

UNCTAD

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Extractive Industries and Sustainable Job Creation

**The experience of a sustainable local
mining industry (Au, Ag, Cu, Zn)**

By

Dr. Mohamed Abufatima Abdalla
General Manager, Ariab Mining Company

The views expressed are those of the author and do not necessarily reflect
the views of UNCTAD.



Republic of Sudan
Ministry of minerals
Ariab mining company Ltd. (amc)

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mining industry (Au, Ag, Cu, Zn)**

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GM Ariab Mining Company



Cubic Globe

OUTLINES

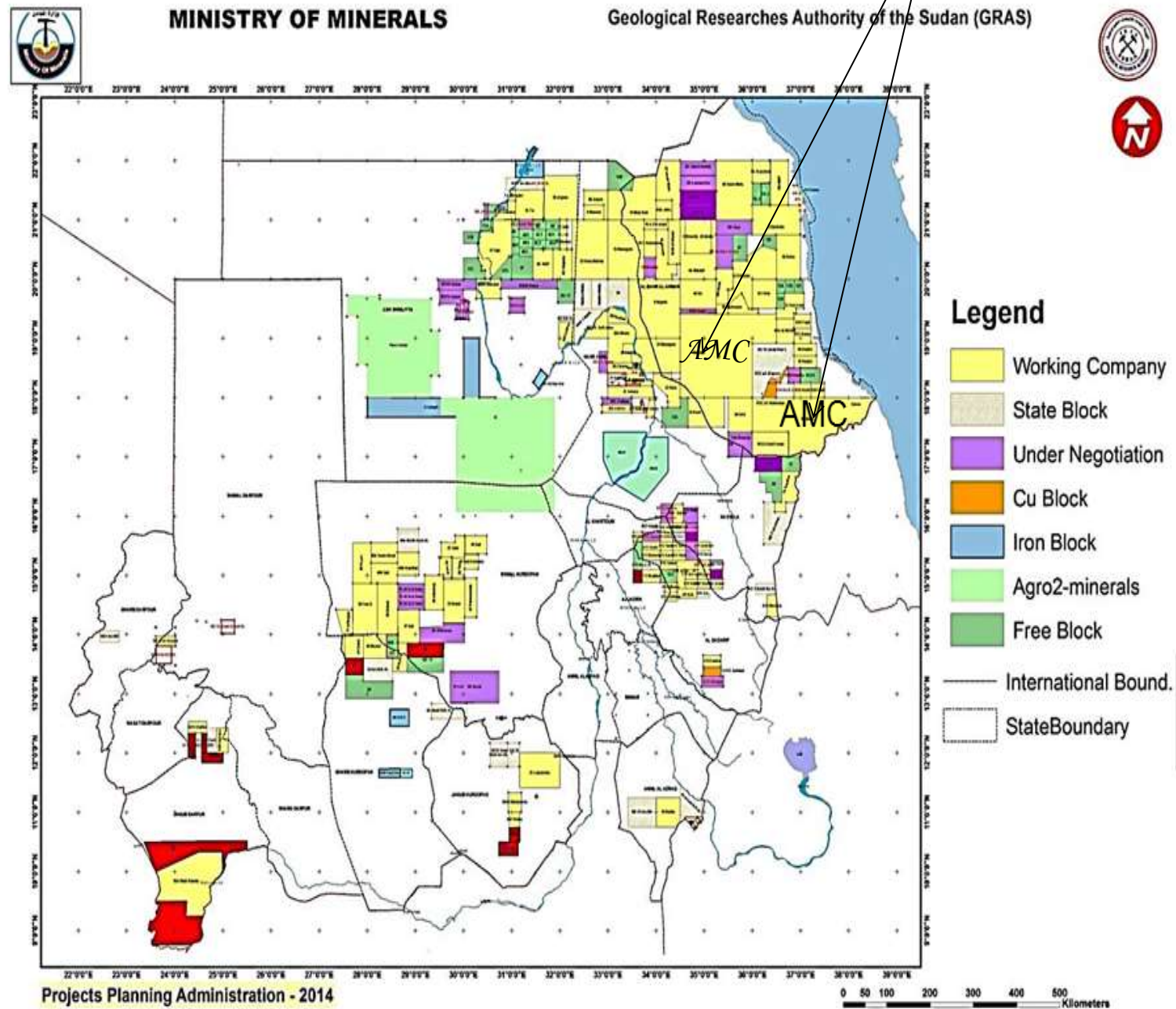
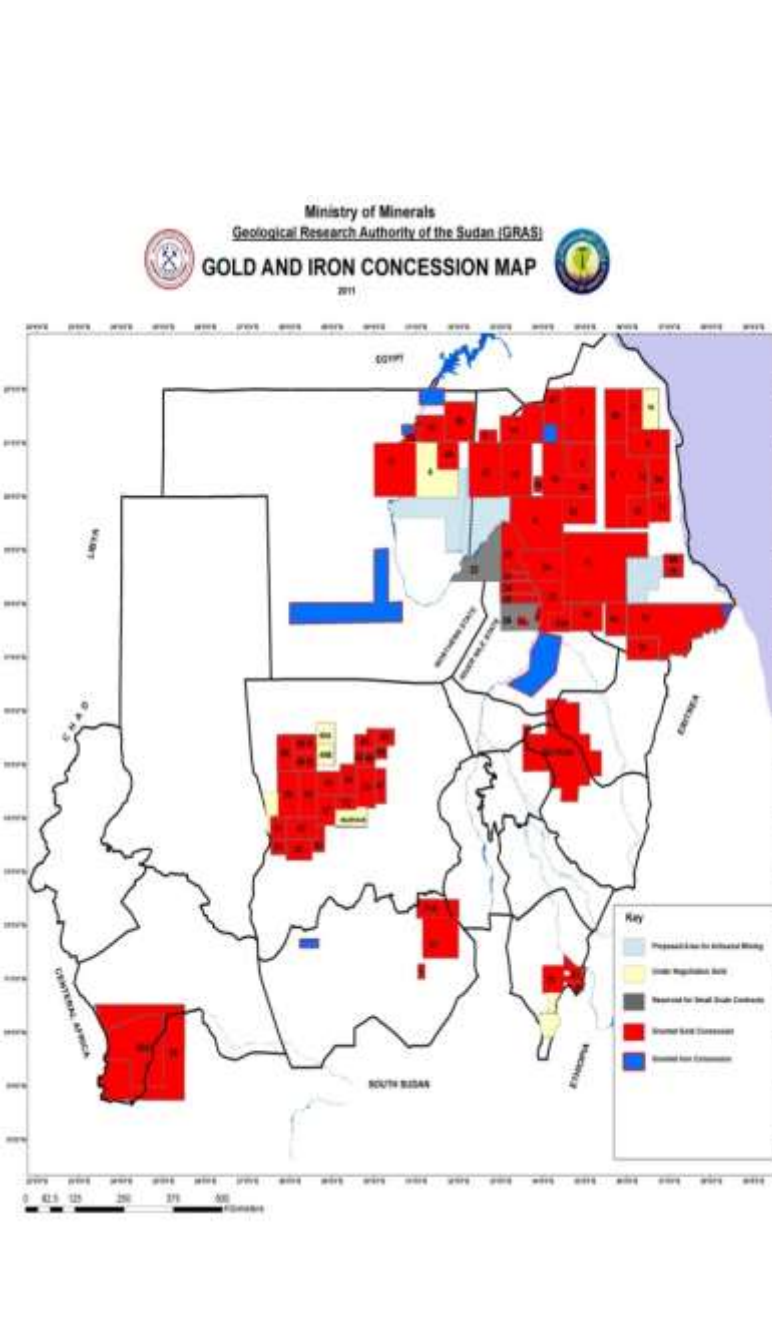
- 1- Introduction**
 - i) Location & Licenses**
 - ii) Brief History**
 - iii) Overview**
- 2- Current Operations**
- 3- Future Projects (Business Plan For Investment)**
 - a) CIL (Carbon In Leach)**
 - b) VMS (Volcanic Massive Sulphides)**
- 4- AMC Gold Production and Financial**
- 5- Social Responsibilities**
- 6- Risk and Opportunities**
- 7- Challenges and Conclusions**



1- Introduction:

i- Location & Licenses

44,000 Km²





Introduction cont.

ii- Brief History: Since 1981 Join Venture agreement concerning exploration and mining development signed between Sudan Government and French companies. Active exploration program for base metals and gold then Started. Commercial exploitation began in 1992 after establishment of AMC the Company with register capital of 30,489 803 euros. In 2012 the French shares transferred to the Egyptian investor Mr. Naguib Sawiris within the Whole La Mancha Group sale ... And so forth..

On April 2015 Sudan Government has bought all the shares of La Mancha (44%) in AMC and it is now subject for sale as equity share.

*Sudanese
Government*

95%

COMPANY SHARES

*Industrial
Development
Bank*

5%

Ariab Mining Company (AMC)



iii- OVERVIEW - HASSAI MINE



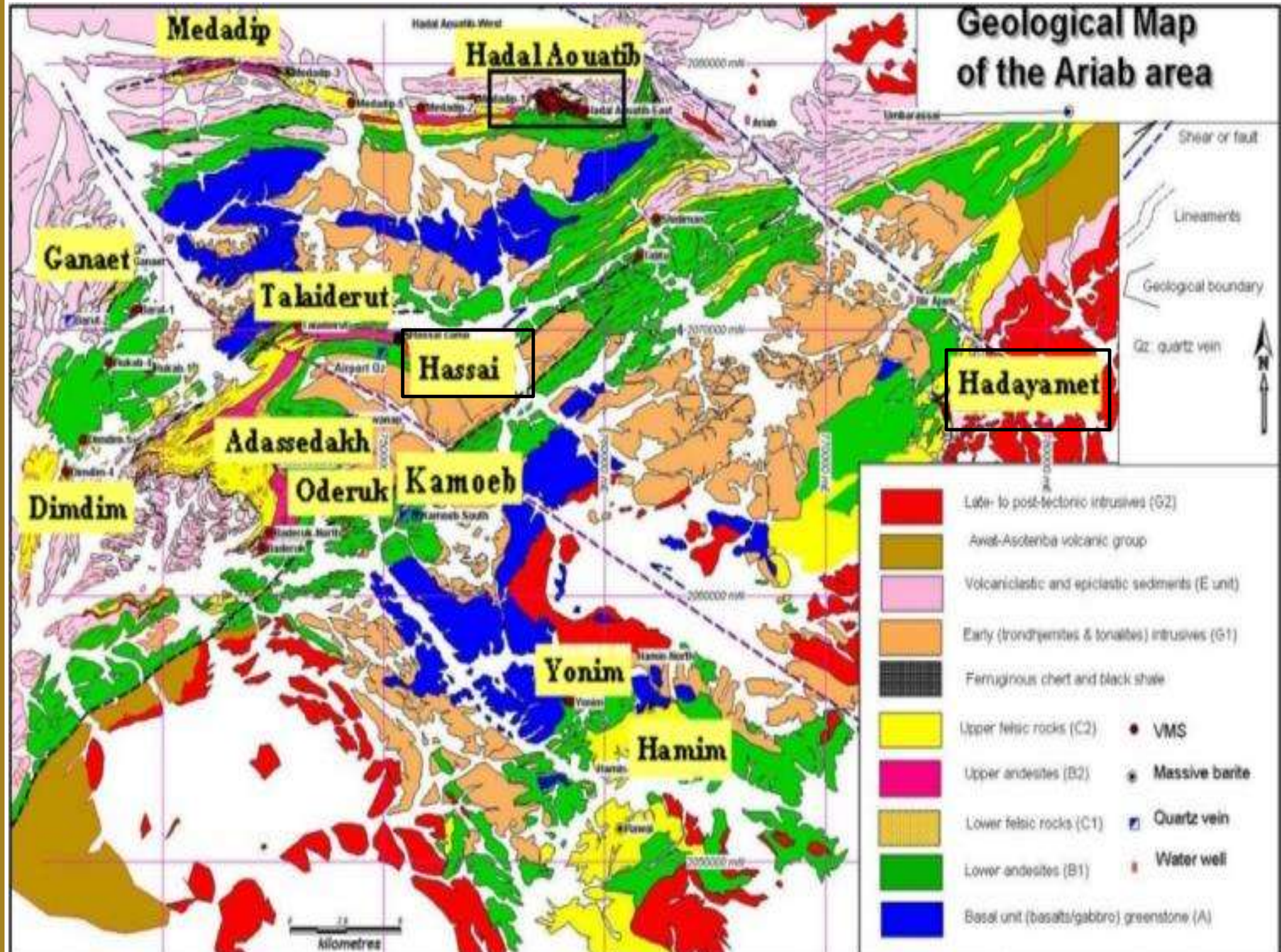
Quick facts:

- ✓ Inauguration: 1991
- ✓ Incorporated as Ariab Mining Company (AMC)
- ✓ Production to 2014: > 2,500,000 Oz or 80t processed by heap leaching + 1m Oz Ag
- ✓ 2015 expected production: 60, 000 Oz or ~ 2.0 t of gold
- ✓ Expected mine life for the current operation (HL/CIC): ~ 2 years (~ 200,000 oz)
- ✓ CIL plant under process (2017-2022)
- ✓ VMS exploration and DFS in progress
- ✓ Mine type: open pit / heap leach
- ✓ Employees: 1200 local workers



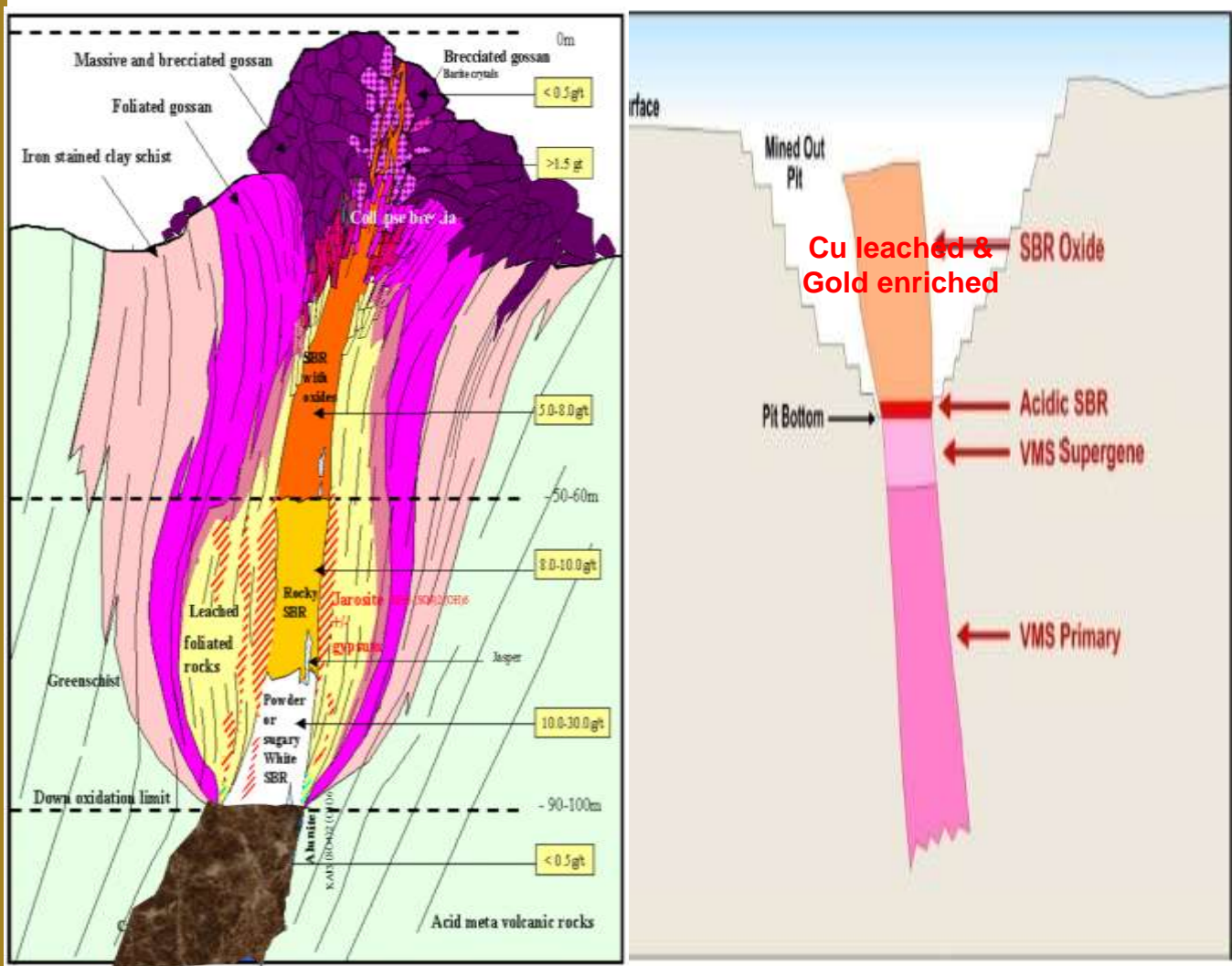
- AMC is The*
- ✓ *Only employer in a 200km radius*
 - ✓ *Quality employer*
 - ✓ *Operations are spread on a 140km² area*
 - ✓ *On site village accommodates 1200 persons*

2- Current Operation Geology and Mine sites.





2- Current Operation Mineralization TYPICAL CROSS SECTION - Hassai



Four principal zones of mineralization with the Ariab main zone have developed though the initial formation of the VMS deposit and its sub-equal oxidation horizons. Leaching and precipitation of metals and include.

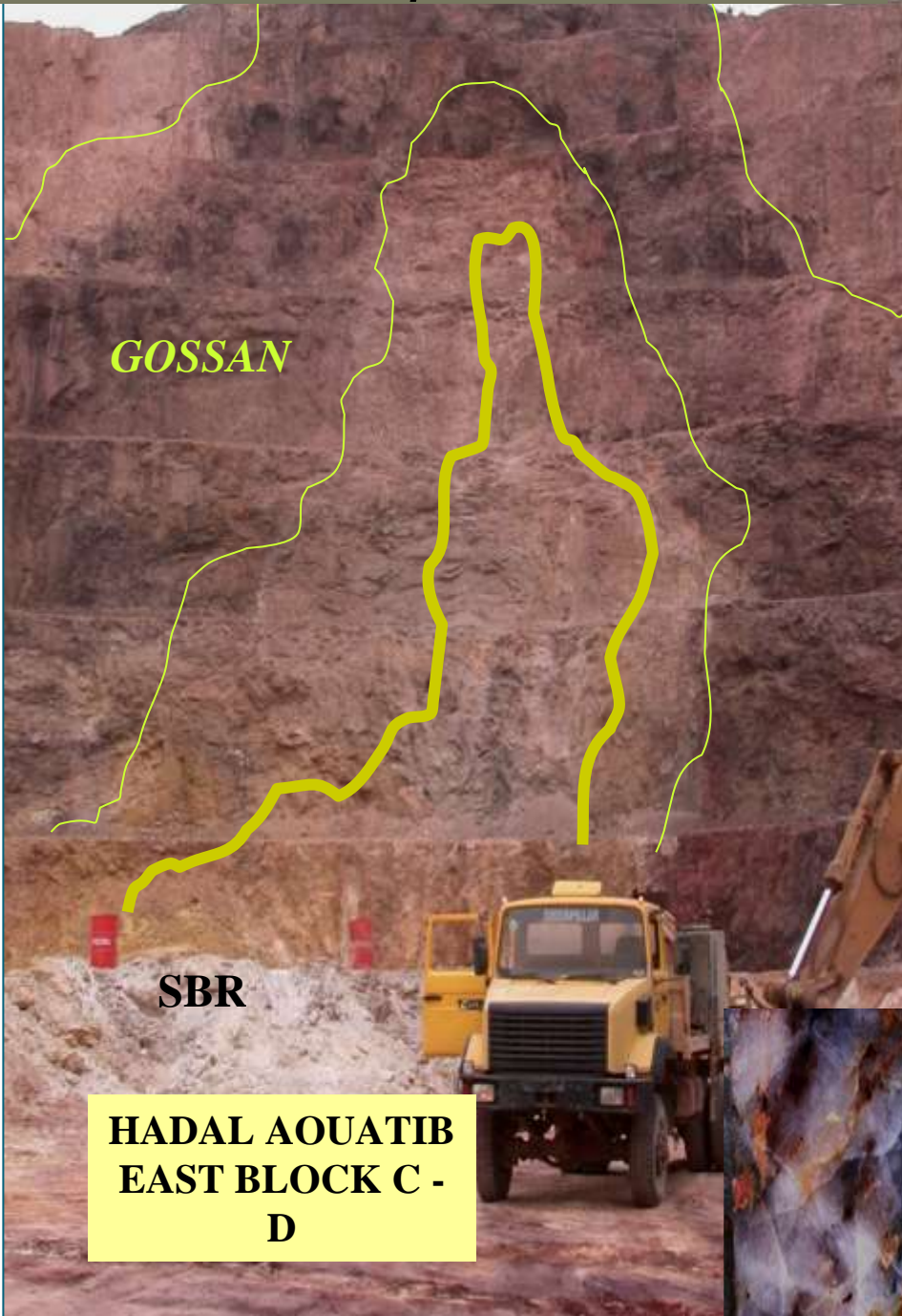
1. a near surface gold-silver rich oxide gossan-silica barite facies .
2. a gold (± silver ± faro site)/horizon that has been subjected to leaching bleaching acidification (acidified), (fais).
3. a supergene copper-enriched horizon (facies)
4. an underlying (copper-zinc) primary massive sulphide fancied (horizon).

VMS – OXIDATION PROFILE

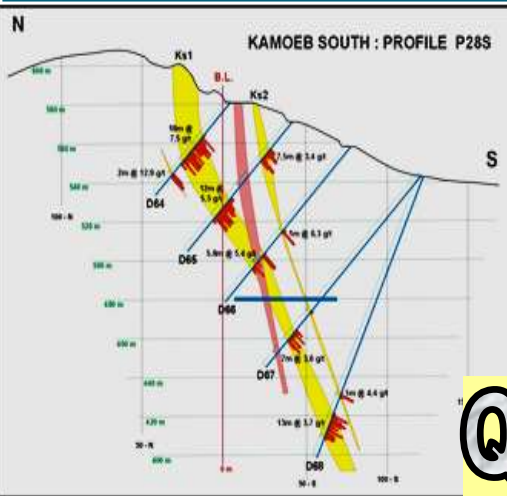
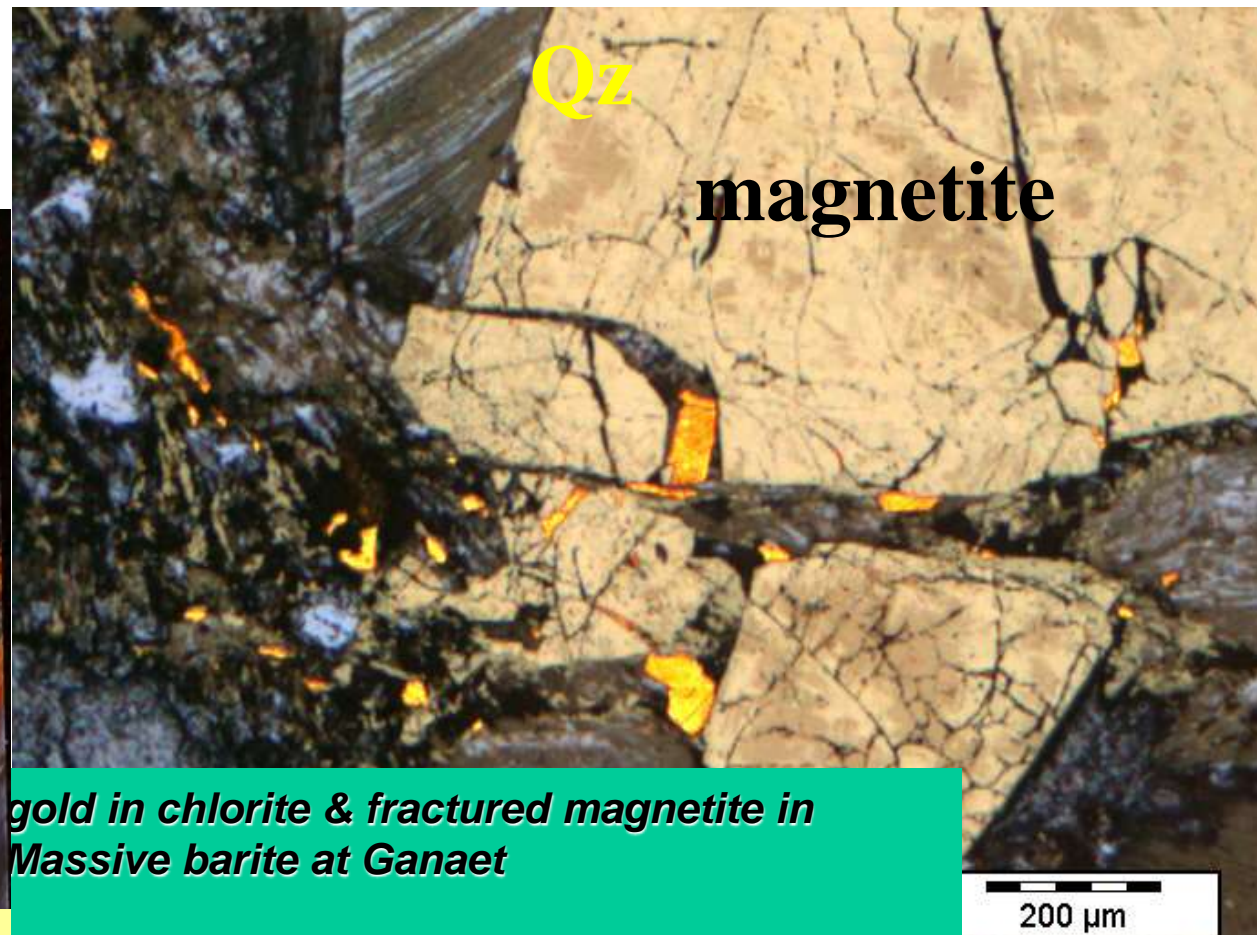
- Above Water Table Cu leached and Gold enriched in Oxidised Zone – **mostly mined out**
- Below Water Table Cu enriched in Supergene Zone
- Primary Deposits contain lower Cu, +/-Zn & Au + Ag

Schematic gossan SBR gold deposit

2- Current Operation Mineralization TYPICAL CROSS SECTION - Hassai



Leached Bleached acid volcanite with SBR Hadayamet



Quartz Veins



2-Current Operation Mining



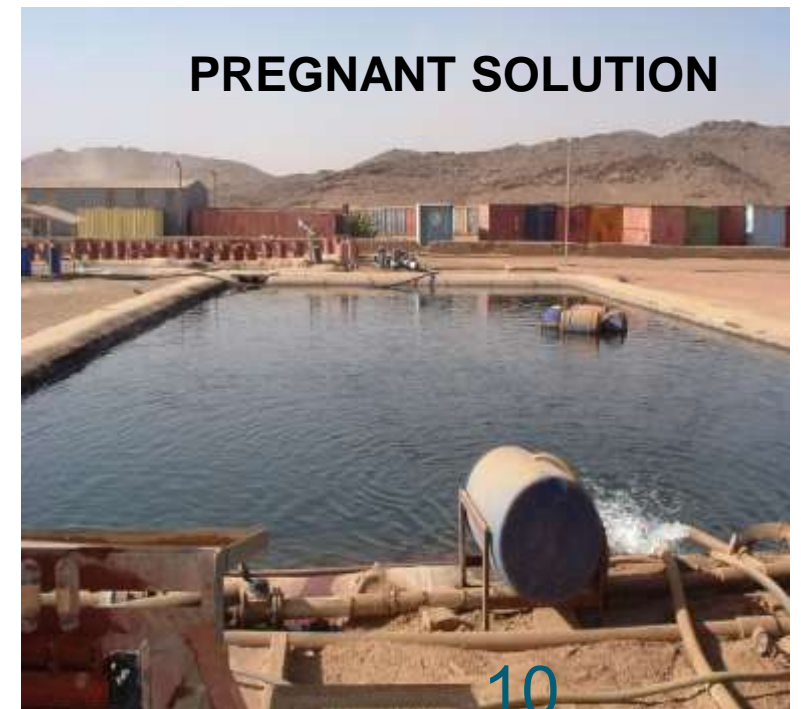
AMC Open Pits operation and Exploration for VMS



2- CURRENT AMC OPERATIONS MINING AND PROCESSING



**General Reserves: 180 Tons of
gold and 3K Tons of Silver**



Gold Hunters in AMC leased areas





Sudan Gold Refinery Co.



Gold



Silver



- Located In Khartoum – Capital of Sudan
- It is Fully owned by the Central Bank of Sudan, the Ministry of Minerals and the Ministry of Finance and National Economy
- Sudan gold refinery maintains a high quality wet chemical refinery (aqua regia process) as well as a complete precious metals melting system for accurate and reliable results.
- The refinery capable of producing gold of different purities including: 995.0; 999.0; 999.9 in one kilo or large standard bars
- Refinery can produce silver of 999.0 fineness (400 kg/day).
- The refinery has an annual production capacity of 270 to 360 t



AMC - PRODUCTION

شركة ارياب للتعدين المحدودة
ARIAB MINING COMPANY LTD.

768

	WASTE	ORE MINED			ORE PROCESSED			n°	GOLD		GOLD	ounces
	t	t	cyan g/t	Au kg	t	cyan. g/t	Au kg		Au kg	%	CUMUL	
1992	834,630	113,385	11.16	1,265	97,240	12.18	1184		982.0	83%	982.0	31,572
1993	2,594,550	135,607	15.50	2,102	127,056	15.53	1,973	1 to 72	1,862.7	94%	2,844.7	59,888
1994	3,116,970	271,016	13.28	3,599	168,435	18.16	3,049	1 to 86	2,679.6	88%	5,524.3	86,151
1995	4,965,530	277,967	15.05	4,183	203,349	19.92	4,051	0 to 123	3,750.4	93%	9,274.7	120,579
1996	9,188,507	432,794	13.95	6,037	383,910	15.15	5,921	0 to 176	4,571.2	77%	13,846.0	146,968
1997	11,170,830	574,994	10.32	5,934	432,403	12.43	5,376	0 to 190	4,556.9	85%	18,402.8	146,507
1998	11,045,460	515,887	12.03	6,205	651,133	10.92	7,111	1 to 237	5,671.0	80%	24,073.8	182,327
1999	13,305,145	583,401	10.62	6,194	702,776	10.30	7,241	1 to 292	5,565.7	77%	29,639.6	178,942
2000	14,522,940	519,908	11.23	5,839	763,515	8.80	6,716	1 to 294	5,772.9	86%	35,412.5	185,603
2001	15,127,500	1,046,160	8.14	8,512	754,034	8.49	6,404	1 to 292	5,415.9	85%	40,828.4	174,126
2002	15,179,000	993,450	5.85	5,813	800,258	8.21	6,568	1 to 315	5,263.9	80%	46,092.3	169,238
2003	14,606,541	1,034,215	7.21	7,456	920,000	6.99	6,431	1 to 292	5,172.9	80%	51,265.1	166,312
2004	13,117,600	851,102	6.04	5,139	915,864	6.22	5,699	1 to 293	4,281.0	75%	55,546.2	137,639
2005	9,396,000	1,530,772	5.78	8,852	1,038,793	5.78	6,009	1 to 310	4,738.6	79%	60,284.8	152,350
2006	9,266,000	1,017,327	5.24	5,328	937,467	4.43	4,148	1 to 280	3,156.3	76%	63,441.1	101,478
2007	5,746,410	541,747	4.58	2,483	888,621	4.06	3,598	1 to 294	2,703.0	75%	66,144.1	86,903
2008	3,703,000	458,776	4.07	1,867	809,275	4.07	3,293	1 to 286	2,276.0	69%	68,420.1	73,175
2009	2,999,405	177,367	3.11	551	725,303	3.78	2,740	1 to 230	1,921.8	70%	70,342.0	61,789
2010	5,412,797	573,102	3.49	1,998	812,440	3.70	3,005	1 to 230	2,128.1	71%	72,470.1	68,421
2011	5,915,000	535,831	4.02	2,156	773,867	3.83	2,966	1 to 163	2,231.2	75%	74,701.3	71,734
2012	4,432,590	797,584	3.85	3,067	766,505	3.78	2,899	1 to 164	1,984.6	68%	76,685.9	63,806
2013	4,974,378	745,956	3.09	2,305	758,190	3.25	2,464	1 to 144	1,546.5	63%	78,232.4	49,723
2014	5,189,834	806,718	3.00	2,416	821,077	3.04	2,496	1 to 166	1,775.2	71%	80,007.6	57,074
Total	185,810,617	14,535,066	6.83	99,302	15,251,511	6.64	101,343		80,007.6	79%		2,572,304

Gold in Tailings
Grade

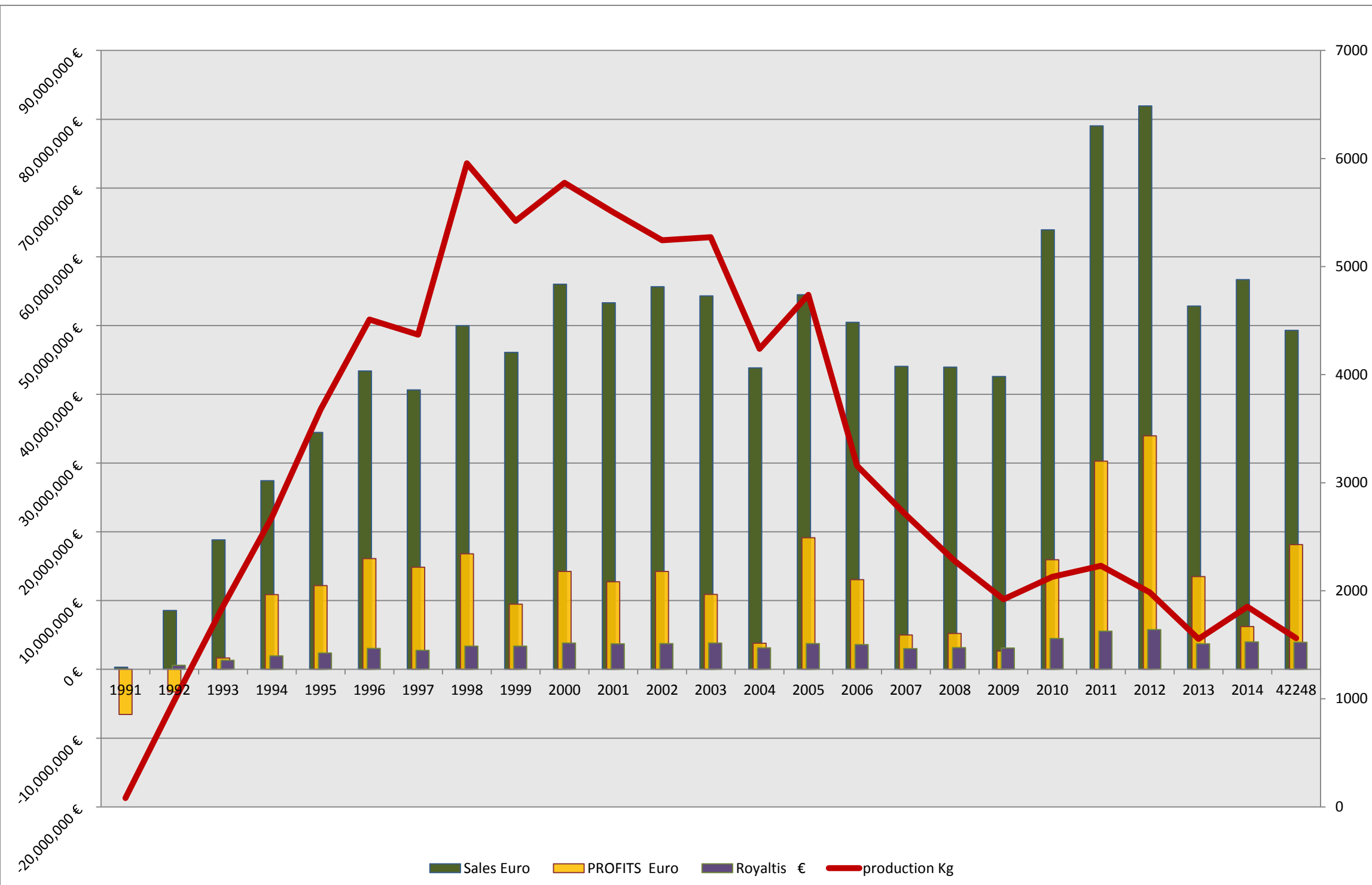
21,334.9
1.40

Ag 42000 kg





4- AMC Gold Production Revenue and Financial



4- AMC Gold Production and Financial



	YEAR	Gold production Kg	Profit % of Sales	Sales Euro	PROFITS Euro	Royaltis €	B.P.TAX €	ZAKAT €	DIVIDENS PAID IN EURO					
									Sud.Government	Cominor	SDB	CCI	TOTAL	
Ioan	1991	81	00.00%	320,142.94	6,559,963.84-									
	1992	982	-38.27%	8,565,172.87	3,277,721.71-	588,148.31								
	1993	1857	08.72%	18,839,640.71	1,643,387.30	1,315,635.02								
	1994	2680	39.57%	27,442,036.29	10,860,066.59	1,948,908.24			4,313,763.71	3,547,577.20	442,013.27	650,395.68	8,953,750.04	
	1995	3679	35.39%	34,457,574.05	12,193,466.04	2,374,393.44			3,414,875.37	2,857,357.88	334,791.61	544,945.63	7,151,970.67	
	1996	4510	37.09%	43,400,247.27	16,098,477.08	3,050,352.39			5,925,804.89	4,958,349.56	580,961.10	945,639.42	12,410,755.16	
Dividens	1997	4370	36.58%	40,630,488.74	14,864,375.56	2,775,944.15			1,167,183.82	2,806,015.94	343,103.74	369,197.83	4,685,501.52	
	1998	5957	33.63%	49,966,615.65	16,804,829.39	3,387,426.92			4,664,939.93	3,048,980.34	381,122.54	304,898.03	8,399,941.05	
	1999	5423	20.54%	46,091,300.65	9,467,833.87	3,390,253.17			4,276,194.93	2,134,286.24	266,785.78	213,428.62	6,890,695.94	
	2000	5775	25.42%	56,024,723.11	14,240,863.88	3,838,272.33			5,442,429.92	4,268,572.48	533,571.56	426,857.25	10,671,431.48	
	2001	5502	23.92%	53,308,931.38	12,750,462.45	3,724,873.89			7,948,256.00	6,214,709.95	779,240.90	621,471.00	15,563,678.14	
	2002	5244	25.59%	55,642,269.64	14,236,180.00	3,742,382.00		376,830.78	6,659,853.44	5,242,631.00	652,926.74	524,263.11	13,079,674.55	
	2003	5272	20.05%	54,308,502.79	10,887,968.49	3,836,562.00		402,646.72	7,689,613.84	6,031,069.68	753,883.71	603,106.97	15,077,674.55	
	2004	4239	08.69%	43,832,164.27	3,807,864.44	3,121,663.36		415,150.43	4,179,459.79	3,255,577.46	409,750.96	325,557.75	8,170,346.78	
	2005	4739	35.14%	54,468,152.00	19,141,276.82	3,737,381.38	1,007,832.70	484,797.00	5,749,129.66	4,702,666.40	606,768.73	470,266.64	11,528,831.67	
	2006	3156	25.84%	50,465,167.00	13,039,809.00	3,596,562.00	1,600,000.00	841,634.93	3,538,322.23	3,600,000.00	422,134.44	360,000.00	7,920,457.06	
	2007	2703	11.34%	44,078,812.00	4,999,790.00	3,012,929.00	591,583.90	772,572.00	4,206,418.64	3,259,816.27	481,270.60	325,981.53	8,273,487.76	
	2008	2276	11.88%	43,955,337.00	5,223,941.00	3,166,889.00	859,049.00	718,473.00	3,744,769.38	3,088,303.05	431,297.90	308,830.32	7,573,201.42	
	2009	1922	06.21%	42,592,340.00	2,646,624.55	3,109,390.00	573,539.00	699,909.38	6,022,435.97	1,566,006.81	289,319.97	156,600.68	8,034,364.82	
	2010	2128	24.95%	63,929,355.00	15,949,648.33	4,491,485.00	2,635,238.59	808,236.98	627,453.20	-	797,482.42	-	1,424,936.06	
	2011	2231	38.29%	79,047,722.00	30,267,948.00	5,553,498.00	4,650,922.00	1,013,325.08	-	2,603,572.66	-	101,313.03	2,704,886.03	
	2012	1985	41.46%	81,928,671.00	33,968,208.00	5,771,766.00	5,043,169.00	1,365,097.00	-	728,823.24	-	159,044.24	887,867.80	
	2013	1555	25.53%	52,851,471.00	13,491,364.00	3,724,156.00	2,068,332.00	1,242,844.01	2,556,066.70	2,892,503.91	-	72,882.32	5,521,453.35	
	2014	1852	10.99%	56,686,940.00	6,230,831.00	3,987,733.00	1,065,970.00	1,212,878.69	31,289.84	976,520.29	-	289,250.39	1,297,061.33	
	Sep-15	1562	36.78%	49,314,412.00	18,137,130.00	3,927,873.00	2,789,572.94	-	61,794,284.36	-	-	-	-	
TOTAL B	81,680.20	21.81%	1,152,148,189.35	291,114,660.23	81,174,477.59	22,885,209.13	10,354,396.00	143,952,545.60	67,783,340.37	8,506,425.97	7,773,930.45	166,221,967.21		

3- Future Projects (Business Plan for Investment)

a) CIL (Carbon In Leach)

b) VMS (Volcanic Massive Sulphides)

SNAPSHOT OF STUDY

CIL with 2 m.t.p.a (2015)

External Consultants:



SEDGIMAN



Project details

Mill size mtpa	2
Start date	2018
Tax regime	
Royalties on gold	7%
Tax holiday	15%
Avg. Gold price	1,100 \$/Oz

Key production figures

Tons milled (Mt)	12.72
recovery rates %	70.3%
Gold produced KOz Au equiv.	506
All in sustaining cash cost Euro,Oz	611

Key Financial figures

EBITDA MEuro	89.6
Initial capex	97.5
Unlevered cash flow (MEuro)	72.9
NPV at 12% (MEuro)	40.9
IRR	34.0%

	Phase 1: CIL	Phase 2: VMS	Global
Main assumptions			
Gold price	USD 950/oz	USD 950/oz	
Copper price	..	USD 2.19/lb	
Royalties (%)			
Gold	7%	5%	
Copper	..	3.5%	
Corporate tax rate	10%	10%	
Production:			
Commissioning	2013	2015	..
Yearly mill run rate, Mtpa	3	5	..
Gold recovered, '000 oz	811	378	1,189
Copper recovered, '000 t	..	323	323
Metallurgical recovery			
Gold	79%	36%	..
Copper	..	90%	..
Yearly production*			
Gold (oz)	155,880	59,355	..
Copper (t)	..	51,516	..
Mine life, years	6	10	6+
Financials:			
Initial capital cost	\$185.6 M	\$319.4 M	\$505.0 M
Average cash costs	\$ 482/oz Au	\$ 1.24/lb Cu***	-
Internal rate of return	30%	11%	17%
NPV @ 5% discount	\$149.8 M	\$122.7 M	\$238.7 M
Payback**, years	1.9	3.9	varies

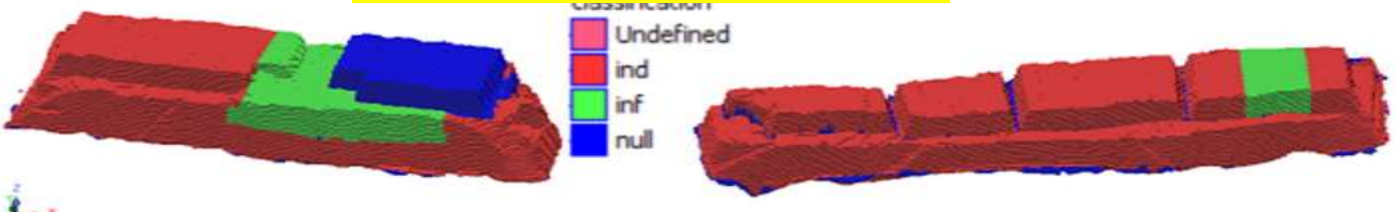


3- Future Projects

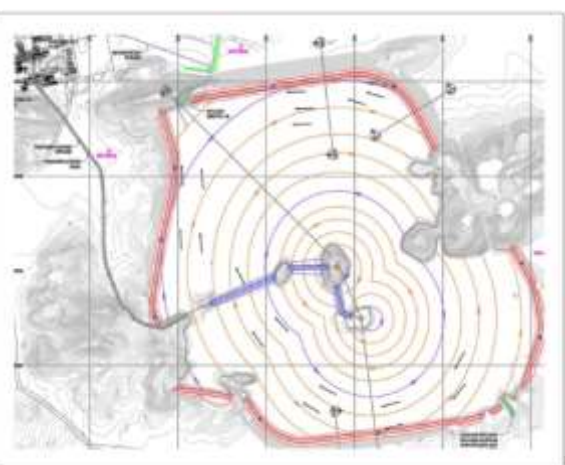
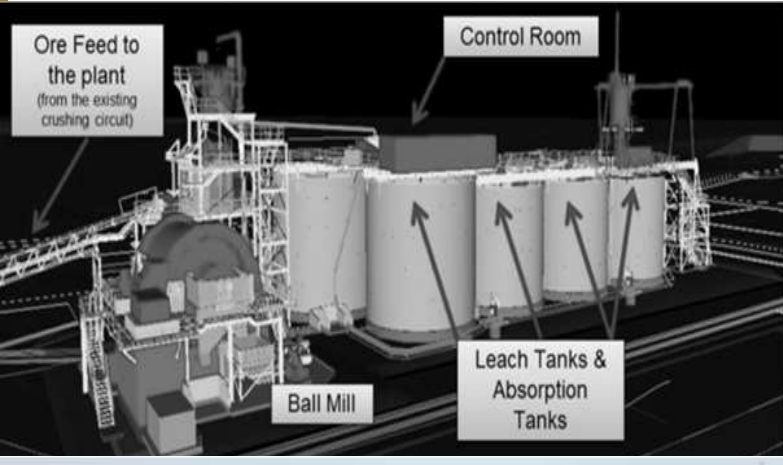
CIL (Carbon In Leach) Resources & Reserve Gold

TAILLING MINED		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	
ROM	Mt	14,60	3,14	3,48	2,74	2,40	2,83	0,00
Waste	Mt	2,40	0,74	0,74	0,53	0,22	0,16	0,00
ore tonnage	Mt	12,20	2,41	2,74	2,21	2,18	2,67	0,00
ore gold grade	g/t	1,6	2,1	1,7	1,5	1,4	1,2	0,00
ore gold content	kg	19 362	5 076	4 637	3 236	3 144	3 269	0
ore silver grade	g/t	7,6	8,9	7,4	6,3	8,0	7,5	0,00
ore silver content	kg	93 060	21 386	20 223	14 005	17 317	20 128	0

12Mt tailings @ 19t of Gold reserve



Block-model caption looking North showing tailing pads with their resource classification

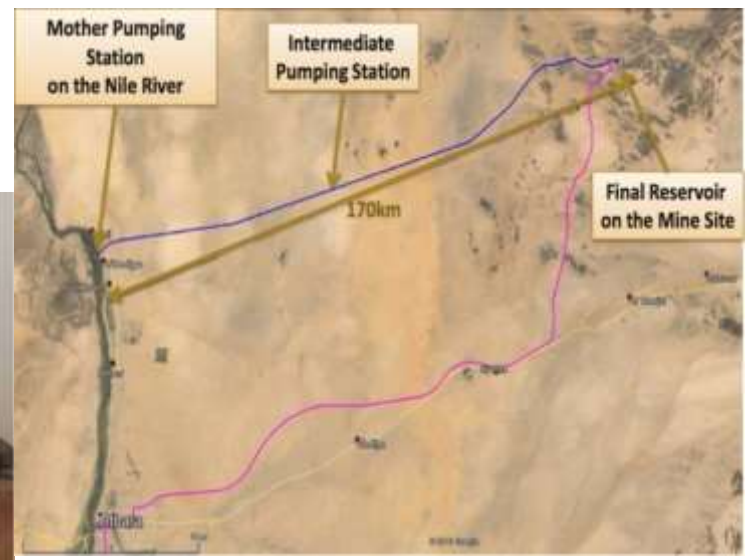


Direct Field Cost	
Machinery, Electrical & Piping	€ 12,622,699
Steel Structure & Platework	€ 3,310,069
Earthwork & Civils	€ 8,537,087
Spares Commissioning	€ 106,529
Transport	€ 2,185,862
Vendor Services	€ 361,141
<i>subtotal</i>	€ 27,123,387

Indirect Field Cost	
Spares (2Years)	€ 1,936,776
Insurance	€ 347,950
Construction	€ 7,300,516
EPCM	€ 11,012,375
<i>subtotal</i>	€ 20,597,617
Total Process Plant	€ 47,721,004

Nile Pipeline	€ 38,885,000
Phase 2 of Power station	€ 7,029,274
TSF Earthwork	€ 3,627,211
Total Infrastructure	€ 49,541,485

TOTAL PROJECT COST	€ 97,262,489
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1m @16,6% Cu and 1,58g/t Au included
in 12,9m@4,87%Cu and 1,07g/t Au

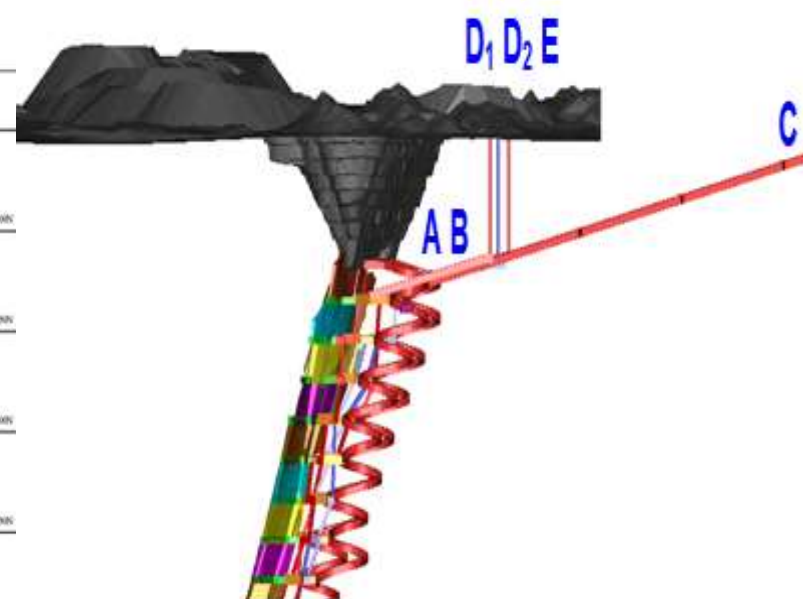


*This Project will employ more than 500 person for infrastructure constructions and more than 350 as permanent skill workers.
Expected life time per the current prefeasibility study is more than 20 years*

1m @18,5% Cu and 0,79g/t Au included
in 7m@9,56%Cu and 0,86g/tAu



HAW Open Pit Design



Hassai U/G Mine Entrance

	Ore (t)	Gold (g/t)	Gold (oz)	Copper (%)	Copper (t)	Zinc (%)	Zinc (t)
HADAL AWATIB EAST	67.477.564	1,11	2.404.300	1,05	706.200	0,75	508.800
HASSAI SOUTH	41.915.000	1,46	1.972.000	1,25	525.000	0,29	121.900
HADAYAMET	7.796.828	0,93	232.670	1,01	78.820	1,97	153.460
TOTAL	117.189.392	1,22	4.608.970	1,12	1.310.020	0,67	784.160



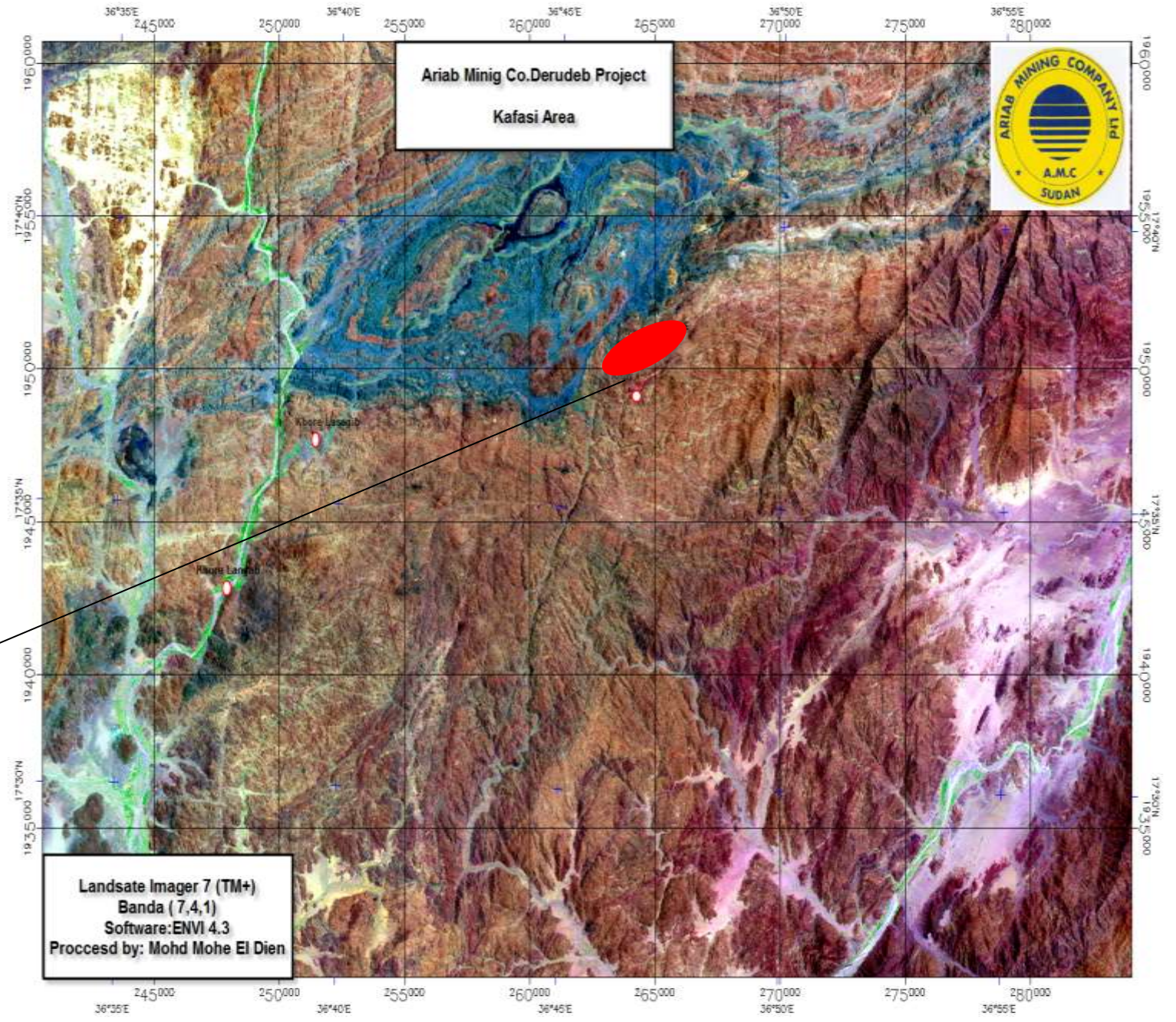
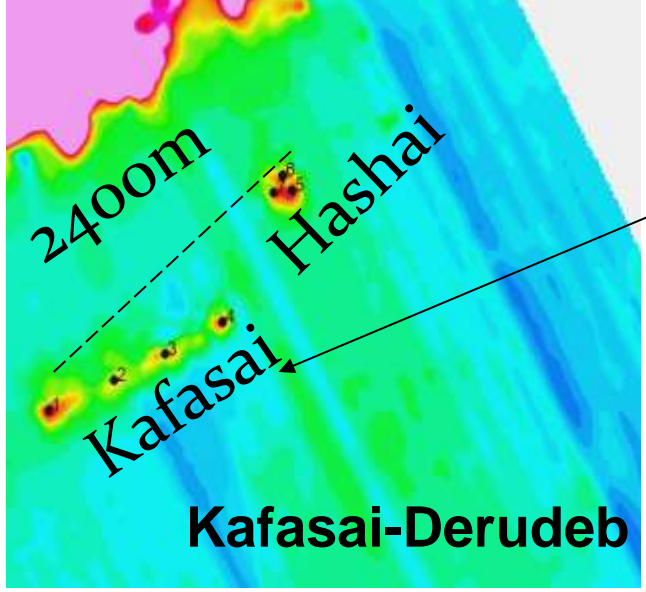
Future Projects: Opportunity for Stand alone Project



Derudeb Anomaly (block-18)



1ST Target Kafasai

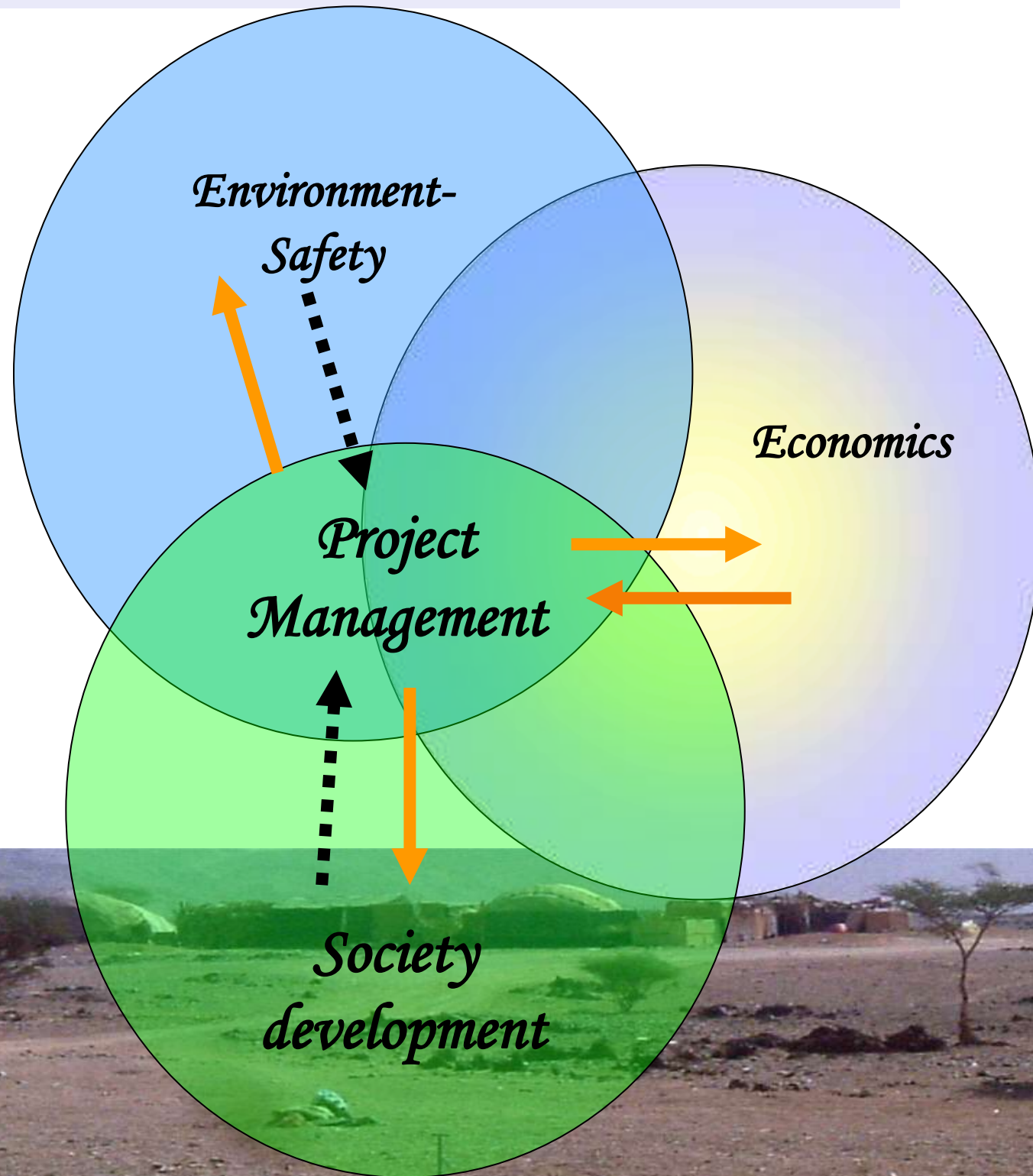


SAFETY & ENVIRONMENT ACTION PLAN

Our Gold enterprise Commitments Stands on a Triad of:

- **Economics**
- **Society**
- **Environment**

INTERACTIONS





5- Social Responsibilities



AMC's Workers Safety and Capacity Building Policy

- AMC supports the highest standards in respect to the safety of its workers;
- AMC commitments to its workers:
 - ❖ Defining a clear and precise safety organization
 - ❖ Integrating safety as a key component of our business
 - ❖ Establishing a prevention policy and a continuous improvement initiative
 - ❖ Developing an integrated safety management training system



On job Training Session





- Social Responsibilities



Training of University Students



5- Social Responsibilities

Socio-Economic Issues at Hassai

- *AMC is the biggest employer in the region and as such is aware of its responsibilities for the local communities (more than 1200 employees on site 60% of them from the region).*
- *AMC is operating a clinic for the labour force and medical centers for their families and for the local population in the vicinity of the mine >7000 inhabitants. AMC employs a full time physician and an assistant and provide all free medications.*
- *AMC also supports the local schools, teachers with incentives, equipment and building expertise, as well as donation for school events. Emergency transport by ambulance/ vehicles as provided by AMC to the surrounding villages.*
- *The mine also provides housing, water and telecommunication to the population around the mine.*
- *The presence of the mine has resulted in a change of life style for the nomadic local population*



- Ensuring that statutory requirements are complied with in all sections;
- Improving the monitoring and evaluation methods used to prevent chemical and biological risks to the environment;
- Managing property use by making good utilization of space in the future and preserving ecosystems.
- Improving, on a comparative basis, environmental performance figures by reducing:
 - ❖ pressure on natural areas and consumption of materials and energy,
 - ❖ contaminants released into water and the atmosphere.



Social Responsibility and the Regional Development Fund

Facts and figures:

- ❖ Development Fun was allocated by AMC in 1998 (500000 USD/Annum)
- ❖ Supports community projects benefiting to the community living surrounding the mine

Accomplishments to date:

- ❖ 7 Basic schools
- ❖ 2 medical clinics
- ❖ Water and Power supply
- ❖ High Secondary School
- ❖ Transportation and Communication services





5- Social Responsibilities



Ariab Region Sustainable Development Projects

School inauguration



Coeducational school



Honest Cooperation Results in Win-Win Condition

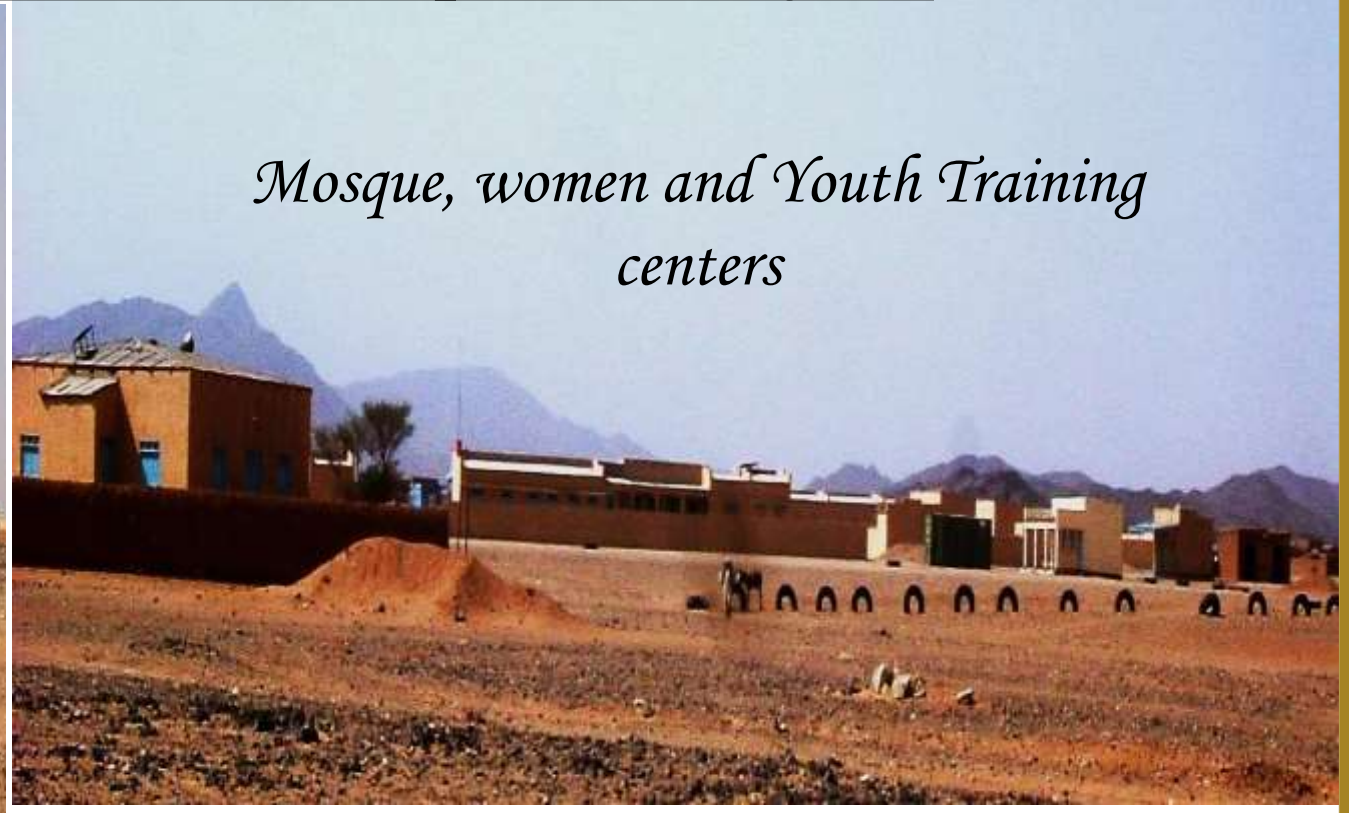


Ariab Region Sustainable Development Projects

Communication facilities



Mosque, women and Youth Training centers



Supporting community events



Schools with Modern Furnisher





5- Social Responsibilities

Social Services, water supply and direct contribution





Risks & Opportunities

- Metal price fluctuation
- An increase in initial Capital , long PBP (Pay Back Period) with strong initial capital (VMS project)
- Recovery rates of the metals
- Impact of supergene material on recovery & operating cost
- Still some resources to be upgraded to reserve and develop other targets (>10 targets)
- Infrastructure available as CIL has included most of it , water, power camp and existence of skill workers.....etc.

Challenges & Conclusions

- **Technology and innovation are basic elements for development to be adopted**
- **Limited Number of Financial institutes to fund projects locally**
- **More efforts needed to Attract DFI (**fiscal system upgrade**)**
- **Design global incentives for competitive business environment**
- **Limited Human Capital or Capacity building institute in the field of the extractive industry**
- **To Add value for the current exported raw materials (+ accredited smelters)**

