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Düzenleyen Kuruluşlar
İTÜ Maden Fakültesi
Maden Mühendisliği Bölümü

•
Yurt Madencilik Geliştirme Vakfı

ITU,
Suleyman Demirel Kultur Merkezi,
Konferans Salonu, Istanbul
29-30 Nisan 2005

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The Choice of Supplying Stream of Knelson Concentrator-Determining Factor for Maximum Extraction of Free Gold

ABSTRACT

The results from mineralogical, semi-industrial and industrial investigations are indicated in the article, for gravitational extraction of free gold from the deposit “Chala”, East Rhodopes, Bulgaria. The industrial tests carried out by the traditional scheme of gravitational dressing presented unsatisfactory extent of gold extraction – 30%. A new choice of supplying stream of the Knelson concentrator in the grinding cycle of gold-bearing ore considerably increases the extraction extent. Semi-industrial tests are carried out with a Knelson concentrator – KC-12 and a two-stage scheme of grinding. An industrial scheme of gravitational dressing of gold-bearing ore in Gorubso-Kardjaly-JSCo, is suggested and introduced on the basis of these tests. The new choice of supplying stream of the Knelson concentrator increases the gold extraction extent on gravitational way up to 70%.

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Figure 1 High-grade gravity concentrate produced by Knelson Concentrator at Gorubso-Kardjali

1. INTRODUCTION

In 2004 in parallel with the preparation of the deposit “Chala” (1,4 Mt@12g/t Au) for production of gold-bearing ore, technological investigations were carried out for gold concentrate production and gravitational technology was designed and successfully introduced.

During the period of regular operation the installation shows reliable work and achieving of high extraction – 70% for the gravitational cycle.

The final choice of the technology was made on the base of extended mineralogical investigations, high-performance dressing technology tests, results obtained by industrial and semi-industrial tests.

1. Technological investigations

1.1 *Mineralogical Investigations*

Mineralogical investigations for forms of presence of free gold in the ore, shows that the gold is in the form of native gold, moreover extremely irregularly distributed; bearing minerals of native gold are all sulfide minerals and quartz; according to grain-size composition the native gold is related to both the basic categories: “invisible” and “visible” gold. The sizes of the particular gold particles are in the frame of parts of micron to 0,8 mm. but in weight ratio the particles with dimensions from 10 up to 200 microns are predominated. Morphological forms of the native gold are quite various: drop-shaped, prolonged, lamella-shaped, fibre-shaped, dendrite-shaped, and quite complex.

The native gold contains as admixture only silver. The silver is isomorphous admixture in galena and the native gold. The native gold is hydrothermal – low temperature [1].

1.2 *Industrial Tests*

The results from accomplished parallel to the semi-industrial, industrial tests in ore-dressing plant “Zidarovo” with processing of 500 tons ore are given in Table 1.

The existing gravitation-flotation scheme on the base of which the ore was processed, is standard used scheme included one-stage grinding, scalping introduction of 20 inches “Knelson” concentrator to the sands of hydrocyclone in the grinding cycle, basic, control, and two purifying

1.3 Semi-industrial investigations

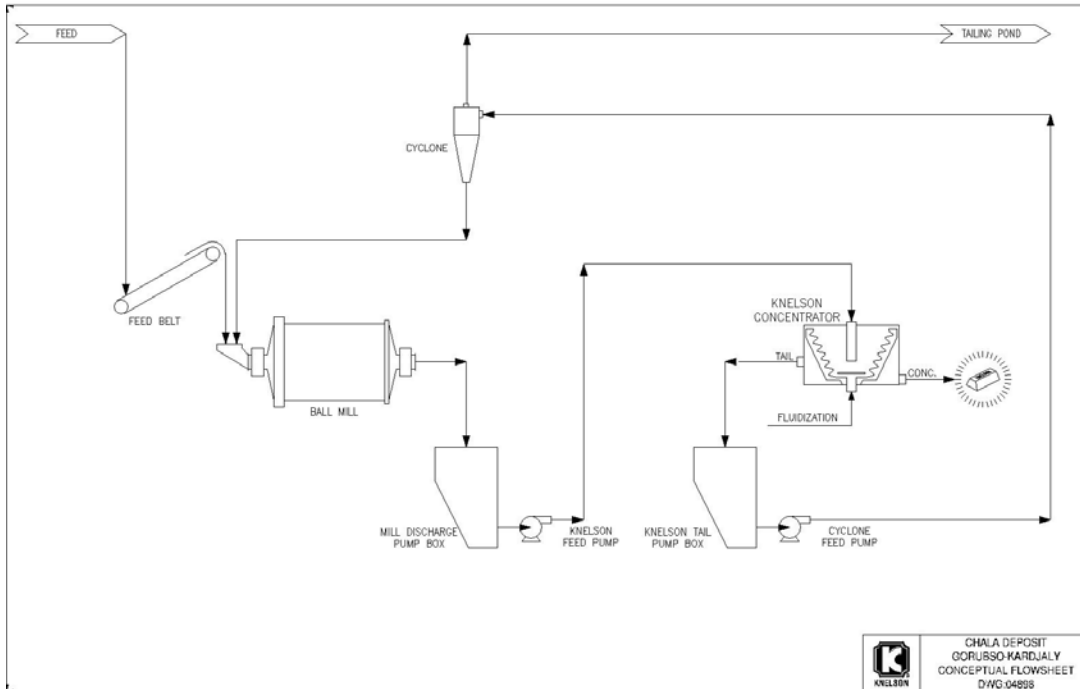
Semi-industrial investigations were carried out with the processing of 45 t ore with gold content in both the batches ore granted from 10,0 to 22,0 g/t. Results from the experiments carried out are given in Table 2.

Table 2. Data for gold extraction extent depending on the sort of technological schemes

Conditions	Products	Content of Au, g/t	Extraction extent of Au, %
Two stages of grinding • <i>Output</i> -750 kg/h • <i>Extent of grinding</i> (-0,08 mm) – 87%	Concentrate	5760	64
	Drain ball grinder	7,17	
	Drain Knelson Concentrator	4,89	
	Waste	3,79	
	Ore	10,73	
Two stages of grinding • <i>Output</i> 655 kg/h • <i>Extent of grinding</i> (-0,08 mm) – 96%	Concentrate	5700	75,8
	Drain ball grinder	13,12	
	Drain Knelson Concentrator	8,47	
	Waste	2,17	
	Ore	8,96	
Two stages of grinding • <i>Output</i> 655 kg/h • <i>Extent of grinding</i> (-0,08 mm) – 93%	Concentrate	7640	63,3
	Drain ball grinder	25,27	
	Drain Knelson Concentrator	20,81	
	Waste	6,92	
	Ore	8,96	
Two stages of grinding • <i>Output</i> 480 kg/h • <i>Extent of grinding</i> 96%-0,063 mm (100%-0,08mm)	Concentrate	4500	62,7
	Drain ball grinder	8,30	
	Drain Knelson Concentrator	6,28	
	Waste	5,77	
	Ore	15,05	

From the semi-industrial investigations, carried out for choice of technology for dressing of gold-bearing ore from deposit “Chala”, the following conclusions were made:

- On the base of the ore type and composition, the data from mineralogical, phase and technological investigations carried out, as well contemporary technologies for dressing of this ore type existing in the world practice.



The basic equipment in the installation for gravitational extraction of gold is the Knelson concentrator.

The scheme is developed with a purpose maximum revelation of the free gold, with minimizing of the possibility for re-grinding, with modifying of the revealed gold form (lamellae formation) and complete passing of freshly liberated gold through the Knelson concentrator. This is achieved by transportation of the **whole drain** from the ball grinder through the concentrator, in contrast to standard applied schemes of Knelson concentrator [2,3,6].

On account of that reason, the Knelson concentrator KC-XD30 is chosen with greater productivity from 50 to 100 t/h, instead of smaller size KC-XD20 with output from 10 to 50 t/h, corresponding to the same output at ore, using traditional scheme of covering the sands of hydro cyclone.

In spite of higher value of the capital investments, this variant is more advantageous, because in the semi industrial investigations carried out [1], gaining of extraction to 70-75% is demonstrated, compared to extraction 31% by the industrial experiment accomplished in Zidarovo (Table 1).



Figure 2 Knelson KC-CD30 at Gorubso-Kardjali processing facility in Bulgaria

REFERENCES

1. Ecotech Consult –Ltd., Account on theme “Technological investigations for determination of the extraction extent of free gold”, Sofia, June, 2003
2. Knelson – Mineral Processing – Providing Unique Processing Solutions to the World, 2003
3. Batch Knelson Concentrators, Providing Unique Processing Solutions to the World, updated Feb. 2004
4. Balances of the concentrate obtained from gold bearing ore and analyses of fire assay, “Gorubso-Kardjaly”- JSCo. August-September, 2004
5. Grewal I., M. Fullam, Gravity Circuit Optimization via Mathematical Modelling by Particle Size Classes, www.KnelsonGravitySolution.com, 2004
6. Bimak AD, The introduction of a gold gravity circuit at the Bimak Copper Concentrator, Bulgaria, Mineral Engineering, 1998.