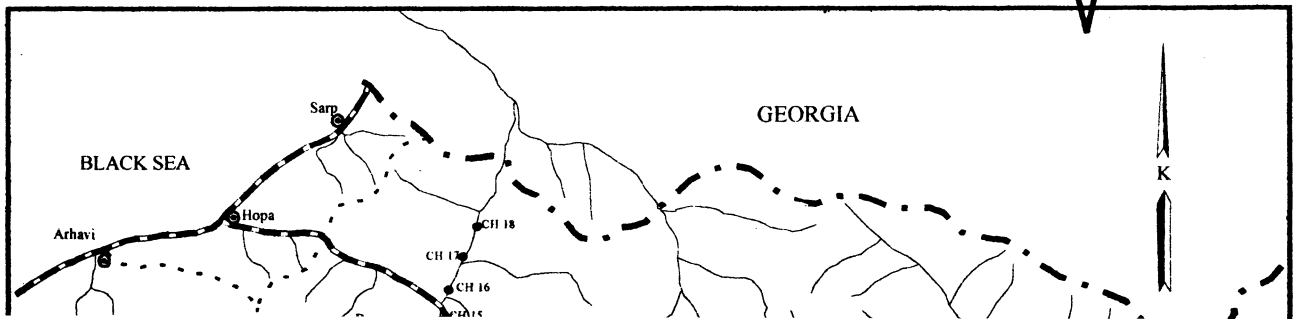
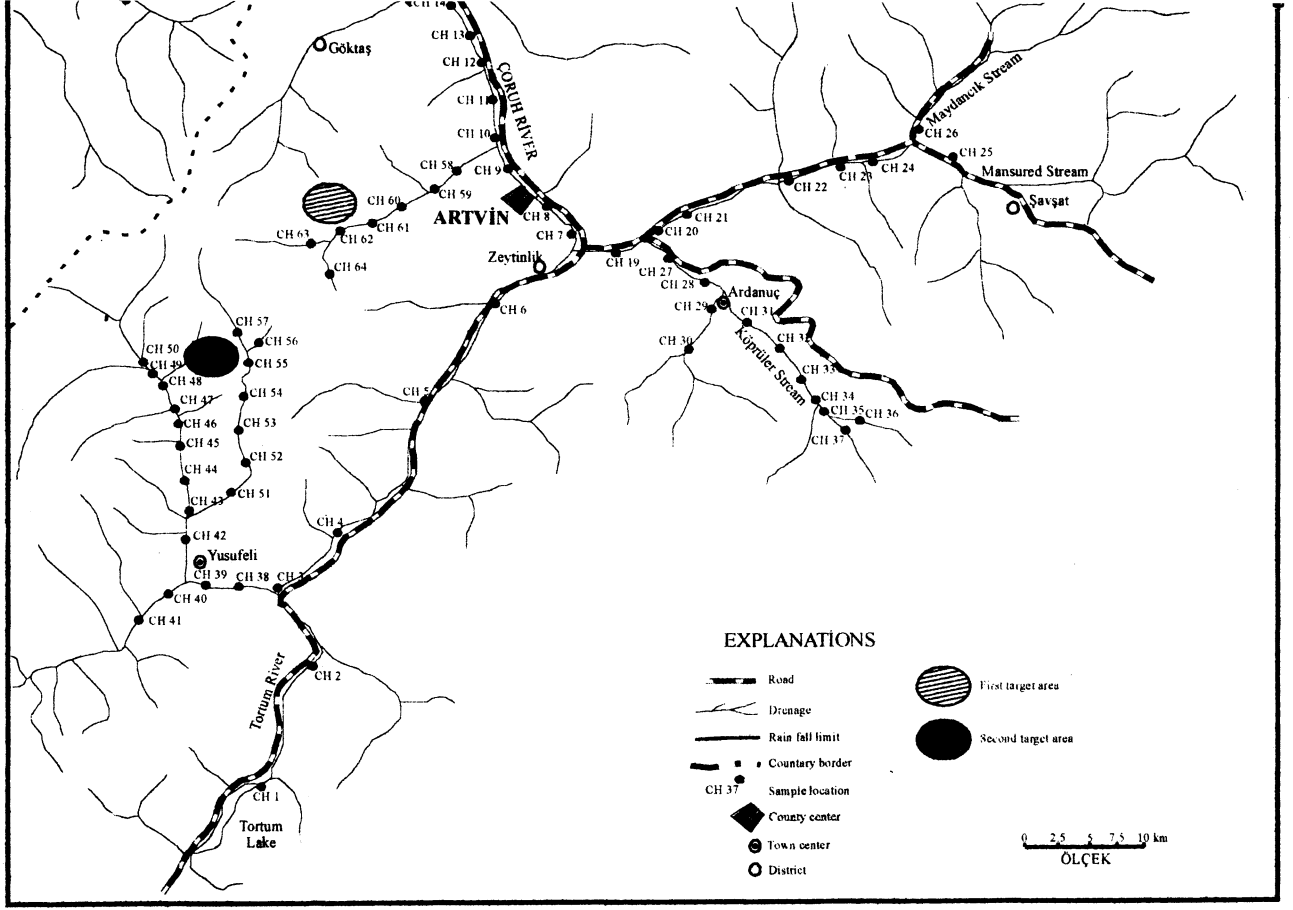



Fig. 5. Yusufeli region ore and concentrate Au content


BLACK SEA
İSTANBUL
Marmara Denizi
ANKARA
EGEAN SEA
MEDİTERİAN SEA
SİNOP
KASTAMONU
SAMSUN
ORDU
TRABZON
ZONGULDAK
KOCAELİ
SAKARYA
BOLU
ÇANAKKALE
BURSA
BİLECİK
ESKİŞEHİR
BALIKESİR
KÜTAHYA
AFYON
KIRIKKALE
YOZGAT
SİVAS
ERZURUM
AĞRI
TUNCELİ
KIRŞEHİR
KAYSERİ
BİNGÖL
MUŞ
BİTLİS
VAN
MALATYA
DİYARBAKIR
BATMAN
SİİRT
AKSARAY
NEVŞEHİR
NİĞDE
AKDENİZ
AYDIN
DENİZLİ
ISPARTA
KONYA
Yahyalı
Seydişehir
KAHRAMANMARAŞ
MUĞLA
BURDUR
ANTALYA
ALANYA
KARAMAN
ADANA
OSMANİYE
GAZİANTEP
ŞANLIURFA
MARDİN
Ömerli


BLACK SEA
GEORGIA
Sarp
Hopa
Arhavi
CH 18
CH 17
CH 16
K




Maps of the investigation sites

and recovery value is approximately 75%. As can be seen from the mineral processing test, Kafkasör region has good gold content and recovery value.

## Conclusions

Gold miners in the world generally use traditional methods with leaching procedure. But these methods also have harmful effect for the environment. Placer mining has been studying expecially heavy minerals for example, beach sands, rutile, ilmenite etc. The tenor of pay streaks or of placer gold gravels and sands, in general, is referred to by the value (in ounces, grams, pennyweights, or in any unit of currency) per cubic yard or metre, per running length (foot or metre) of channel, per surface unit of cross-section, or per unit of surface (square foot or metre); also occasionally in bonanzas by dollars or some other unit of currency per pan. Note that placer deposits can be worked whose gold content is as low as 0.1 ppm. The pay streaks of placer deposits may rest on or near bedrock or on some stratum above bedrock. The bedrock in placer deposits is commonly referred to as the 'true bottom', although the term is little used today. When the streaks rest on a well-defined stratum of sand, gravel, or clay above the bedrock, they are said to be on a 'false bottom'. According to the mineral processing experiments Kafkasör deposits have produced the best amount of gold content. Ore deposits content is aproximately 1 ppm Au and concentrate has 3 ppm gold concent. And also according to the experimental results after the shaking table tests, approximately 70% Au in ore is transferred to the concentrate.

## REFERENCES

1. E. Andic Agir Minerallerin Arastirilmasi, M.T.A. Region Yayinlari-12, Izmir (1987).
2. A. Akyol, *Plaser Yataklar*, s: 86–89 (1992).
3. T. Chernet, 'Titanium Minerals', 6th International Congress on Applied Mineralogy, Göttingen, Germany (2000).
4. J.D. Winter, ERMS Roasting Process: Technology for the Separation of High Tenor Ilmenite from Murray Basin Mineral Concentrate, in: Murrary Basin Mineral Sands Conference: Geoscientist, Bulletin No. 26, pp. 169–171 (1999).
5. I. Kursun, K. Çinku, F. Eskibalci and A. Duban. Sahil Kumlarinin Titan ve Demir Kaynagi Olarak Degerlendirilebilirliginin Araştirilmasi, Genç Araştirmacilar Kongresi, 17–20 Şubat 2002, Istanbul.
6. A.B. Holland-Batt, Gravity Separation: A Revitalized Technology, Mining Engineering (1998).
7. T.W. Dickson, A History of Exploration for Heavy Minerals in the Victorian Section of the Murrary Basin, in: R. Steward (Ed.), Murray Basin Mineral Sands Conference: Extended Abstracts, Australian Institute of Geoscientists, Bulletin No. 26, pp. 34–41 (1999).

(*Received*: 20 February 2004; *Accepted*: 16 May 2005) AJC-4224