THE INTRODUCTION OF A GOLD GRAVITY CIRCUIT AT THE BIMAK COPPER CONCENTRATOR, BULGARIA

Operation : The Bimak AD Cu/Au Concentrator, Chelopech, Bulgaria

Client : Navan Resources plc (majority shareholder of Bimak AD)

Agent : South West Metallurgical Services, European agents for Knelson Concentrators

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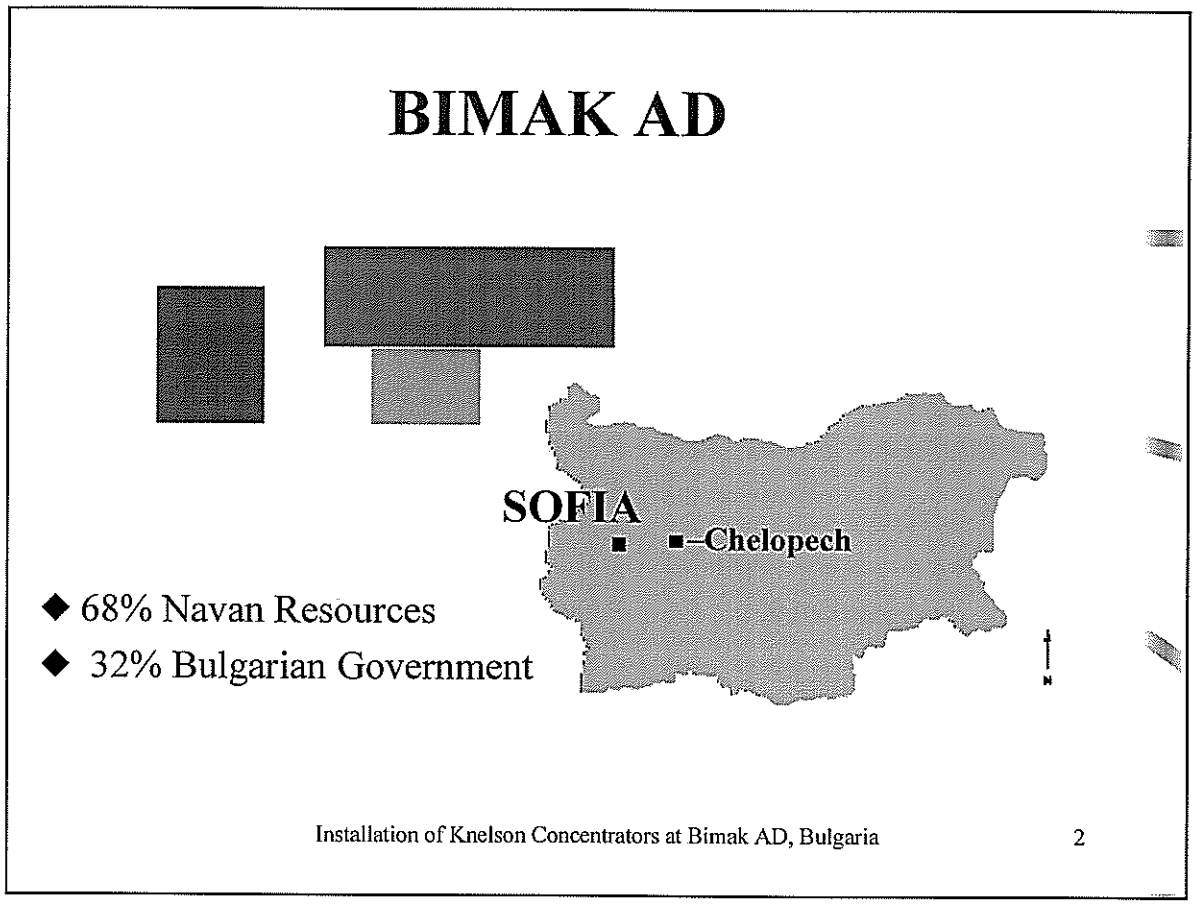
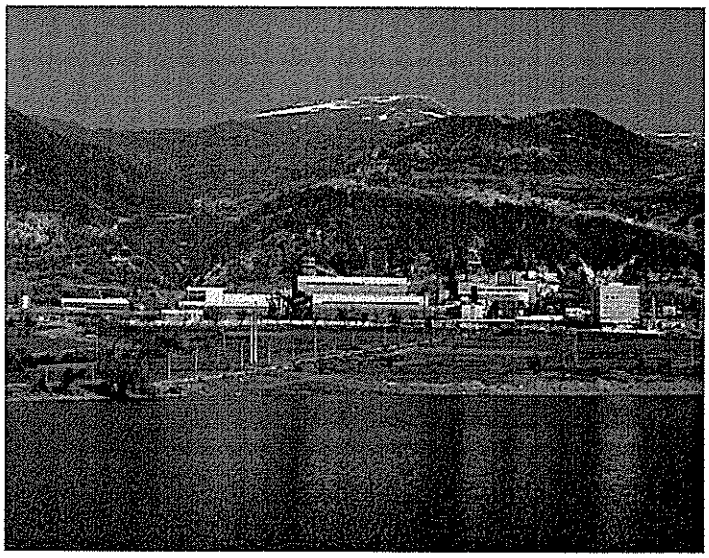
Bimak AD was incorporated in December 1993 as a joint venture between Navan Resources plc and the Bulgarian state.

Previous mineralogical investigations had shown that approximately 10% of the gold in the ore could be liberated. This presentation details the initial testwork and the installation of Knelson concentrators at Bimak AD.



The Chelopech gold-copper mine is located in west central Bulgaria 80km east of Sofia on the southern flank of the Balkan Range at Chelopech village adjacent to the towns of Zlatitsa and Pirdop. (Bulgaria's major copper smelter, an Outokumpu flash-process smelter with an annual capacity of 170 000 tonnes, recently privatized by Union Miniere, is situated 7km east of Chelopech at Pirdop).

Bimak Processing Facilities at the foot of the Balkans



History of the Mining District

1840 - First description of mineralization.
1953 - Discovery of Orebodies by State Survey.
1956 - Mining begun.
1970 - Attained 100,000 tpa production.
1976 - New 500,000 tpa Mine and Mill commissioned.
1990- Closed by Governmental Decree due to arsenic content of bulk flotation concentrate.
1993 - Navan enter joint-venture agreement. Bimak AD formed.
1994 - Underground production commenced.
1995 -Concentrator commissioned with new differential flotation circuits.
1997 - Knelson Concentrator circuit installed to recover free gold.

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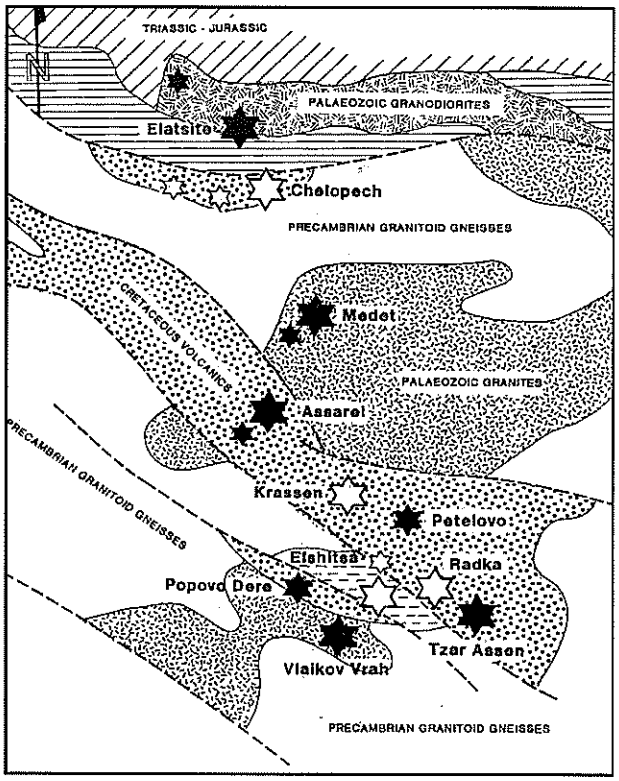

Laramide Mineral Deposits of the Panagyurishte District

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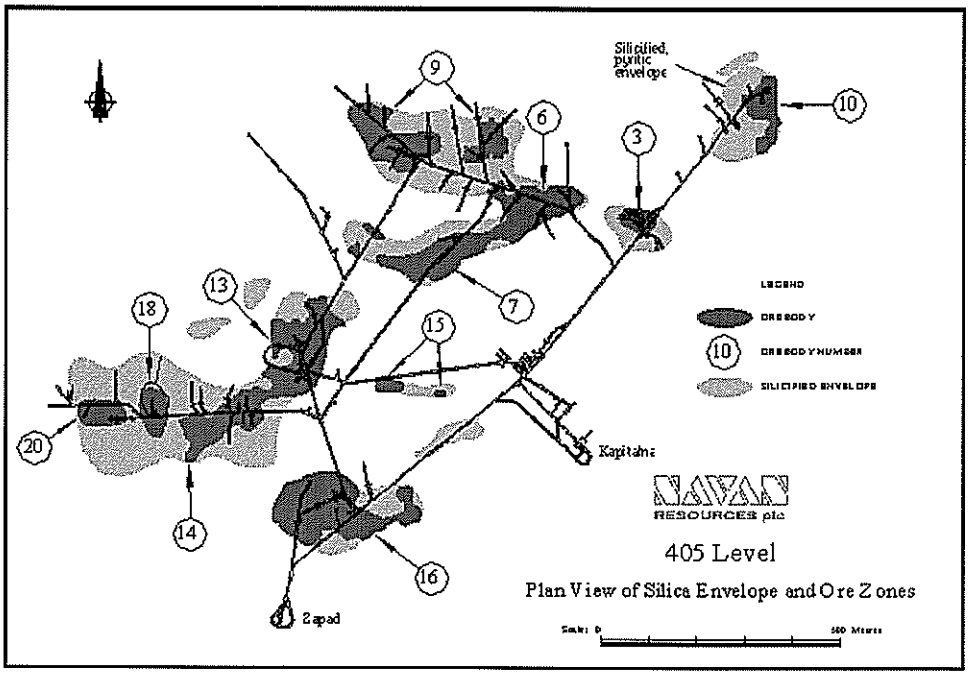
The Chelopech deposit lies to the north of the Panagyurishte mining district where a number of cupriferous massive sulphide and porphyry copper deposits exist including the open-pit mines of Elatsite and Assarel – Medet.

It is located within the so-called Panagyurishte metallogenetic district within the central part of the Srednogorie zone some 80km east south east of Sofia. Mineralization is dominated by porphyry copper type deposits as at Assarel, Medet, Elatsite, Vlaikov Vrah, Tzar Assen, Popovo Dere, Petelovo, Sivata, Orlovo Gnezdo and Gorna Kamenitsa; and by so-called 'cupriferous massive pyrite' deposits as at Radka, Elshitsa, Krassen and Chelopech.

Plan View of Ore Zones on the 405 Level



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The Chelopech deposit is correctly classified as a "gold-enargite high-sulphidation epithermal mineralizing system" similar to the deposits mined at Lepanto in the Philippines, El Indio in Chile, Freda River in Papua-New Guinea and Nansatsu in Japan. The mineralization is of upper Cretaceous age and is hosted within a series of andesitic, dacitic and rhyodacitic, tuffs, agglomerates and lavas. Mineralization consists of sulphide-rich zones of anastomosing veins and replacive massive sulphide bodies within enveloping haloes of silica-sericite alteration. The orebodies, which comprise steeply dipping lenses, branched converging mantos and discrete pipes extend from surface at about 700m above sea level, to below sea-level. Ore mineralogy is complex but in abundance pyrite dominates followed by enargite-luzonite, tennantite, bornite and chalcopyrite.

Copper and Pyrite Flotation Circuits

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Arsenic is contained in the copper mineral enargite and it is important to maximise copper recovery, as any residual enargite will report to the pyrite concentrate exceeding the specification of 0.2% arsenic.

Initial Testwork with 7.5" Knelson

April/May 1995

Test No.	Sample Point	Gold Grade gpt		Upgraded Conc. Au %	Au Recovery %
		Feed	Knelson Conc.		
2	Overflow	4.39	484	5.70	13.7
4	Overflow	4.44	2,687	4.60	40.4
5	Overflow	4.40	683	4.26	11.3
6	Overflow	4.40	682	1.67	5.6
7	Pyrite Conc.	10.00	108	0.42	1.1
8	Cu Conc.	50.00	120	0.40	3.2
9	Underflow	16.00	195	0.51	25.7
10	Underflow	16.00	230	0.85	39.2
11	Underflow	16.00	472	2.11	47.9

Note: Testwork and results repeated March 1996

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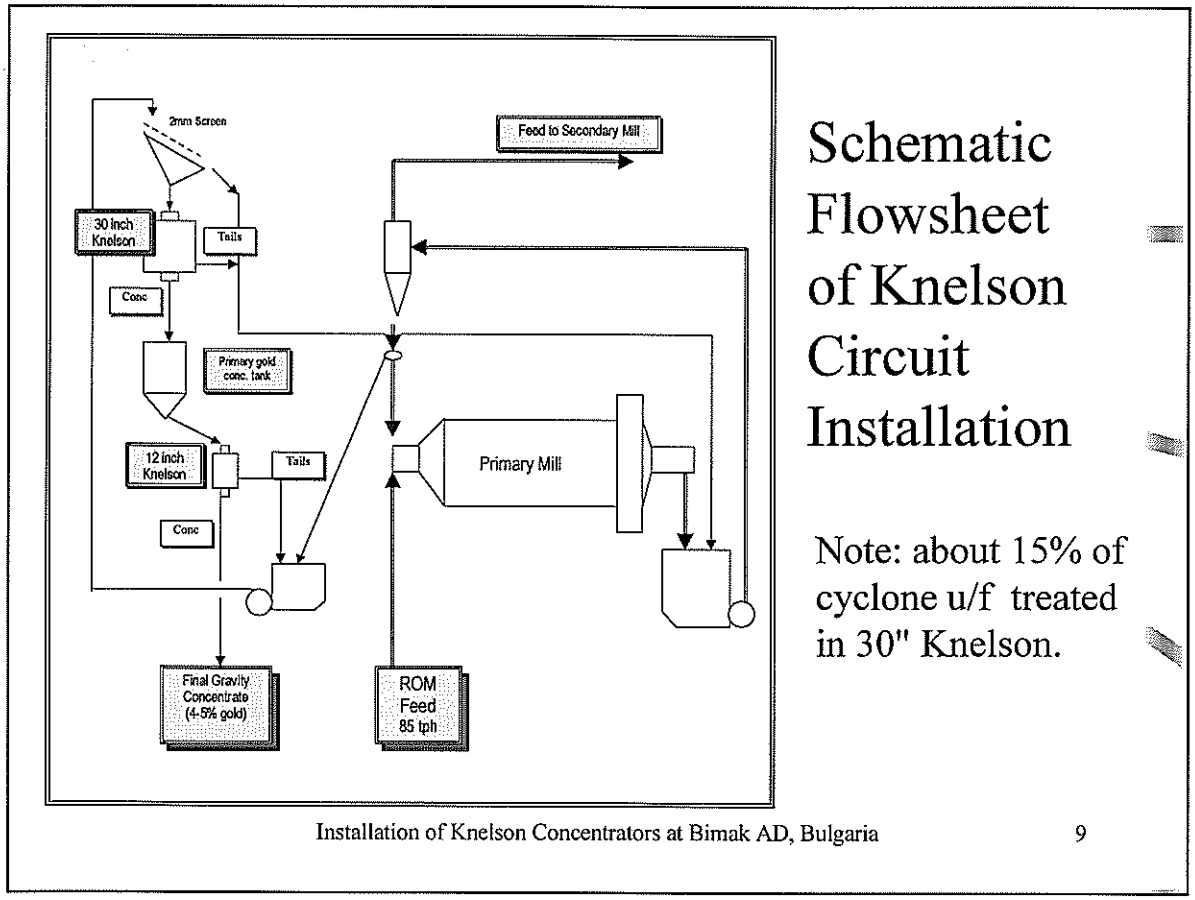
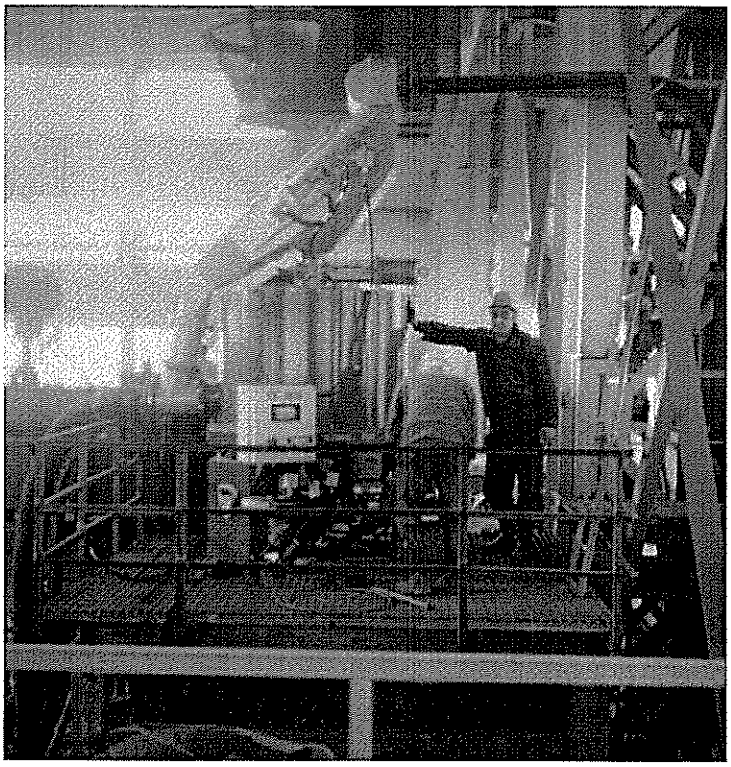
Navan Resources carried out an extensive gold exploration programme in Borland Glen in 1992. A mobile trailer-mounted 7" Knelson concentrator was used to process 0.7 tonne samples. Mineralogical analysis of the concentrates showed that it was successful in recovering the –20 micron gold. This was the reason for choosing this type of unit for the recover of the fine-goat Bimak.

The same 7" unit was installed in the grinding circuit at Bimak and various streams processed with the results as shown above. The testwork was repeated in March 1996 with similar results.



This is the flowsheet as designed by South West Metalurgical Services and Navan. Approximately 15% of the primary cyclone underflow is pumped to a 30" Knelson concentrator. A gold concentrate of 0.2% is discharged every four hourly cycle into a primary concentrate cone. Each day this is upgraded in the 12" Knelson to a 4-5% gold concentrate. The tails from the 30" Knelson are returned to the primary mill sump; the fluidization water used in the Knelson replaces the normal water addition to this sump. The tails from the 12" are recirculated to the feed to the 30" unit.



i) Installation of 30" Knelson Concentrator and Screen

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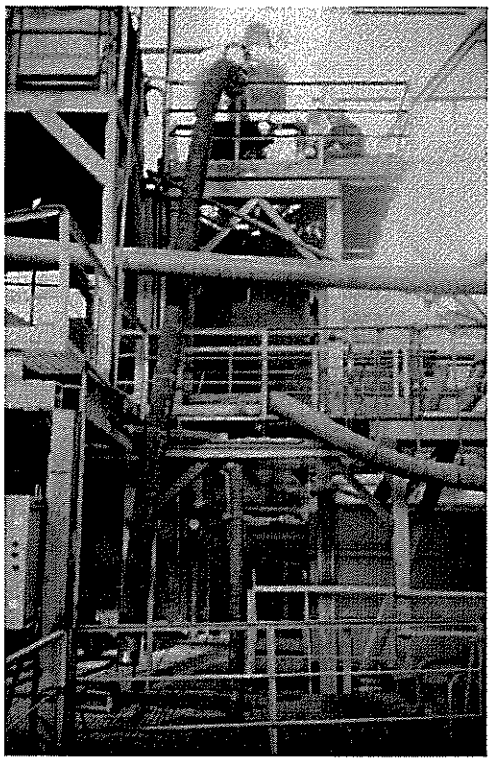
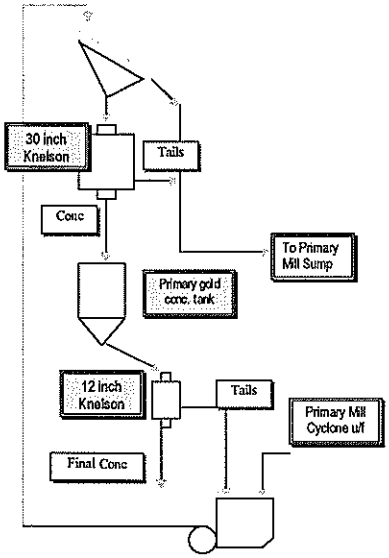


ii) Installation of 30" Knelson



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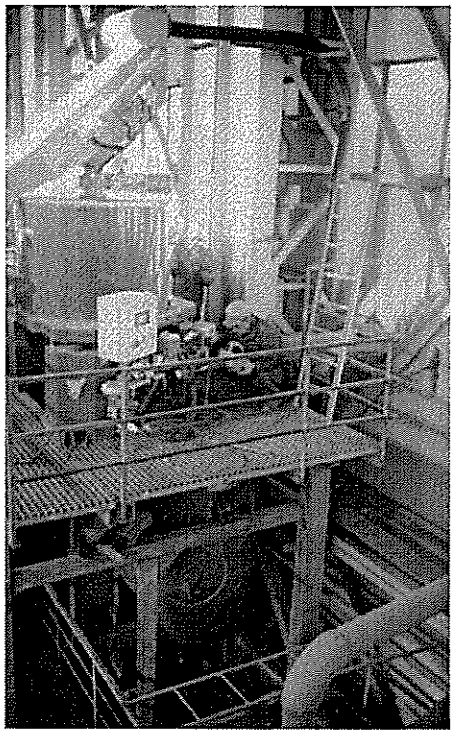
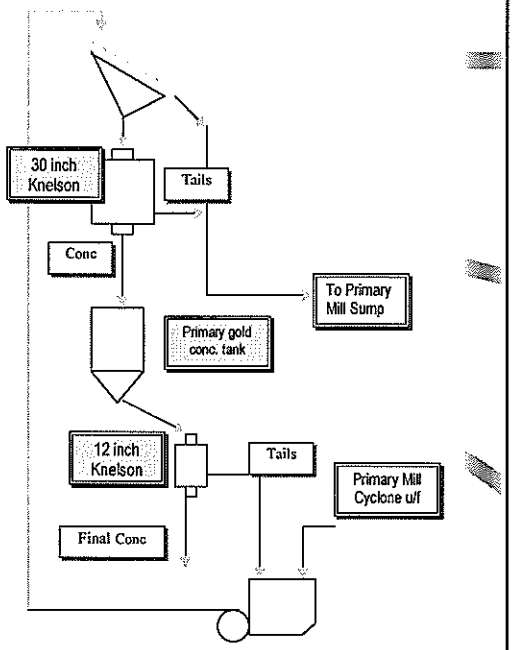


iii) Installation of 30" Knelson



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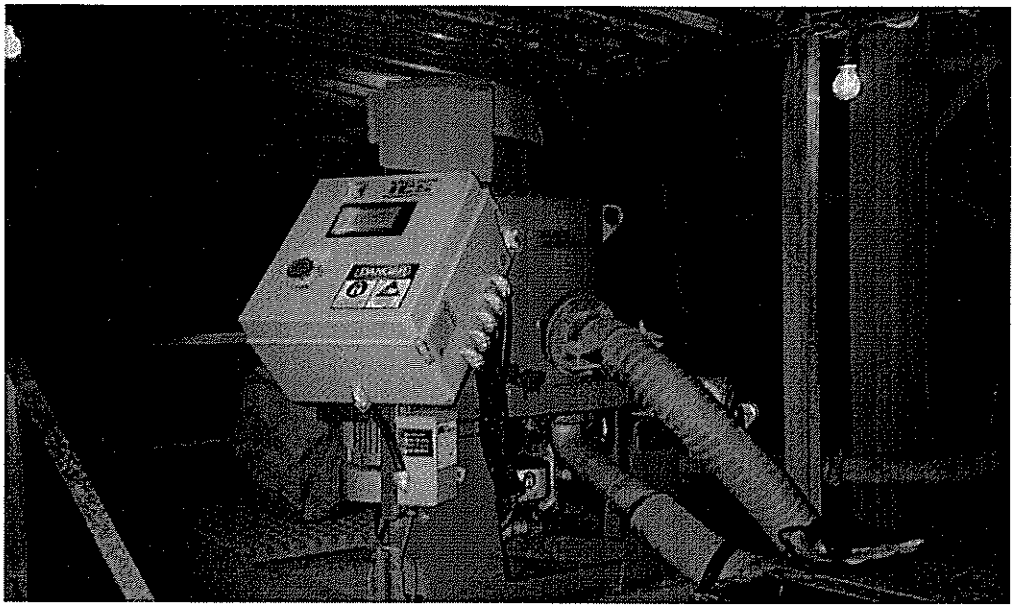
12" Knelson: Used for up-grading primary concentrate



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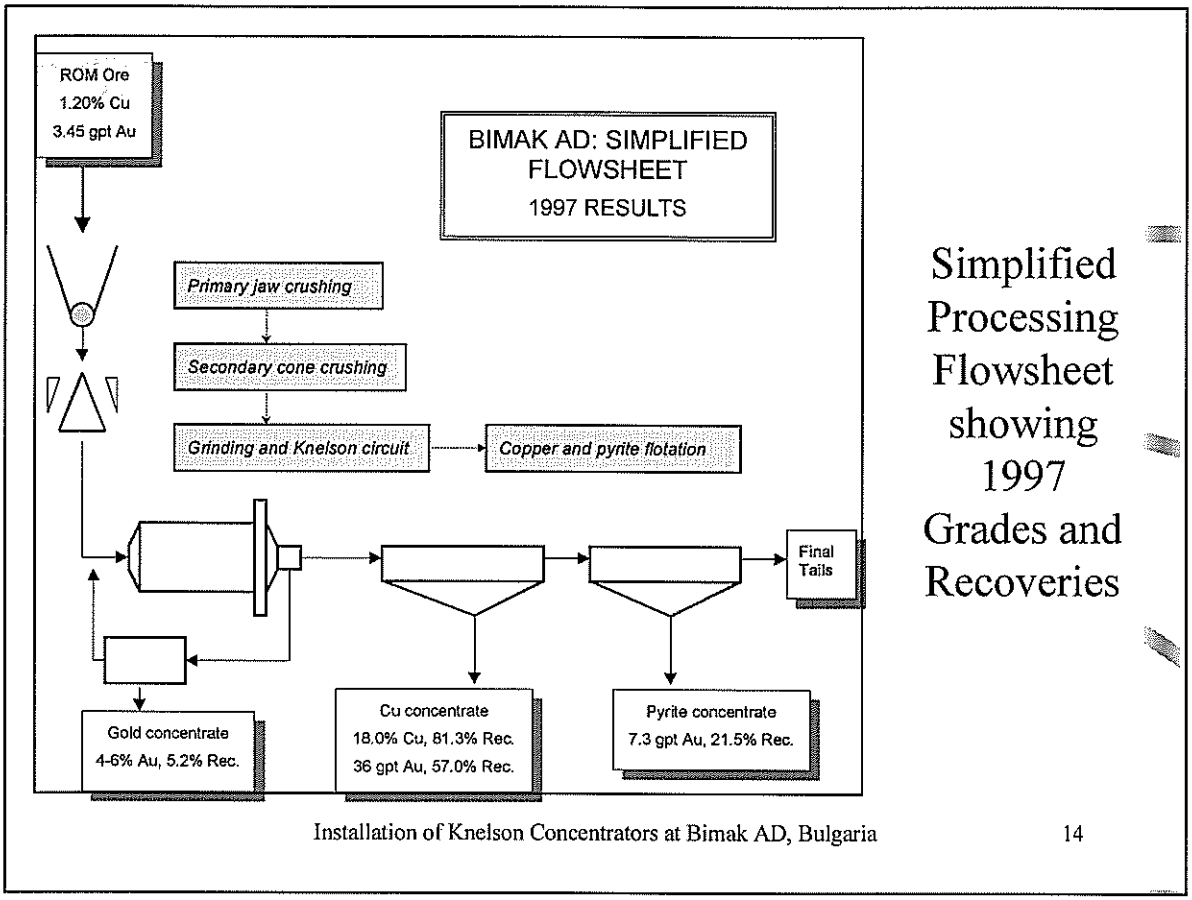


The processing route is:

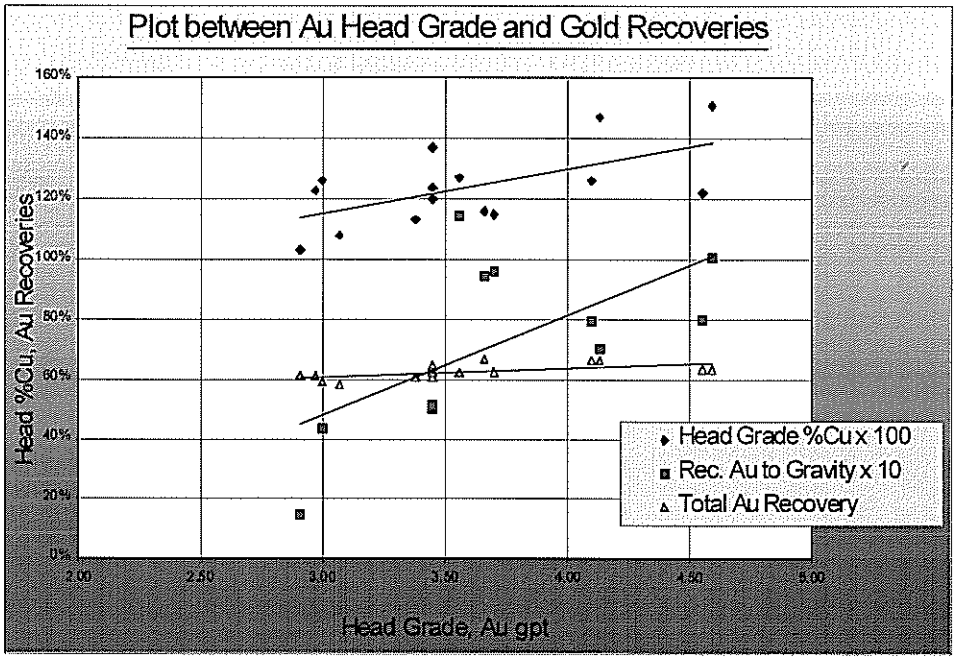
i) Conventional primary jaw crushing followed by secondary cone crushing to produce a fine crushed ore.

ii) Two stage close circuit milling produces a flotation feed of 80% passing 90 microns.

iii) Copper concentrate is floated at a pH of 11 with Aerophine 3418a. Until December 1997 a pyrite concentrate was floated with xanthate after reducing the pH to 6.

The grades and recoveries shown are for 1997. The gravity recovery is for the whole of 1997 including the commissioning period and other downtime. The operational recovery for the year is calculated as 9.4%.

Results of Knelson Circuit (Jan 97 - Feb 98)



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The most accurate sampling point for the ROM ore is the flotation feed but the removal of 'free gold' by the Knelsons lowers the gold content of this sample. The true gold head grade must be reconciled and currently this is only done on a monthly basis. The above plot shows the relationship between the gold head grade and the copper head grade, the gold recovery to gravity concentrate and the total gold recovery (gravity concentrate and copper concentrate combined).

Typical Concentrate Specifications.

Payables	Gold	4 - 8%
	Silver	0.2 - 0.3%
Penalties	Lead	5.0 - 6.5%
Major Components	Copper	3 - 5%
	Iron	25 - 35%
	Sulphur	15 - 20%
	Silica	20 - 25%
Minor Components	Arsenic	0.7 - 1.2%
	Zinc	0.2 - 0.3%
	Antimony	0.3 - 0.4%
Trace Elements	Bismuth	< 170 ppm
	Selenium	< 200 ppm
	Telurrium	< 130 ppm
	Cadmium	8 - 15 ppm
Physical	Moisture	0.01 - 0.5%

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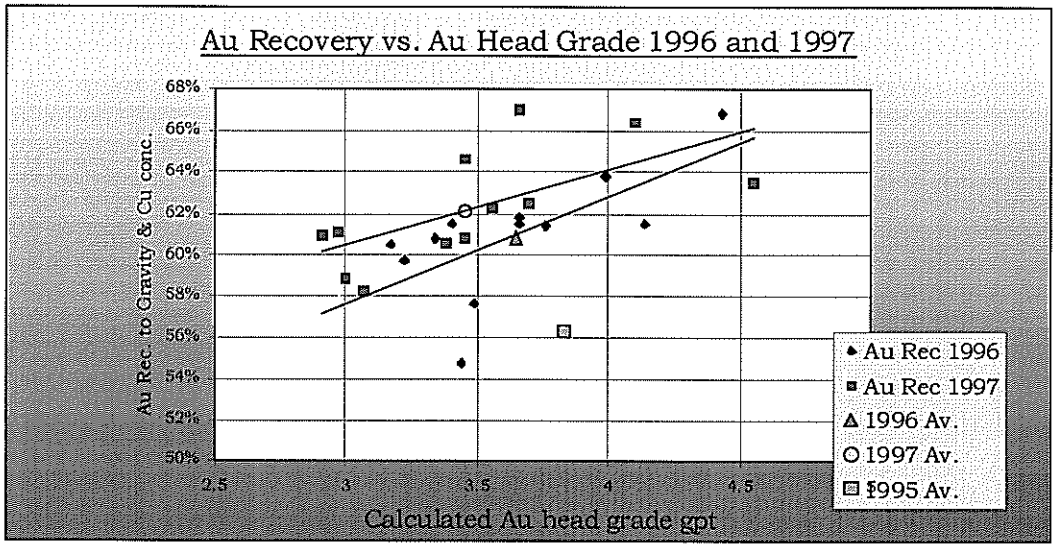
Comparison between Gold Recoveries for 1996 and 1997



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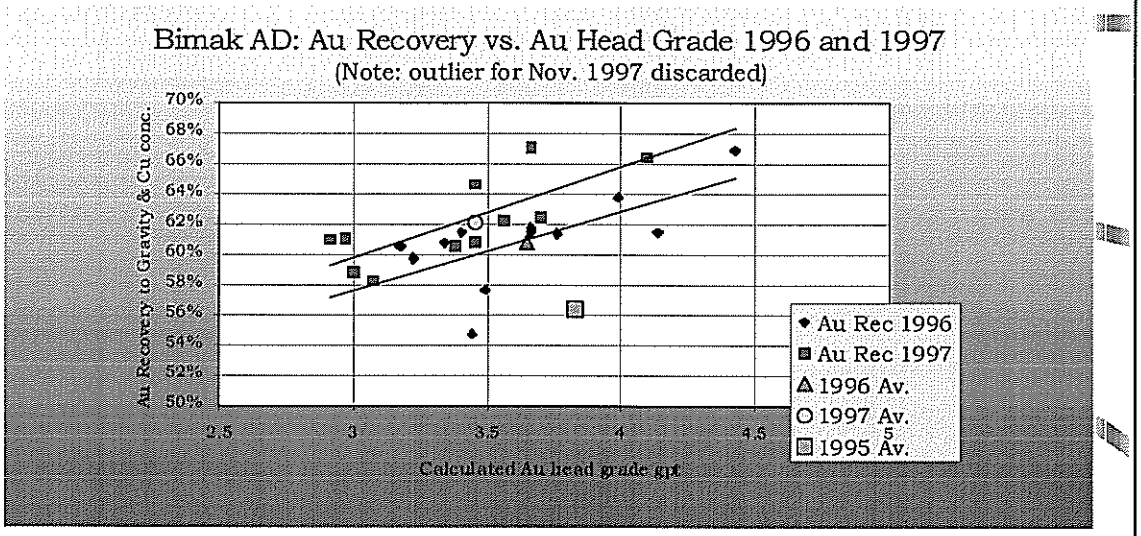
Free gold would historically report to the copper flotation concentrate. The Knelsons have lowered the gold grade of the copper concentrate and reduced the recovery to copper concentrate. In order to illustrate how the introduction of the Knelson circuit has affected the total gold recovery (gravity and copper flotation concentrate) is plotted against gold head grade for each month of operation.

Comparison between Gold Recoveries for 1996 and 1997



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The above plot is the same as the previous but with the removal of the doubtful data point for November 1997.

Summary of Knelson Circuit Performance

- 1.5%-2% increase in overall gold recovery
- 9.4% recovery of gold to gravity concentrate
- Gold smelter revenues increased from 95% to 98.75%
- Regular revenues from monthly concentrate shipments
- Installation payback within 12 months