

Ghana's state mining companies and mineral sector development

Peter Claver Acquah

1. Introduction

Ghana has a large mineral resource base, comprised mainly of gold, diamonds, bauxite, manganese and iron ores (of medium quality). There are smaller deposits of tinstone, titanium and impure graphite. Lead, copper, molybdenum, tungsten, niobium, barytes and asbestos have been found, as well as uranium, cassiterite, platinum, molybdenite and columbite-tantalite. G O Kesse has developed a detailed account of Ghanaian mineral resource potential in *The Mineral and Rock Resources of Ghana*.¹

Ghana's main rock formations, mostly Precambrian, are the metamorphosed and folded Birrimian, Tarkwaian, and Dahomeyan systems; the Togo series and the Buem formation. Most of the minerals currently being mined are derived from the Birrimian systems², which underlie nearly one-sixth of the total area of Ghana.

The mining industry contributes to Ghana's economy by earning and/or saving foreign exchange; providing employment; supplying raw material inputs for some industries; paying taxes; and promoting rural development. Mining accounts for about 20% of the country's foreign exchange earnings; it is Ghana's second largest foreign exchange generator. The mining sector directly employs approximately 23 000 (1987) people, of whom about 11 000 work for the State Mining Enterprises. It has been estimated, conservatively, that every man employed in Ghana's gold mining industry directly supports some five other persons.³

Ghana's mining potential lies in future discovery and development of gold, diamonds, base metals and industrial minerals. Until recently the country was unable to attract new foreign mining investment capital; however, some Ghanaian and foreign companies now have been given concessions for prospecting. A few of these companies have completed exploration and feasibility studies

and are negotiating for mining leases. In addition, there are plans to develop forward and backward linkage industries to support mineral production (especially of gold and diamonds) and to increase the economic impact of mining development.

Table 1 gives the mineral production statistics from 1980 to the first quarter of 1987. Table 1 shows that from 1980 to 1986 inclusive, Ghana exported 2 173 027 ounces and 4 534 522 carats of gold and diamond, respectively. For the same period, 924 008 and 1633 131 metric tons of bauxite and manganese were exported. As shown in Table 1, there was a general decline in mineral production from 1980, with the lowest point reached between 1982 and 1984. This decline caused the government to introduce measures to reverse this trend, most notably the rehabilitation program.

Table 2 shows that, from 1980 to 1986, Ghana's mineral export earnings exceeded 1 011 GUSD. The cumulative percentage of export earnings from 1980 to 1985 for gold, manganese, diamond and bauxite was 89.0, 5.5, 3.7 and 1.8 respectively. Gold, then, is the main foreign exchange earner in the minerals sector.

Table 3 shows Ghana's mineral export earnings compared against total export earnings from 1980 through 1985. In that time, the percentage of foreign exchange earned by the mineral sector ranged from about 13% to 30%. Table 3 also shows that the relative export earnings from minerals declined from 17.9% in 1980 to 13.1% in 1982. However, it reached a peak of 29.7% in 1983 and afterward declined to 25.9% and 20.1% in 1984 and 1985, respectively. The 1983 figure is an anomaly, however; the nation's production of cocoa, its main foreign exchange earner, declined sharply that year because of a drought and resultant bushfires that devastated cocoa plantations.

Individual circumstances at each mine contributed to the mining sector's

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Minerals Commission,

sharp production decline between 1972 and 1982.⁴ However, the following are common to all Ghana's mining operations:⁵

- (i) inadequate re-investment, development and exploration
- (ii) mining of low-grade ores,
- (iii) lack of training programs and facilities,
- (iv) loss of technical personnel,
- (v) ineffective management,
- (vi) inadequate mine infrastructure,
- (vii) financial insolvency because of an imbalance in prices and costs.

The government's basic policy objectives for the mining sector in the *Economic Recovery Program* (ERP) in 1984 and 1986 were to boost Ghana's Gross Domestic Product through increasing mineral production; halt the decline in output; and reverse the overall downward trend during that period. The rehabilitation program for the gold subsector centered on the State Gold Mining Corporation, and involved the Prestea, Tarkwa underground mines and the Dunkwa alluvial mine.

The rehabilitation program emphasized repair and overhaul of underground ore extraction operations, haulage facilities, and equipment; modifications to increase processing mills'

capacity; repair of the Dunkwa dredges; and increasing the stock of spare parts and consumables. Concurrently, the Ministry was to engage a mining company to manage the *State Gold Mining Corporation* (SGMC) rehabilitation program under a management agreement. The Ministry was also to formulate a medium-range plan that would ensure SGMC's long-term viability.

Policies and strategies for other mineral sub-sectors are discussed below.

2. The mineral sector

Ghana has excellent mineral resource potential, although the mineral sector has had limited impact on the country's economy. This is primarily because the nation's mining sector was largely neglected until the 1984 introduction of the Economic Recovery Programme.

Five large mining companies or corporations currently exploit the Ghana's minerals. They are the *State Gold Mining Corporation* (SGMC); *Ashanti Goldfields Corporation* (AGC); the *Ghana National Manganese Corporation* (GNMC); *Ghana Bauxite Company* (GBC) and *Ghana Consolidated Diamonds* (GCD). The SGMC and the AGC produce gold, while the GNMC, the

GCD and the GBC produce manganese, diamonds and bauxite, respectively. Since AGC and GBC are not wholly state-owned, their activities are not discussed in this paper.

2.1 Gold

Gold mining in what was then the Gold Coast (now Ghana) began in the 17th century B.C. For many centuries Ghana was a major source of world gold production; indeed, Ghana was the world's leading gold producer for some centuries.

Table 4 summarizes gold production of the Gold Coast from 1493 to 1934. It shows that the Gold Coast produced about 35.5% of the entire world's production of gold during the period 1493-1600. Production dropped from 35.5% to 22.8% during the period 1601-1700, and was sharply down to 8.9% from 1701 to 1800. By 1900, the Gold Coast lost its position as a major world producer; its share of total production dropped to 0.7%, while South Africa had emerged as the world's major source of gold.⁶ Ghana's gold production for 1984, 1985 and 1986 was 0.6, 0.6, and 0.5%, respectively of the total world gold production.

During the period 1880 and 1934, there were 45 mines operating on the then Gold Coast. Thirty-three of those companies were listed on the London Stock Exchange by June 1935. By 1933, there were as many as 7 000 enquiries reported for mineral concessions in Ghana, of which 600 concessions had obtained good title and certificates of validity by 1935.

At the beginning of the Second World War (1939), the British Government closed a number of mines in the Gold Coast to mobilize for war. Only eleven of these mines were re-opened after the war, although the others' resource potential was still good. The war's repercussions overall, when added to the mine closures and the Gold Coast's movement for independence, adversely affected the

Table 1
Mineral production statistics, 1980-1987

Year	Exported bauxite (in Mt)	Exported manganese ore (in Mt)	Gold produced (Fine Ozs)	Diamonds produced (Carats)
1980	196 892	240 006	342 904	1 148 698
1981	156 769	197 439	338 041	836 020
1982	92 954	132 232	337 754	682 415
1983	82 310	175 288	285 291	336 309
1984	44 169	267 996	282 298	341 978
1985	12 4453	357 270	299 615	631 801
1986	226 461	262 900	287 124	557 301
1987 (up to March)	49 887	65 070	80 243	-

investment climate for foreign mining equity-capital in the post-war era.

From about 1950, most of Ghana's eleven operating gold mines deteriorated. There was little ore reserve exploration; costs rose; and the grade of ore being produced was poor. Mining operations lacked working capital. Gold prices, which had been fixed at 35.00 USD an ounce since 1934⁷, held down development. Ghana's struggling gold mines had to request Government grants and loans to promote mine development or simply to maintain operations at prevailing levels. The Government, however, was unable to oblige, and most of the mines either reduced operations or resorted to reclamation mining in the high-grade areas, with the intention of closing down.

To forestall economic dislocation, the Government bought all the equity shares of mines threatening to close, and in March 1961, the Ghana State Mining Corporation was formed. The Government re-incorporated the State Mining Corporation by the promulgation of the Statutory Corporations Act 1964 (Act 232) and established the State Gold Mining Corporation under Legislative Instrument in 1965. At present (1987) the remaining state gold mines are Prestea,

Tarkwa and the Dunkwa Goldfields. The first two are underground mines, and Dunkwa is a dredging operation.

With the development of South Africa's gold mining capacity, Ghana lost its relative importance in world production; however, output expanded steadily, and peaked at close to one million fine ounces a year in the early 1960s. Since then Ghana's gold production declined steadily until 1983, when it reached its lowest point - 275 000 oz.

Table 5 shows the steady reduction in the gold produced the Prestea mine since 1970. The chart shows that 110 533 fine ounces of gold were produced in 1970 and the corresponding development footage achieved was 19 991 feet. In 1983, however, 20 568 fine ounces of gold were produced and the development footage achieved was only 7 873 feet. The sharp decline in production and development at Prestea shows similarly in all Ghana's gold mines in this period.

Again using Prestea as an example, Table 5 shows that the development footage achieved in 1982 declined from 12 441 to 7 873 feet in 1983, a reduction of 37%. However, in 1985 the development footage attained increased to 10,198 and rose again to 12 654 feet in 1986. This year (1987) it is likely that

the development footage will exceed 14 000 feet, with 30 000 feet projected for 1990. Operational mining stopes are being increased from 35 to 47 this year. In addition, the mine's Geology Department is increasing ore reserves. Other state gold mining companies are expected to follow's Prestea's lead in increasing output, albeit slowly.

SGMC has the potential for a fast return to profitable and efficient mining activities if additional funding is made available to complete the rehabilitation program. An additional 90 MUSD can be expected to increase gold production to 140 000 oz a year by 1991 (compared to the 40 000 oz produced in 1986.) Additional funding can be raised through loans from donor agencies or outside commercial sources or through establishing joint-ventureship(s).

2.2 Diamonds

Ghana has been a major producer of diamonds for decades. Its diamonds are widely distributed geographically; in addition to the well-known alluvial fields of Akwatia and Bonsa, there are 25 other known diamond deposits in widely separated parts of the country. This figure is based, however, on diamond prospecting covering only 27% of Ghana's surface area.

The Akim Diamond Fields Limited commenced large-scale diamond mining at Abomosu, in the Eastern Region of Ghana, in early 1920. This company operated for only three years. The *Consolidated African Selection Trust Limited* (CAST) started exploiting the very rich diamond deposits at Akwatia in 1923. The West African Diamond Syndicate began operations at Kokotintin (Eastern Region) in 1925. In 1971, *Ghana Consolidated Diamonds Limited* (GCD) was formed out of CAST - a subsidiary of Selection Trust Limited of United Kingdom. Dunkwa Goldfields Limited (of SGMC) once recovered diamonds as by-product when it operated its dredges in the Jimi River at the latter part of the

Table 2
Mineral export earnings, 1980-1987
(in USD)

Year	Bauxite	Manganese	Gold	Diamond
1980	3 542 931	10 393 642	202 358 379	12 770 000
1981	2 717 913	8 843 482	166 976 940	7 408 000
1982	1 789 365	5 242 068	126 586 353	3 228 000
1983	1 584 467	4 501 000	104 690 534	253 000
1984	905 465	9 263 700	99 297 000	2 714 523
1985	2 737 966	9 420 000	93 841 878	5 467 936
1986	4 982 142	8 159 000	107 134 015	4 903 983
1987(up to March)	1 147 401	2 155 278	28 942 876	-

1970s. Apart from the wholly state-owned GCD, the other diamond operators are now marginal producers.

Technical assistance by UNDP in 1981 to the former Diamond Industry Commission enabled development of an assessment that Ghana's geological environment favours the occurrence of bodies of kimberlite. The UN Consultant, Phillip Hall, concluded in his report that the diamond potential of Ghana was thus considerable and largely untested. Hall made strong recommendations for a systematic and effective search for kimberlite pipes in the country.

Kesse has given a comprehensive account of diamond production in the country.⁸ His work showed that, from 1969 to 1972, Ghana was the fourth largest producer of diamonds in the world, after Zaire, the USSR and South Africa. In 1973, Ghana moved to the fifth position (having been overtaken by Botswana.); one year later, Ghana moved back to fourth again, only to drop to fifth once more from 1975 to 1976, with an average diamond production of about 2.2 million carats per year.

Table 6 shows the production of dia-

monds by the world's major producing countries (excluding synthetic diamond production). Ghana produced 1 423 000, 1 225 600, 1 149 200, 836 482 carats of diamonds in 1978, 1979, 1980 and 1981, respectively, representing about 3.6, 3.1, 2.7, and 2.2% of the world's production of diamonds in the corresponding years. At present, Ghana's diamond production has declined sharply; the country only produces about 600 000 carats of diamond a year, despite the vast national potential.

GCD is the main producer of diamonds in Ghana, accounting for more than 90% of all the diamonds produced in the country since 1923. The GCD's Akwatia shallow alluvial and eluvial deposits have produced more than 73 million carats since 1923. The Akwatia diamonds are small, averaging about 60 stones per carat, but range in size from 1.5 carats to 1/300 of a carat. 85% by weight of the normal production is suitable only for industrial purposes.

Table 7 shows that, from 1957-58 to 1963-64, CAST consistently produced more than 1 million carats a year. From 1964-65 to 1976-77, the company stead-

ily produced more than 2 million carats a year. In spite of this, CAST failed to re-invest and prospect aggressively and to increase its ore reserves sufficiently, even though the company's projections showed that the Akwatia concession would be exhausted by 1982.

Under the 1972 Mining Operations Decree, the Government of Ghana acquired 55% of the company's equity capital, leaving CAST with the remaining 45%. Despite this Government participation, it is evident from Table 7 that while the company continued to extract diamonds at a high rate until the late 1970s, it still failed to re-invest and explore sufficiently. By the end of the 1970s, it had become clear that only extensive prospecting could save GCD from closure. GCD then sought UNDP assistance to evaluate the adjacent deep alluvial deposits below the flats of the Birim River (which drains the Akwatia diamondiferous field) This effort was made both to establish new reserves to maintain production, although at somewhat lower levels than in the past. This study - conducted between 1978 and 1981 - located a deep-seated, intermedi-

Table 3
Relative mineral export earnings

Commodity	1980		1981		1982		1983		1984		1985	
	(MUSD)	%	(MUSD)	%	(MUSD)	%	(MUSD)	%	(MUSD)	%	(MUSD)	%
Gold	202.35	15.8	166.98	13.3	126.59	12.1	104.69	28.0	99.30	23.0	93.84	16.9
Diamonds	12.77	1.0	7.41	0.6	3.23	0.3	0.25	0.1	2.72	0.6	5.47	1.0
Bauxite	3.54	0.3	2.72	0.6	1.79	0.2	1.58	0.4	0.90	0.2	2.74	0.5
Manganese	10.39	0.8	8.84	0.7	5.24	0.5	4.50	1.2	9.26	2.1	9.42	1.7
Cocoa	790.05	61.7	416.45	33.2	406.69	38.8	141.76	37.9	271.66	62.9	306.01	55.2
Timber	33.63	2.6	36.89	2.9	16.01	1.5	7.06	1.9	6.66	1.5	35.64	6.4
Others	227.49	17.8	616.58	49.1	489.80	46.6	114.38	30.5	41.16	9.7	101.07	18.3
Total	1 280.24	100.0	1 255.87	100.0	1 049.35	100.0	374.22	100.0	431.66	100.0	544.19	100.0

Source:

Central Bureau of Statistics, Mining Companies, Chamber of Mines.

Table 4
Summary of gold production of Ghana (then Gold Coast) from 1493-1934

Period	Fine Ounces produced in Ghana	Percentage of world production
1493-1600	8 153 428	35.5
1601-1700	6 430 148	22.8
1701-1800	5 465 626	8.9
1801-1900	2 543 294	0.7
1901-1910	1 540 406	0.8
1911-1920	3 376 448	1.7
1921-1930	1 815 935	0.9
1931	246 075	1.1
1932	264 422	1.1
1933	284 841	1.2
1934	308 960	1.1
Total	30 429 583	2.6

Table 5
Production and development at Prestea (SGMC)

Year	Gold production fine oz	Development footage achieved Ft.
1970	110 533	19 991
1971	105 080	21 833
1972	97 746	17 648
1973	117 425	19 530
1974	103 177	24 328
1975	83 922	20 728
1976	83 761	19 868
1977	79 894	15 632
1978	95 263	12 836
1979	82 102	11 957
1980	64 018	17 407
1981	40 586	13 597
1982	30 360	12 441
1983	20 568	7 873
1984	20 391	8 862
1985	18 709	10 198
1986	19 556	12 654
1987*	27 819	18 000

* Projected

Table 6
Production of diamonds in carats by the world's major producing countries

Country	1978	1979	1980	1981
Zaire	11 245 000	8 734 000	10 334 000	7 500 000
Soviet Union	10 550 000	10 700 000	10 850 000	10 600 000
South Africa	7 726 605	8 384 332	8 520 328	9 525 876
Botswana	2 799 000	4 394 000	5 101 000	4 960 252
Namibia	1 898 211	1 652 536	1 559 885	1 247 960
Ghana	1 423 000	1 225 600	1 149 200	836 482
Sierra Leone	797 043	855 164	592 018	305 356
Venezuela	755 869	802 646	665 721	490 426
Tanzania	295 117	341 912	269 876	236 500
Angola	650 000	840 000	1 500 000	1 400 000
Liberia	307 377	301 808	298 446	336 023
Brazil	500 000	500 000	666 832	600 000
Central African Republic	284 246	314 067	350 000	311 903
Guinea	80 000	85 000	38 000	38 000
Ivory Coast	45 000	48 000	-	-
Lesotho	48 977	52 421	53 714	52 921
India	15 942	15 229	14 432	15 717
Guyana	17 226	15 824	10 236	9 533
Indonesia	15 000	15 000	15 000	15 000
World total	39 500 000	39 300 000	42 000 000	38 500 000 (Carats)

Table 7
Diamond production in Ghana by CAST and GCD 1950-51 to 1979-80

Year	Production (Carats)	Year	Production (Carats)
1950-51	569 392	1965-66	2 301 659
1951-52	800 967	1966-67	2 633 527
1952-53	674 743	1967-68	2 398 631
1953-54	789 550	1968-69	2 413 415
1954-55	911 973	1969-70	2 355 797
1955-56	960 622	1970-71	2 542 100
1956-57	972 583	1971-72	2 482 822
1957-58	1 165 577	1972-73	2 375 582
1958-59	1 213 474	1973-74	2 406 860
1959-60	1 138 665	1974-75	2 255 227
1960-61	1 567 039	1975-76	2 231 791
1961-62	1 713 286	1976-77	2 085 511
1962-63	1 765 461	1977-78	1 817 818
1963-64	1 968 176	1978-79	1 391 058
1964-65	2 070 142	1979-80	1 227 071

ate grade, diamondiferous deposit in the Middle Birim and also raised the prospects of finding more diamond deposits in the Birim River basin.

In 1978, CAST/GCD requested Government financial assistance to develop the Birim River project. The request was refused. By 1980 the company was operating at a loss – of 2.4 million cedis in 1980 as against 8.0 million cedis profits in 1979. CAST gave a year's notice to the Government in 1982 and on May 31, 1983 sold out its shares for 100 cedis to

Ghana's Government. The company also withdrew its technical management contract.

The departure of CAST in the early 1980s left GCD with worn-out machinery, largely exhausted shallow valley reserves and few skilled technical personnel. The company, with the help of the Government and the UNDP, began a rehabilitation programme in 1985 that will require a total investment funding of 21.5 MGBP. The company's restructuring exercise is expected to span 15

years, and to be accomplished in two phases.

A total investment of 10 MGBP was required during the six-year first phase of the investment programme (from 1985 to 1990 inclusive). This amount was to be used to buy mining equipment and rehabilitate treatment plants. However, only 7 MGBP was available for the rehabilitation program. Despite this shortfall, new Birim reserves have been developed, and the main plant and equipment rehabilitation programme have been partially completed. The company now has a fairly modern stock of mining equipment, including new trucks and draglines.

The first phase of the rehabilitation is not yet complete, because of the 3 MGBP investment shortfall. Production levels have therefore fallen, after a rise of about 40% between 1983 and 1985. The decline is the result of difficulty in procuring spare parts for the company's plant and dumper trucks, as well as unexpected variations in ore grade. Consequently, the projected production target has now been revised downward, from 1 million to 800 000 carats.

The rehabilitation's second stage is to be completed by 1989. This phase is designed to build back-up, long-term investment to sustain the first-phase production targets of 800 000 carats a year through 1990, and thereafter raise the production to, and sustain it at, one million carats a year.

To achieve this objective, GCD will replace obsolete and aged equipment and will introduce new and more efficient cost-saving methods. The main components of the second phase rehabilitation are the acquisition of two additional drag lines with spare parts; the purchase of other heavy equipment (eg, dozers, scrapers, etc.); completion of the rehabilitation of the diamond treatment plants; and installation of a 10km overland belt conveyor system. A conveyor-truck combination haulage system will replace an obsolete truck haulage system

Table 8
1984 Production of manganese ore

Company	Country	Production (kt)
State organisations	USSR	10 070
Comilog	Gabon	2 119
Samancor	South Africa	1 755
Groote Eylandt	Australia	1 700
Industria e Comercio de Minerios	Brazil	1 700
State Organizations	China	1 597
Associated Manganese Mines of South Africa (ASSOMAN)	South Africa	1 089
Orissa Mining Corp.	India	500
Cia Minera Autlan	Mexico	431
Manganese Ore (Mobil)	India	425
Ghana National Manganese Corp(GNMC)	Ghana	269
Rand London Manganese Mines	S.Africa	211
State Organizations	Hungary	60
Sté Chérifienne d'études minières (SACEM)	Morocco	57
State Organizations	Bulgaria	45
Eleusis Bauxite Mines (Elbaumin)	Greece	42
CVRD	Brazil	40
Manganesos Atacama	Chile	26
Chugai Kogyo	Japan	24
Klipveld Manganese	South Africa	16
Hokuchin Kogyo	Japan	12
Total (Companies listed)		22 188
Total Production in 1984		23 138

Table 9
Manganese production from Ghana National Manganese Corporation from 1954 to 1986
 (in t)

Year	Ore produced	Ore railed	Ore exported
1954-55	505 317	434 101	420 349
1955-56	567 315	607 481	432 772
1956-57	731 507	686 577	686 230
1957-58	686 676	667 766	665 255
1958-59	587 483	525 085	529 261
1959-60	577 648	557 333	537 910
1960-61	559 760	527 141	542 247
1961-62	443 391	459 346	448 889
1962-63	394 080	451 557	471 483
1963-64	424 657	399 967	397 110
1964-65	509 166	482 071	482 760
1965-66	638 000	598 213	578 808
1966-67	596 572	641 225	636 954
1967-68	484 696	475 936	486 475
1968-69	400 363	405 483	407 926
1969-70	354 726	356 768	353 766
1970-71	455 253	450 264	454 169
1971-72	476 690	469 571	466 034
1972-73	533 789	537 100	535 633
1973-74	255 393	180 250	184 985
1974-75	282 291	321 375	325 282
1975-76	384 162	346 275	346 702
1976-77	343 228	375 125	370 439
1977-78	321 443	352 000	348 157
1978-79	342 051	301 150	313 133
1980	262 317	238 500	240 006
1981	229 340	184 450	197 439
1982	162 971	131 285	132 232
1983	169 840	134 022	175 288
1984	243 260	250 685	267 996
1985	349 716	264 212	357 270
1986	333 314	259 885	262 900

to move mined ore. According to GCD's preliminary calculations, the installation of that conveyor belt will reduce haulage costs by 60%.

GCD envisages that a successful restructuring will enable the company to revive its operations and achieve, among others, the following:

(i) increased production, to 1 million carats a year;

(ii) adequate internally generated funds for further investment; and

(iii) net profit of about 5 031 million cedis over the 15-year plan period.

GCD has great potential. The Company is now negotiating for funds to enable it restructure in order to enhance efficiency and profitability.

2.3 Manganese

Ghana was one of the leading manganese producers in the world from the 1920s until 1960. Between 1930 and 1960, Ghana ranked among the three major producers of manganese in the world. However, since 1960, Ghana's manganese production has generally declined, while production of the mineral in the other leading countries has increased significantly. Table 8 shows that, in 1984, Ghana ranked eleventh out of twenty-one major producers of manganese. Ghana's production in that year represented about 1.2% of the (1984) world's production.

Three types of manganese deposits have been identified in Ghana, all associated with the rocks of the Upper Birrimian series. They are:

(i) manganiferrous phyllites and fine schists with sub-ordinate siliceous phyllites;

(ii) spessartite - quartz rocks with or without rhodonite, in association with biotite-paragneiss, biotite schists and amphibolite; and

(iii) segregation deposits formed by weathering of the first and second types.⁹

These manganese deposits are in the Western, Ashanti and Upper West Re-

gion. However, the main manganese deposits in Ghana are found in the Western Region at Nsuta and Salman (Esamang) and in the Dixcove and Daboasi areas.

The Nsuta Manganese deposits were discovered by Kitson in 1914. The African Manganese Company began mining these deposits in 1923 as a wholly owned subsidiary of Union Carbide of United States; the *African Manganese Company* (AMC) operated an open pit mine at Nsuta from 1923 to 1973. In October 1973, the Government, by legislative instrument, set up GNMC to market manganese ore mined by *African Manganese Company* (AMC). By consent between the Government and AMC, Ghana National Manganese Corporation took over the operations at the Nsuta mine in 1975 and has been managing the operations since. GNMC's open pit mine is the sole producer of manganese in Ghana.

The Nsuta manganese ores are chemically of two main types, oxide and carbonate.

The main minerals of the oxide type are pyrolusite and psilomelane. Manganite and wad are rare, but manganiferrous garnet (sperssartite) is widely distributed in the lower grade ores (gonditic ores). Where weathered, it is frequently represented by pseudomorphous manganese oxides.

Nsuta produces various categories of oxide ores. The most valuable currently mined is the high (R) grade oxide or black ore, which usually contains about 52% Mn. The next grade oxide ore is the "standard metallurgical grade" with a manganese content of 48 to 50% Mn. Other grades are the "B" grade with 46% Mn and the "C" grade with 42 to 45% Mn. GNMC is currently experiencing problems in marketing the "C" and standard metallurgical grade fines.

The main mineral of the carbonate ore is rhodochrosite. The carbonate ores are classified as "N" or "carbonate, grade" ore. The high grade carbonate ore contains about 25% Mn, whereas the

low grade ore has approximately 15 to 20% Mn.

Table 9 shows that Nsuta mine production of manganese ore peaked in 1956-57 with 731 507 tons and reached its lowest level in 1982 with only 162 971 tons. Table 9 also shows that there was a steady decline of ore production from 1972-73 until 1982-83, when the decline was arrested.

The tonnage of manganese ore exported has varied over the years. Low ore production and shipments are the result of worn-out and obsolete machinery at the mine (prior to the rehabilitation), and the Ghana Railways Corporation's operational inability to haul the ore consistently.

The clear need to rehabilitate the mine to arrest the steady output decline resulted in the *European Investment Bank* (EIB) approving a loan of 6 million ecus in June 1984 by entering into an agreement with Ghana's government. The 3-phase rehabilitation project comprised:

- (i) Procurement of equipment (1984 and 1985);
- (ii) Acquisition of the services of a 4-member technical management team; and
- (iii) Rehabilitation of the existing oxide washing plant.

Phases One and Two have been completed, at a total cost of 3.69 million ecus. The balance of 2.3 million ecus has been earmarked for rehabilitation of the washing plant.

GNMC is gradually running out of reserves of manganese oxide, its main product. Its known oxide reserves are only about 28 million tonnes of manganese carbonate ores at Nsuta. As the market for the carbonate ore is limited, the company assumed that if the carbonate ores could be converted to oxide nodules, the mine's life could be extended.

On March 3, 1978 GNMC and the Fuller Company of the United States signed a contract for the construction of

an 18 MUSD "turnkey" nodulization plant at Nsuta. Although offshore and onshore costs of 20 MUSD and 50 MUSD, respectively, have already been expended, the plant is not in service, because of a dispute between GNMC and the plant contractor.

GNMC needs an additional 3-6 MUSD to start up the nodulization plant; to test the equipment and the process; to study the market for manganese oxide nodules; and to better understand the economics of nodulization.

When the nodulization plant becomes operational, GNMC anticipates to produce up to 300 kt of manganese oxide nodules a year for export. This will be in addition to normal manganese oxide exports of about 200-300 kt a year. Loading facilities at the Takoradi port for manganese ore would not be able to handle that volume, primarily because of inadequate storage capacity. GNMC then would need to rehabilitate Takoradi's loading facilities and increase its storage capacity at a cost conservatively estimated to be about 3 MUSD.

3. Conclusion

Ghana's mineral sector has a great potential for development, and an need for economic investment equal to that prospect. The amount of economically attractive investment existing in this sector is large, including the rehabilitation and expansion of existing mining companies and development of new mines.

Ghana has a substantial mineral resource base of gold; therefore, most new mines are likely to be gold producers. There is, however, a great potential for diamond production, and to a lesser extent, for development of the nation's iron and steel producing capacity.

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