



The mineral economies of SADCC - Tanzania

By Paul Jourdan

In our series on the mineral economies of Southern Africa Paul Jourdan looks at the potential of the mineral industry in Tanzania, one of the largest states both in terms of size and population, but one of the least developed economically.

Paul Jourdan is a Researcher at the Institute of Mining Research at the University of Zimbabwe, Harare. Address: IMR, PO Box MP 167, Mount Pleasant, Harare, Zimbabwe. The article was published as a report (no 78) by IMR in June 1988. It was revised for RMR by the author in June 1989. PJ is a member of the Advisory Board of RMR.

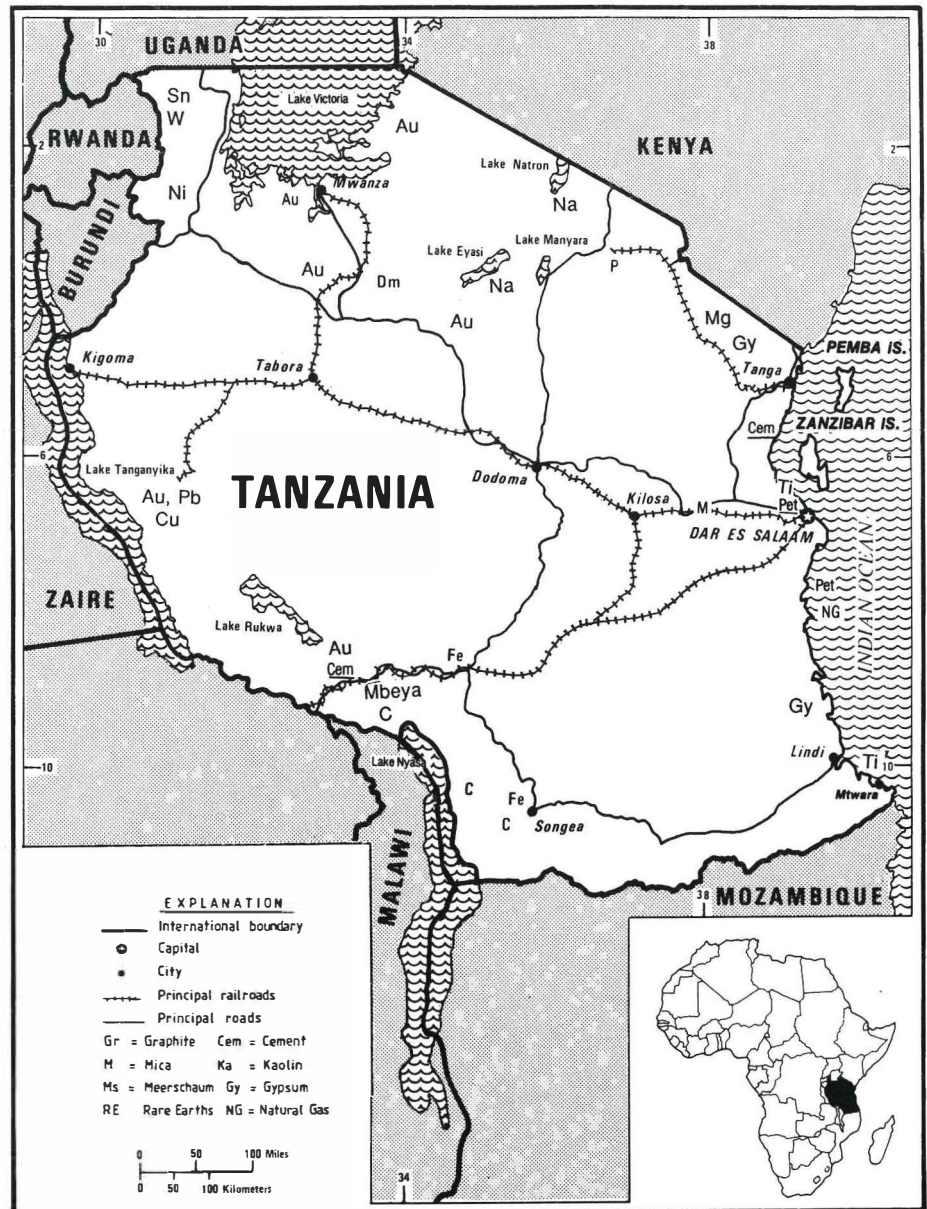
I. INTRODUCTION

Tanzania's main political party, the *Tanzania African National Union* (TANU), was formed in 1954 by Julius Nyerere and it led a smooth transition to independence which was gained in 1961. In 1964 a union with the island of Zanzibar was formed which was named Tanzania. In 1967, under the leadership of Nyerere, the ruling party TANU made a dramatic commitment to social-

ism and self-reliance with the Arusha Declaration. The policies embodied in this declaration have officially guided the country since 1967. In 1977 the parties of mainland Tanzania (TANU) and Zanzibar (ASP) were merged to form the *Chama Cha Mapinduzi* (CCM) party.

Mining has long been practiced by the people of Tanzania. Ferrous mining and smelting, mainly of haematite and

Map 1



laterite, has been carried out over the last two millenia over the whole of the country, while gold and base metal mining has been practiced in selected areas (the so-called Archean "greenstone schist belts"). Iron smelting at Ufipa was renowned right up to the time of German colonisation.¹

There was a rapid increase in mineral exploitation following colonial penetration by Germany at the end of the last century. After the First World War control of the country was transferred to Britain to be held in trust for the League of Nations. After the Second World War Tanganyika, as it was then called, became a Trust Territory under the United Nations, administered by Britain.

The economy

At independence in 1961 there were only 220 industrial establishments employing more than 10 persons with assets of more than 20 000 *Tanzanian shillings* (TZS, 1 000 GBP, 9 500 1987 USD) in the whole country and total manufacturing employment was a mere 20 000 workers.² As Tanzania was only a Trust Territory, the British directed most investment to neighbouring Kenya which was a full colony.

The *East African Community* (EAC) was made up of Tanzania, Uganda and Kenya but most of the infrastructure to service this zone was located in Kenya. The EAC finally broke up in 1977. In 1980 Arusha, in Tanzania, was the venue for the founding of the *Southern*

African Development Coordination Conference (SADCC), which grouped Tanzania with the states to the south including the newly independent countries of Zimbabwe, Mozambique and Angola.

Basic economic and demographic data for the SADCC grouping for 1985 is given in Table 1.

Tanzania is the second largest state in the region (19% of total) and at 22 million (1985) had the largest population (31% of SADCC), while its population density is about double the regional average.

Economically it is one of the poorest states in the SADCC contributing, in 1985, 24% of the regional GDP of 24 G USD. At 266 USD, the GDP per capita

Table 1
The SADCC: Basic economic and demographic data 1985

	Area km ²	Population million	Population density km ²	Forex rate/USD	CPI 1980=100	GDP imp GUSD	GDP/cap USD	Exports FOB MUSD	Imports CIF MUSD	Trade balance MUSD	Debt ² xGUSD	Debt/GDP %	Labour force k
Angola	1 247	8.8	7.0	30.0	na	4.83	552	2 234	657	1 576.8	2.45	50.7	1 000 ³
Botswana	600	1.1	1.8	1.9	168.2	1.13	1 025	728	576	152.0	0.18	15.6	117
Lesotho	30	1.5	50.4	2.2	189.0	0.26	167	22	305	(283.0)	0.17	67.4	51
Malawi	118	7.1	59.8	1.7	173.8	1.17	166	249	288	(38.9)	0.99	84.3	411
Mozambique	802	14.0	17.4	43.2	261.0	3.27	234	76	424	(347.4)	1.44	44.1	700
Swaziland	17	0.7	38.0	2.2	199.4	0.34	510	167	264	(97.1)	0.08	24.1	85
Tanzania	945	21.7	23.0	17.2	373.6	5.77	266	314	1 040	(726.2)	2.90	50.3	748
Zambia	753	6.7	8.9	2.7	250.8	2.33	347	548	770	(222.4)	3.21	137.7	362
Zimbabwe	391	8.3	21.3	1.6	196.2	4.55	545	1 118	900	217.2	1.53	33.6	1 040
Total (avg)	4 903	69.9	14.3			23.64	338	5 455	5 224	231.0	12.95	53.7	4 513

Notes:

¹ Consumer Price Index; ² Total external debt; ³ Estimates

Sources:

SADCC states government data, EIU: 1987-88, IMR SADCC Minerals Databank: 1988

is well below the regional average of 338 USD. Inflation from 1980 to 1985 was 274%, by far the highest in the region. In 1985 it made up a mere 6% of total exports and 20% of imports to and from the region, which stood at 5.5 and 5.2 GUSD respectively. In addition its external trade deficit is the highest in the region standing at -727 MUSD in 1985. In that year Tanzania's external debt stood at 2.9 GUSD, 22% of the SADCC total.

Since 1980 inflation has averaged about 30% per annum resulting in a 395% increase by 1986. Over the same period the Tanzanian Shilling has dropped from 8 to the USD to 39 to the USD and exports as a percentage of imports has fallen from 46% in 1980 to 36% in 1986, while external debt as a percentage of GDP has more than doubled from 44% in 1980 to 107% in 1986 (Table 2).

Agriculture has always been the principle economic activity of the country and its percentage contribution to the GDP has varied between 39% and 60%. Table 3 gives GDP breakdown by industrial origin for selected years from 1961 to 1985.

The contribution to GDP of the manufacturing sector increased more than four-fold from 1961 to the early seventies and then steadily decreased to 6.1% in 1985. The inverse occurred with the contribution of agriculture, falling from nearly 60% in 1961 to a low of less than forty percent in 1971 then rising back to 58.5% in 1985. The contribution of the mining and quarrying sector stayed roughly constant until 1967, declined rapidly to a mere 0.3% in 1974 before settling down to about 0.5% in the eighties (Table 3 & Figure 1)

The rapid increase in both the relative and the absolute size of the manufacturing sector after independence was in part due to the extremely small starting size, but mainly to a concerted effort to develop this sector by the state, particularly after the Arusha Declaration of 1967 and subsequent nationalisations. Hence the share of the public sector in manufacturing value-added increased from 5% in 1966 to 39% in 1975.³

With declining terms of trade from the mid-seventies, the manufacturing sector contracted rapidly as increasing shortages of foreign currency for essen-

tial imported inputs cut back production, and expansion plans were shelved. By 1986 the manufacturing sector contributed a mere 5.5% to GDP, down by 52% on 1972 (11.4%).

Agriculture is also the dominant sector in terms of exports. In 1986 agricultural products made up 69% of foreign exchange earnings including coffee (48%), cotton (6%), cashew nuts (4%), tea (3%) and tobacco (3%). Manufactures made up 5%, of which 36% were sisal products (twine and rope), mining contributed 2.5%, of which diamonds were 96%, and services (tourism and transit trade) earned 19%.

In 1986 a cautious liberalization policy was embarked upon with a massive devaluation of the Tanzanian shilling of 54% in an attempt to stem the worsening balance on external trade. The economic reforms also included a lessening of controls on imports and state control of agricultural marketing.

Overall, the *Economic Reform Programme* (ERP) of President Mwinyi appears to have fairly widespread support, though the rapid increase in the cost of living, five-fold since 1981, has not been compensated for in wage in-

Fig 1
Mining: Contribution to GDP (%)

Source:
Bank of Tanzania: 1983 and 1987

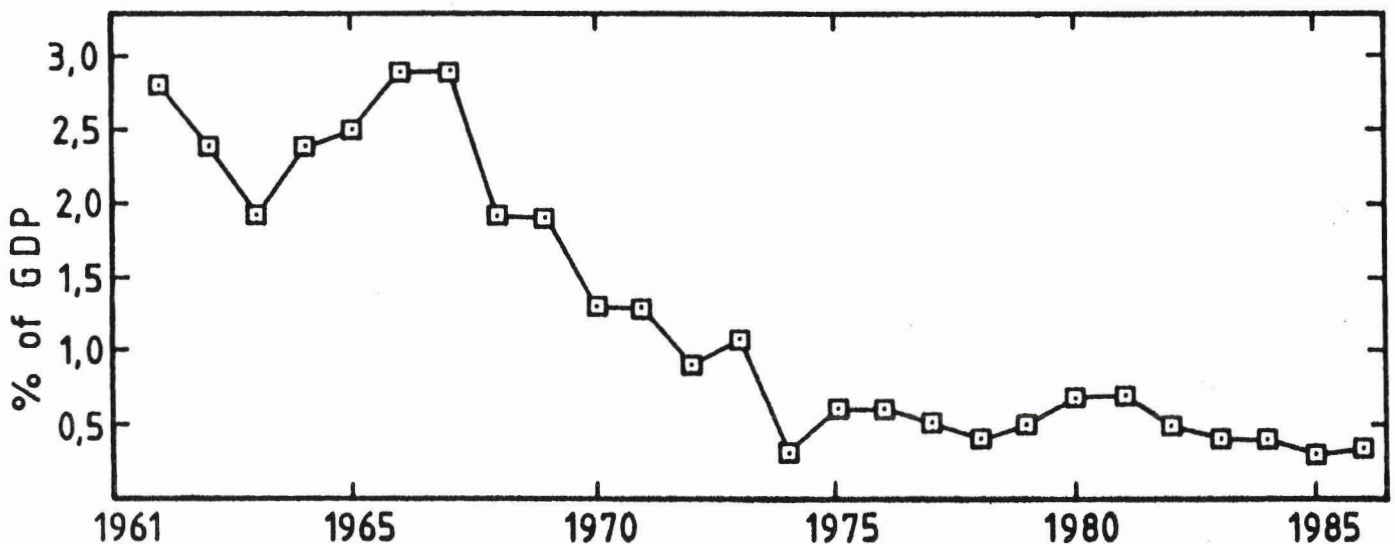


Table 2**Tanzania: macroeconomic indicators**

	Unit	1980	1981	1982	1983	1984	1985	1986
Population	M	18.46	19.11	19.78	20.41	21.06	21.73	22.46
Population density	km ²	19.53	20.22	20.93	21.60	22.29	23.00	23.77
Forex rate	USD	8.19	8.29	9.55	12.46	16.35	17.21	37.85
CPI ¹	% annual increase	100	125.65	162.03	205.87	280.28	373.58	494.70
			25.7	28.9	27.1	36.1	33.3	32.4
GDP mp	G*	37.45	43.91	52.55	61.01	76.26	99.33	131.35
GDP/cap	USD	248	277	278	240	222	266	155
Exports FOB	G	4.70	4.80	4.30	4.30	5.80	5.40	10.90
SADCC	G	.02	.01	.01	.09	.10	.07	.05
Imports CIF	G	10.20	9.70	10.50	9.00	12.90	17.90	30.20
SADCC	G	.02	.07	.20	.09	.20	.22	.36
Trade balance	G	(5.50)	(4.90)	(6.20)	(4.70)	(7.10)	(12.50)	(19.30)
Exp/Imp	%	46.1	49.5	41.0	47.8	45.0	30.2	36.1
GFCF ²	G	9.60	11.10	12.20	9.60	11.90	17.80	25.90
GFCF/GDP	%	25.6	25.3	23.2	15.7	15.6	17.9	19.7
Debt ³	GUSD	2.0	2.2	2.4	2.6	2.5	2.9	3.7
Debt /GDP	%	43.7	41.5	43.6	53.1	53.6	50.3	106.6
Labour force	k	556	575	675	687	732	748	749
Govt revenue	G	8.86	9.99	10.95	13.61	14.74	20.10	23.07

Notes:

* Tanzanian shillings unless otherwise indicated; ¹Consumer price index, ²Gross Fixed Capital formation, ³Medium and long term external debt.

Sources:

Bank of Tanzania 1987/8; Bureau of Statistics 1987; IMR SADCC Minerals Databank

Table 3**GDP at factor cost by industrial origin (%)**

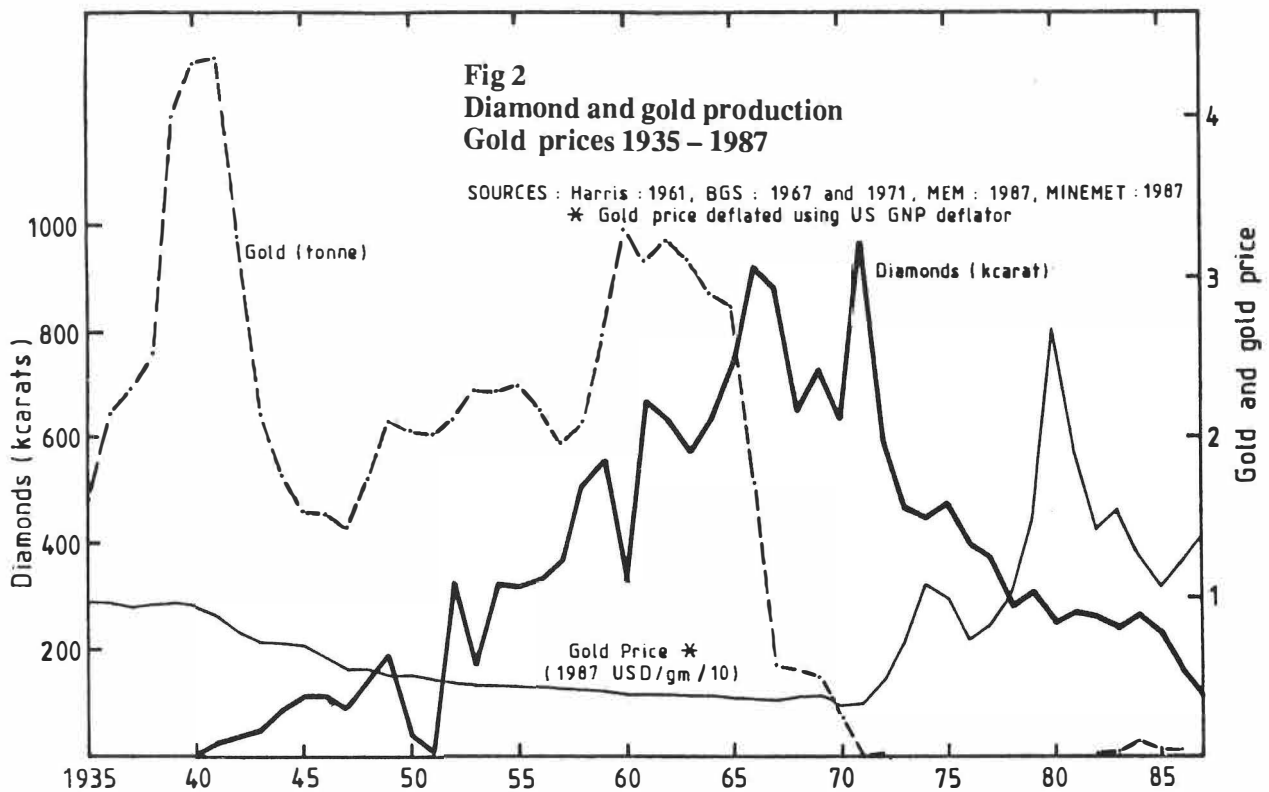
Year	Agriculture	Mining	Manuf. ¹	Constr. ²	Trade	Transport ³	Finance ⁴	Pub Ad ⁵
1961	58.9	2.8	3.4	3.0	11.4	4.4	4.3	10.6
1966	45.3	2.9	9.1	3.4	12.7	7.4	9.5	10.5
1971	39.4	1.3	11.7	5.6	12.4	9.0	10.5	11.5
1976	46.2	0.6	10.9	3.4	11.4	7.8	8.7	11.9
1981	46.3	0.7	11.2	3.6	12.4	7.1	10.3	10.8
1985	58.5	0.3	6.1	1.9	13.3	6.7	7.0	7.9

Notes:

¹Manufacturing, electricity & water supply; ²Construction; ³Transportation/Communications; ⁴Finance & Insurance; ⁵Public Administration

Sources:

Bank of Tanzania: 1983, Bureau of Statistics: 1986



creases, particularly in the state sector. The ERP has clearly benefited the rural (peasant) population more than the urban sector, as prices for their products have kept up with inflation.

II. THE MINING SECTOR

The minerals sector of Tanzania is amongst the smallest in the region, though not for a lack of mineral resources. In 1985 its mining sector contributed a paltry 0.3% of GDP compared to the SADCC average of 12% and the gross value of mineral production was 19 MUSD, or 0.4% of the SADCC total of 4.2 GUSD (Table 4). The value of mineral production per capita was less than 1 USD contrasting with a SADCC average of 60 USD while mineral exports at 21 MUSD were less than one percent of the regional total of 3.7 GUSD (Table 4).

On the labour side, eight-and-a-half thousand people were employed by the mining sector (6% of SADCC) in 1985 representing 1.1% of the total formal labour force. The value of mineral output per labourer stood at 2 200 USD,

well below the SADCC average of 31 000 USD, excluding hydrocarbons (Table 4). On the positive side there are no migrant Tanzanians working on the South African mines.

The percentage contribution of the mining sector to GDP is presented in Figure 1. The mining sector has declined from being small at independence to insignificant today. Basic indicators for the mineral sector for the years 1980 to 1986 are given in Table 5. The mineral sector appears to make a slight recovery in 1986 in terms of exports and production, but this increase is due to the devaluation of the Tanzanian shilling in that and subsequent years. Mineral production per miner, expressed in USD, actually fell 30% from 1985 to 1986. Gross fixed capital formation in mining, as a percentage of the national total, started the decade at half the size of the sector's contribution to GDP before rising to almost twice its size, more in line with the general tendency for mining to be a more capital intensive sector. Average wages in the mining sector rose 41% in current terms

from 1980 to 1986, but fell by over seventy percent in real (deflated) terms.

In 1959, two years before independence, the total value of mineral production was 7 MUKP (140 MTZS) or just over 70 million 1987 US dollars, five times more than the value of current output (14 MUSD in 1986, Table 5). In that year diamond output contributed 63% of the total value, followed by gold at 17%. Up until 1945 the premier mineral in terms of value was gold, but in that year increasing output of diamonds from the operations of Williamson Diamonds Limited overtook gold in value. Since then diamonds have remained the principal mineral in terms of both the total value of mineral output and exports. In 1986 diamonds made up 81% of total value and 94% of mineral exports (Table 6.)

Mineral production in terms of volume is presented in Table 7 for the years 1972 to 1986. The most striking feature is that production has either declined or stagnated for almost all minerals except for gold, but even gold has declined drastically compared to

Table 4

The SADCC: basic mineral sector data 1985

	GDP Mining MUSD	GDP Mining %	Mineral prod MUSD	% of SADCC prod	MP/capita USD	Mineral exports MUSD	% of SADCC exports	Mineral exports % ¹	Mining labour force k	% of SADCC	Mining lab force % of total	MP/labour kUSD	Miners RSA2 k	% of SADCC	Remittances MUSD
Angola	1 488.0	30.8	2 228	53	254	2 152	58	96.4	na	na	na	na	.0	0	.0
Botswana	528.6	46.9	542	13	493	615	16	84.4	9.4	7	8.0	57.6	16.4	7	27.3
Lesotho	<	<	<	<	<	<	<		1.0	1	2.0	<	116.2	52	541.2
Malawi	<	<	<	<	<	<	<		.3	0	.1	<	19.6	9	17.9
Mozambique	3.2	.1	5	.1	0	0	0	.4	1.0	1	.1	5.4	55.7	25	1.8
Swaziland	9.2	2.7	13	.3	20	13	0	7.7	2.4	2	2.9	5.4	14.0	6	13.0
Tanzania	14.6	.3	19	.4	1	21	1	6.6	8.6	6	1.1	2.2	0	0	0
Zambia	478.2	20.5	975	23	145	495	13	90.4	57.5	43	15.9	17.0	0	0	0
Zimbabwe	327.4	7.2	392	9	47	437	12	39.1	54.3	40	5.2	7.2	0	0	0
Total (avg)	2 849	12.1	4 174	100	60	3 733	100	68.4	134	100	3.0	31.0	222	100	601

Notes: < = less than 1 MUSD or 0.05%; MP = mineral production; ¹Mineral exports of total exports, ²Migrant workers in the RSA
Sources: SADCC states government data, EIU: 1987/8, IMR SADCC Minerals Databank: 1988

Table 5

The Tanzanian minerals sector - basic indicators (TZS)

	Unit	1980	1981	1982	1983	1984	1985	1986
GDP Mining	M	329	299	266	249	337	251	474
% GDP Mining	%	.88	.68	.51	.41	.44	.25	.36
GFCF Mining ¹	M	46	41	41	104	72	105	155
% Mining GFCF	%	.48	.37	.34	1.08	.61	.59	.60
Mineral prod ²	M	370	207	221	273	346	322	518
Mineral prod/cap	USD	2.45	1.31	1.17	1.07	1.00	.86	.61
Mineral exports	M	300	538	406	461	253	357	518
% Min exports	%	6.4	11.2	9.4	10.7	4.4	6.6	4.7
Mining labour ³	k	4.30	4.30	7.20	7.56	8.31	8.58	8.87
% Mining labour	%	.77	.75	1.07	1.10	1.13	1.15	1.18
Min.prod/lab	USD	10 515	5 804	3 214	2 893	2 544	2 181	1 543
Avg mining wage ⁴		9 361	7 873	7 959	12 321	12 340	12 600	13 170

Notes:

¹Gross Fixed Capital Formation in mining, ²Value of mineral production, ³Mining sector labour force, ⁴Average wage in the mining sect.

Sources: Bank of Tanzania: 1987/8, IMR SADCC Minerals Databank.

slightly earlier values (2.8 tons in 1965).

III. ECONOMIC GEOLOGY

The structural geology of Tanzania is dominated by the Tanzanian Shield bounded by mobile belts in the west and east and cut by the Great East African Rift Valleys.

The oldest rocks are Archaean and can broadly be divided into the late Archaean (Usagaran and Ubendian) and the early Archaean (Dodoman and Nyanzian). The latter are situated on the shield, particularly around Lake Victo-

ria and the Nyanzian rocks, which overlie the Dodoman, constitute the well-known schist or greenstone belts which are the host rocks of most of the gold occurrences in Tanzania.

The conglomerates and quartzites of the Kavirondian System (Musoma district) rest unconformably on the Nyanzian rocks and are occasionally host rocks to gold mineralisation. The metamorphic rocks of the Usagaran System constitute a belt running north-south from Mozambique to Kenya in the centre-east of the country. This system is the source of limestones, graphite, kya-

nite and is cut by mica-bearing pegmatites, particularly in the Morogoro area. The highly metamorphosed sedimentary and igneous sequence of the Ubendian System are situated in a belt running north-west south-east in the south-west and west of the country and include the Mpanda Mineral Field in the centre-west of the country (Pb, Cu, Au/Ag), several titaniferous magnetite deposits (Liganga) and the Lupa Goldfield in the Rukwa Trough in the south-west of the country (Chunya).

The Proterozoic and Palaeozoic are represented by the slightly metamor-

Table 6
Value of mineral production for selected years 1929-87 (MTZS)

Mineral	1929	1941	1947	1965	1971	1977	1983	1984	1985	1986	1987
Calcite					.014	.028	.550	.520	.851	.801	.709
Coal				.121	.139	.218	2.348	4.250	2.734	2.285	2.053
Copper				0	0	0	0	0	0	0	0
Diamonds	1.770	1.405	12.633	145.11	136.36	204.75	214.58	265.81	249.74	436.00	341.39
Gold	.773	22.379	8.169	22.808	.048	.096	3.074	11.901	9.487	9.983	na
Graphite				0	0	0	0	0	0	0	0
Gypsum				.202	.510	.622	.050	.056	1.109	2.375	4.120
Kaolin			.055	.027	.148	0	1.948	3.474	5.348	0	0
Lead				0	0	0	0	0	0	0	0
Limestone			.226	.504	.890	2.339	3.860	4.133	5.609	37.126	39.755
Magnesite				.419	.210	.015	0	0	0	0	0
Meershaum				.016	.160	0	.033	.040	0	.024	.124
Mica	.296	.059	1.199	2.068	.600	.141	.253	0	.017	0	0
Phosphate		.001	.007	0	0	0	0	0	31.961	18.287	36.110
Salt	.784	.942	1.462	7.778	8.579	16.829	48.914	71.011	50.576	51.336	89.096
Silver		.040	.073	.213	.004	.000	0	.029	1.243	13.449	0
Tin conc	.057	1.296	.761	7.151	3.215	0	.250	.588	0	0	na
Tungsten conc		.004	0	0	.132	0	0	0	0	0	0
Vermiculite				.009	0	0	0	0	0	0	0
Other+	.197	1.699	.459	1.611	.955	2.742	2.342	2.872	8.594	3.333	25.666
Total	3.88	27.83	25.04	188.04	151.97	227.78	273.20	364.68	367.27	575.00	539.02

Notes: Between 1926 and 1961 GBP converted to TZS at 20:1,+ mainly gemstones and artstones.

phosed sediments of the Karagwe-Ankolean System in the north-east with associated mineralised pegmatites (Sn, W), followed in age by the unmetamorphosed sediments and lavas of the Bukoban System, also in the north-east.

The mainly continental sediments of the Karoo System are preserved in grabens and troughs in the south-west of the country around Lake Nyasa and are economically important for their coal seams.

The Mesozoic is represented by the Jurassic and Cretaceous sediments of the coastal belt containing resources of

limestone, clays, gypsum, anhydrite, evaporites (salt) and natural gas. Finally, the Quaternary sediments are important for their resources of limestone (coral), clays (kaolin), heavy mineral beach sands (Ti) and, in lake bed deposits, gypsum, phosphates, diatomite, meerscham and soda ash.

The economically most important volcanic rocks are the diamondiferous kimberlite pipes in the Mwadui area and the carbonatites of Panda Hill (Mbeya), Oldoinyo Dili and Wigu Hill, the latter for their niobium, apatite and rare earth resources. The neogene vol-

canics of the Rift Valleys are of virtually no economic importance other than that they often form excellent soils for agriculture (Kilimanjaro).

IV. THE COMPANIES

A. Introduction

In the mid-sixties Tanzania had a small but healthy minerals sector. There were numerous small mining companies and a few medium-sized ones. In 1967 there were six diamond mining concerns, 18 gold and silver mining companies which produced 2.7 tons of gold, 21 mica operations, 18 salt producers, 81

Table 7

Mineral production (volume) for selected years 1972-1987

Mineral	Unit	1972	1977	1980	1981	1982	1983	1984	1985	1986	1987
Calcite	kt	3.49	3.03	2.86	2.47	2.99	2.34	2.17	3.55	7.36	2.90
Coal	kt	3.5	4.9	6.7	6.1	10.8	10.0	8.2	7.2	5.2	2.9
Diamonds	Mct	.595	.376	.256	.272	.262	.243	.266	.236	.161	.113
Fe, Steel	kt	68.4	27.5	17.3	10.1	16.0	13.4	-	11.3	-	-
Gemstones	t	1.044	.129	5.748	1.203	.006	10.12	.389	.646	.048	4.362
Gold	t	.007	.001	.002	.006	.007	.024	.097	.055	.085	.201
Gypsum	kt	14.12	158.7	9.69	12.33	58.17	6.77	7.64	14.41	14.14	24.65
Kaolin	kt	1.46	0	5.38	2.92	1.61	1.62	1.72	1.64	2.27	1.45
Limestone	Mt		.26	1.10	1.20	.45	.26	.14	-	.37	.68
Cement	kt	237.0	244.9	306.3	389.6	369.8	273.4	368.5	376.5	441.4	-
Lime	kt	1.86	5.50	6.75	5.17	6.80	3.01	3	2.47	-	-
Magnesite	kt	.058	.036	0	0	0.823	0	0	0	.249	0
Meerscham	kt	.018	0	0	0	0	0	0	0	0	.003
Mica, sheet	kt	.018	.005	.004	.007	.003	.001	.000	.000	.001	0
Oil, prods+	kt		.61	.62	.52	0.50	-	-	-	-	-
P, Apatite	kt	0	0	0	0	0	0	14.6	21.0	10.0	18.4
Salt	kt	32.5	34.4	37.0	42.2	32.1	29.7	29.9	21.1	22.1	41.1
Silver	t	.001	0	0	0	0	0	0	0	.005	0
Tin *	kt	.074	.019	.011	.018	.009	.002	.000	.002	.008	.005
Tungsten*	kt	.006	0	0	0	0	0	0	0	0	0
Vermiculite	kt	0	0	0	0	0	0	0	0	0	0

Notes: * = concentrate, + = oil products Tiper Refinery.

Sources Tables 6 and 7: BGS:1988, Harris: 1961, MEM:1987.

small and medium scale tin mining operators who produced over 300 tons of concentrates, and numerous small gemstone mining operations. In that year the industry employed 9 500 people and the total value of mineral output was 183.3 MTZS or 78.5 million 1987 USD.

At independence most mining was in foreign hands and in the sixties most mines (principally gold) curtailed exploration and development due to falling grades and falling real prices and all gold mines closed.

At its formation Stamico also had the responsibility of taking over the run-down or abandoned private operations, but, due to Tanzania's extensive social programs in the 1970s, there was inadequate investment capital available to the mining industry.

To overcome this lack of development capital the government passed a new mining law in 1979 which allowed foreign investment in medium to large scale operations, to complement internal efforts. This new Act was also to shorten the negotiation period between the government and foreign investors. Shortly after this, a new petroleum act was passed on similar lines, and several oil trans-nationals invested in exploration. In the case of mining not much interest has been shown, due to the low international mineral prices since 1980, except for gold.

B. State Mining Corporation

In addition to the *National Development Corporation* (NDC), in the early seventies activity specific parastatals were set up such as the *State Mining Corporation* (Stamico). Following the Arusha Declaration of 1967, it became policy for the state to control key sectors of the economy including mining. Accordingly Stamico was formed as the state holding company in the minerals sector and to spearhead mineral development in Tanzania.

The Act for Stamico was passed in 1972 and it started operation on 1st January, 1973. It immediately had transferred to it the mineral related holdings of the *National Development Corporation* (NDC) and other state mineral holdings which gave it a controlling equity in the following companies:

- 1) Williamson Diamond Mine Ltd (50%)
- 2) Diamond Cutting Co. Ltd (75% in 1972 from NDC, now 100%)
- 3) Nyanza Salt Mines (T) Ltd (83%, from NDC)
- 4) Tanzania Gemstone Industries Ltd (100%, from NDC)
- 5) Tanganyika Meerscham Corp. Ltd (57%, from NDC)
- 6) Tanzania Portland Cement Co. (100% from NDC).

The Tanzania Portland Cement Company was later transferred to another state company, Saruji Corporation. Since then the following new companies have been acquired or set up for new operations

- 1) Buckreef Gold Mining Co. Ltd.
- 2) Minjinju Phosphate Co. Ltd.
- 3) Coastal Salt Works Co Ltd
- 4) Tanzania Magnesite Co. Ltd.
- 5) Kiwira/Ilima Coal Mines Project
- 6) Kabulo Coal Project
- 7) Natron Soda Ash Project (planned)
- 8) Nzega Base Metals Project
- 9) Samena Pyrite Project
- 10) Kahama Gold Mines Ltd.
- 11) Lupa Gold Mines Co. Ltd.
- 12) Pugu Kaolin Mines Ltd.

In addition, Stamico is considering the possibility of developing the following deposits where pre-feasibility studies have already been done:

- 1) Beach Sands Mining Company (Ti)
- 2) Panda Hill (Apatite/Nb)

- 3) Chunya Iron Ore
- 4) Mchuchuma Coal
- 5) Sekenke Gold
- 6) Kilwa Gypsum
- 7) Chambogo Magnesite
- 8) Merelani Tanzanite (clinozoisite)

Stamico's income should, as a holding company, come from dividends from its equity in its subsidiary companies. Income is also generated through services rendered to its subsidiaries (management fees). In 1986 income from subsidiary companies (management fees) was 23.5 MTZS and in the same year income from its trading activities was more than 22 MTZS. The state generally puts up part of the initial investment (equity) capital for new projects.

In 1986 Stamico had 320 employees of which 170 (53%) were based in Dar es Salaam, and 150 in Dodoma. In that year total capital employed was 1.65 GTZS (43.6 MUSD) from which a net profit of 10.9 MTZS (289 kUSD) was made (0.66% return on capital), but after deducting a loss of 30.8 MTZS brought forward from 1985, the company made an accumulated loss for the year of 22.9 MTZS. Selected financial data for Stamico for the period 1984-86 is presented in Table 8.

Stamico's exposure to loans and loans to subsidiaries increased significantly from 1984 to 1986 (Table 8). From 67 to 283 MTZS for the former and 0 to 187 MTZS for the latter.⁴

The company's consistently poor performance was attributed by the Chairman in his statement for 1985 to a "weakened" market for minerals, a lack of risk finance and a shortage of working capital, but for 1986 the Chairman stated that Stamico's performance was "...linked to the national economic trend..."⁵

Considering that most of the group turnover comes from diamonds and salt (92% in 1986), neither of which have registered major price falls over the last

decade, and that the main immediate mineral potential is in gold which has also maintained its real value, the reasons for Stamico's poor short and long term performance must lie in causes other than "weakened" markets. Well-managed and healthy subsidiaries should not lack working capital, though the shortage of risk capital for new projects could pose a problem, especially for the foreign currency component.

In 1986 the only subsidiary to declare a dividend was the Tanzania Diamond Cutting Co. Ltd which made a profit of 26.4 MTZS on a turnover of 232.3 MTZS. The total turnover of Stamico's subsidiaries was 778.8 MTZS (20.6 MUS\$) of which diamond mining and cutting constituted eighty-six percent, salt made up 6 percent and all the other activities a mere 8 percent.⁶

Stamico's total equity holding in its subsidiaries amounted to 57.1 MTZS in 1986, after provision for diminution, of which 99% was its 50% holding in Williamson Diamonds Ltd. Funds to subsidiary companies amounted to 405.5 MTZS in 1986, up 42% on 1984 (see Appendix I). One third went to Buckreef Gold Mines, 23% to Minjinju Phosphate Company and 28% to the two salt companies (Appendix I).

In 1986 Stamico spent 776 MTZS on 36 development projects, 56% more than the 1984 figure of 498 MTZS. These projects are listed in Appendix I.

Spending on the three coal projects (Songwe/Kiwira, Kabulo and Ilima) constituted 94% of the total, the only other significant amount was on the Lake Natron Soda Ash project which was 2.7% (Appendix I).

Stamico's impressive list of development projects appears to bode well for the future expansion of the Tanzanian minerals sector, except that many of them have been about to go into production for the last decade, and are unlikely to see the light of day in the next decade. In March 1981 Stamico published a list of six projects about to go into production which, by 1982, should have contributed 30-40 kg of new gold, 80 kt of salt, 100 kt of phosphate concentrate and an increase in gemstone output.⁷ From Table 7 it is apparent that, even by 1986, these increases had not even marginally been realised.

A UN report in 1988 which rounded up over twenty years of UN support to the Tanzanian minerals sector and fifteen years of working with and in Stamico, had as one of its recommendations the "disbanding" of Stamico.⁸

Table 8

Stamico: selected financial data, 1984-1986

MTZS	1984	1985	1986
Capital employed	746.92	1 090.42	1 652.10
Grants	652.19	1 010.40	1 316.88
Loans	67.02	45.42	282.81
Income	31.01	46.12	70.67
Expenditure	32.91	41.20	59.73
Net profit	- 1.90	4.92	10.94
Accumulated loss	- 37.66	- 30.75	- 11.94
Application of funds*			
Loans	00.00	3.00	186.84
Subsidiaries	75.22	63.12	57.11
Development projects	113.30	282.43	277.83

Notes:

* A detailed breakdown of funds to subsidiaries and to development projects is given in Appendix I

Source:

Stamico 1987 and 1988.

C. Williamson Diamonds

Currently all diamond production comes from Williamson Diamonds Ltd and its subsidiary, New Alamasi (1963) Ltd. The company is 50% owned by the State, through Stamico. The other half of the equity is held by Willcroft Company Ltd of Bermuda, a subsidiary of the South African diamond mining and trading giant, De Beers Consolidated Diamond Mines Ltd. The management is 100% Tanzanian, but the board is evidently 50% Willcroft nominees.

Since 1983 the Company has made a loss and by the end of 1987 the accumulated loss stood at -251 MTZS (Table 10). Recovery grades have also fallen, from 0.3099 carats/ton in 1966 to 0.0519 carats/ton in 1987, a decrease of 74%. Roughly 85% of output is gem grade.

Its subsidiary, New Alamasi (1963) Ltd exploits what is essentially the same deposit at a much smaller scale. It typically produces between four and eight percent of its parent, Williamson Diamonds and in 1985 its output was

19.7 kcarats from 304.5 ktons of ore mined giving a grade of 0.06483 carats/ton, slightly lower than that of its parent. In the same year New Alamas's gross proceeds from diamond sales were 17.3 MTZS and operating costs were 20.9 MTZS resulting in a loss of 3.6 MTZS.

In 1986 Stamico's 50% shareholding in Williamson Diamonds was valued at 56.45 MTZS. In the same year Stamico was owed 8.1 MTZS by the company and it derived no income from its holding.⁹ In 1985 Williamson Diamonds Ltd employed capital of 358.5 MTZS on which it made a loss of 78.7 MTZS.

The diamonds are sorted by the *Tanzania Government Diamond Sorting Organisation* (Tansort). All of the production is finally exported, but part is allocated to the *Tanzania Diamond Cutting Company* (Tancut) which is paid for in local currency (Tshs). All exports are done through the Diamond Corporation Tanzania Limited to the De Beer's marketing cartel, *Central Selling Organisation (CSO)*. In 1984 the company consumed 46% of the forex it generated and in 1985, 25 percent.¹⁰

The main problems experienced by the company are: The high percentage of down-time of plant and machinery resulting in a low level of plant availability (only 58% in 1985 and 39% in 1986). This is in part caused by the lack of access to foreign exchange for essential spare parts and consumables. The second and major problem is that of falling grades, down by 70% on the mid-sixties.

The third problem is that of theft. It seems that the current diamond security structure which relies on Tanzania Government Police is inadequate and no longer effective to enforce the specialised security measures that are necessary for a diamond mine. Some diamonds therefore are lost through theft, the quantity of which is not known. In 1988 a delegation of Mwadui police

was sent to Debswana in Botswana to study their security measures.¹¹

Finally, international diamond prices have not been as stable as anticipated over the last decade, but on the whole have held up much better than most mineral prices due to the stabilising effect of the CSO's virtual marketing monopoly. Between 1967 and 1985 diamond prices increased over 50% in *real* terms.

The view of several outside observers is that Williamson Diamonds is the best run mining operation in the country due to good training programs in the sixties and early seventies and is now entirely managed by Tanzanians. Although Willcroft has received no return on their equity for several years, it continues to provide limited consultancy services.

The diamond grades are falling and there are only ten more years of production left. Mineable reserves were recently estimated at 35 Mt containing 0.063 carats/t¹² and exploration for fur-

ther reserves has thus far come up with nothing. The plant is badly in need of rehabilitation, therefore the Government has exempted the company from selected taxes/royalties to allow it to invest in the rehabilitation which will allow production to continue at about 200 kcts/an.

Energy is currently supplied at a high cost from old diesel generators, but plans to connect Mwadui to the national grid are well advanced.¹³

D. Tanzania Diamond Cutting Company Ltd (Tancut)

This company is located at Iringa and was originally a joint venture between the NDC and Belgian interests. It was transferred to Stamico at its formation in 1972/3. Only the smaller range of stones are cut and the installed capacity is for about 900 000 small stones per annum.¹⁴ The company currently has a program to widen the range of stones that it cuts.¹⁵

Table 9

Williamson Diamonds Ltd: financial data, 1984-87 (MTZS)

	1984	1985	1986	1987
Proceeds (net)	256.306	231.232	382.521	385.703
Stocks (change)	14.419	- 27.162	7.815	85.827
Income	270.725	204.070	390.336	471.530
Expenditure	288.102	282.759	400.070	531.708
Profit/loss	- 17.377	- 78.693	- 9.733	- 60.178
Accumulated loss	- 73.248	- 142.499	- 152.233	- 250.997
kt ore treated	3 413.5	3 000.8	2 670.5	2 184.7
kcarats	265.6	235.7	160.9	113.4
TZS/ton ore	84.4	94.2	149.8	243.4
TZS/carats	1 084.7	1 199.7	2 486.5	4 688.8
Grade cts/ton	0.0778	0.0785	0.0603	0.0519

Sources:

Williamson Diamonds Ltd, 1986/88

In 1986 its turnover was 232.3 MTZS, on which it made a profit of 26.4 MTZS (11%) and Stamico's 100% holding in it was valued at 4.5 MTZS.¹⁶

E. Saruji Corporation

In 1972 Stamico inherited one operational plant which was later transferred to Tanzania Saruji Corporation (Saruji) in 1976 together with two projects. Saruji is a parastatal specifically set up for the development of the construction materials sector. Saruji controls the following subsidiary companies:

- 1) Tanzania Portland Cement Company Ltd.
- 2) Tanga Cement Company Ltd.
- 3) Mbeya Cement Company Ltd.
- 4) Tanzania Gypsum Company Ltd.
- 5) Tanzania Sheet Glass Ltd.
- 6) Morogoro Ceramic Wares Ltd.
- 7) Nyanza Glass Works Ltd.
- 8) Tanzania Clay Products Ltd.

There are three cement plants: One on the north coast (Tanga), one near Dar es Salaam (Wazo Hill) and one in the southern highlands (Mbeya). The total installed capacity of these three plants is 1.27 Mt/annum.

All the plants use *heavy fuel oil* (HFO) except for Mbeya which also uses coal. It would not be viable for the Dar es Salaam and Tanga plants to convert to coal due to transport (rail) difficulties and the cost of transport.

In 1985 the total investments of the Saruji Group were 2,287 MTZS of which 77% went to the three cement plants. In the same year total employment by the group stood at 2,796 of which 74% were employed at the three cement plants.¹⁷ Total turnover of the group was 992 MTZS (96% cement) and was projected to increase to 2,541 M 1986 TZS by 1988 of which 85% would be from cement.¹⁸

Saruji has been increasingly looking to export markets to cover their essential forex needs as they are allowed to retain 100% of forex earnings.

Current export markets are Madagascar, Ruanda, Burundi, Comoros, Mauritius and, in future, Uganda. Their 1989 export target is 100 kt.

• Tanzania Portland Cement Company (TPCC)

This company is located at Wazo Hill, 25 km from Dar es Salaam, and is the largest of the three with a capacity of 520 kt/an. It has three kilns (HFO), one large one installed in 1979 and two older, smaller, ones which are being rehabilitated (due to finish in 1989). In 1986 the plant produced 232.3 kt of cement, 44.7% of capacity. Production is planned to increase from 380 kt in 1987/8 to 425 kt in 1990/1.

Proven reserves of suitable limestone at the Wazo Hill quarry are 22 Mt containing 44.4 to 53.5% CaO.

• Tanga Cement Company (TCC):

This plant started operating in 1980 and its current capacity is 500 kt/an. In 1986 162.3 kt of cement were produced, 32.5% of capacity. The main obstacle to increasing production is the acute shortage of railway wagons to move the cement from the plant to the consumers. Production has had to stop due to the silos being full. The problem of regular HFO supply has been overcome through the purchase of a coastal tanker by BP Tanzania. Production is planned to increase from 300 kt in 1987/8 to 375 kt in 1990/1. Limestone reserves are estimated at 45 Mt containing 52% CaO.

• Mbeya Cement Company (MCC):

This plant started operating in 1984 and has an installed capacity of 250 kt/an running on a mix of coal and HFO. In 1986 46.9 kt were produced, 18.8% of capacity. The main limitations to increasing output are, firstly, the heavy quarrying equipment is in bad shape

and there are no spares (forex shortage) resulting in low limestone (travertine) supply and, secondly, the shortage of railway wagons causes distribution problems. Production is planned to increase from 125 kt in 1987/8 to 170 kt in 1990/1. Reserves are estimated at 72 Mt containing 48.7 to 53.8% CaO.

• Other activities:

Other activities of the Saruji group include ceramics. In this field production at Morogoro Ceramic Wares limited started in 1986 and output of table ware and sanitary ware was planned at 765 t in 1986/7 (25% of capacity). Production of sheet glass by Tanzania Sheet Glass Industries (Mbagala, Dar es Salaam) was planned to start at 2.7 kt/an in 1986/7 and container glass production at Nyanza Glass Works Ltd is scheduled to begin in 1989/90 at an initial rate of 4 kt/an. A major constraint to glass production is the lack of a domestic supply of soda ash and cullet, which have to be imported. Production of burnt bricks at the Tanzania Clay Products plant in Arusha was scheduled to start in 1987 and roof tiles in 1990.¹⁹

The Saruji group also has its own transport company, Saruji Trucking Company, which hauls about 100 kt of in-house goods per annum, and a training institute for training key operators and maintenance personnel for the group.²⁰ The training institute also undertakes repairs and manufactures some fast moving spares for the building materials industry.

F. National Development Corporation (NDC)

The National Development Corporation was founded in 1964 and although mining and quarrying operations were transferred to Stamico in 1973, it is still responsible for the setting up of the proposed integrated steel works at Liganga (see section on iron ore) and one of its subsidiaries, Aluminium Africa, runs the only steel furnace in the country. In

1987 the NDC employed capital of 1.94 GTZS on which it generated an income of 117 MTZS and a profit of 51.7 MTZS.

• Aluminium Africa (AlAf, 62.5% NDC)

AlAf is located outside Dar es Salaam and is the sole steel producer in the country. It started up in the early sixties as a private company owned by the Chandaria Group which also has similar plants in Kenya and Nigeria. In 1967, after the Arusha declaration, the state, via the NDC, took a controlling share in the company. Comcraft PLC of the UK (another Chandaria Co) has a management contract for AlAf and the present Managing Director is the son of the original owner.²¹

The principal activity of the company is the transformation of imported aluminium ingots (mainly from Canada, financed by grants). They have an aluminium sheet mill, a foil mill and an extrusion plant, but the company also has a small 10 t arc ferrous furnace made in India with a 18 kt/an capacity. It runs on scrap and local limestone flux (coral, Wazo Hill). It produces billets for castings and sheet rolling.

The capacity of the casting unit is 40 kt/an and in order to fully utilise this facility it is planned to install a second 20 t arc furnace with an annual capacity of 40 kt. At the moment billets are imported to supplement the output of the furnace for the casting plant, but it still operates well under capacity due to forex limitations for the billet imports.

Scrap availability is erratic due to transport problems, particularly rail difficulties (*Tanzania Railway Corporation*, TRC), and at times scrap has had to be imported.²²

AlAf has a cold rolling mill for making corrugated galvanised iron sheeting. Galvanised iron pipes are also produced. The zinc is imported from Zambia (4-6t/an). The AlAf billets are also

used by Steel Rolling Mills Ltd in Tanga.

In 1987 AlAf's turnover was 2.41 GTZS, total capital employed was 244 MTZS on which they made a pre-tax profit of 83 MTZS and paid taxes of 41 MTZS.²³ In the same year NDC received no dividends from AlAf.

• Steel Rolling Mills Ltd (SRM)

This company is located in Tanga and was set up by the state in 1970/1 (97.8% NDC). Equipment was purchased from Daniel & Co. (Italy) who are the technical consultants and own 4.7% of the equity, but it is managed by the NDC. It buys AlAf billets for the manufacture of reinforcing bars (up to 16mm diam) for the construction industry.

The installed capacity is 30 kt/an, but as AlAf cannot supply total needs, about 20 kt/an of billets are imported. The company is also in the process of commissioning a wire drawing plant from Italy (Daniel) with a capacity of 30 kt/an. The plant was installed in 1983 but has not opened yet due to a lack of forex (about 200 kUSD) to get a few missing components. There is also a rolling mill for angles and shapes, but it is not operational due to both a lack of billets and a lack of a market.²⁴

In 1987 the company employed capital of 43 MTZS on which they made a net loss of 26 MTZS.²⁵

G. Tanzania Petroleum Development Corp (TPDC)

The Tanzania Petroleum Development Corporation is a parastatal under the Ministry of Energy and Minerals and commenced operations in 1972. Its objectives are to explore for and produce petroleum and natural gas and to act as the government agent in joint undertakings with other oil companies.

TPDC is the sole importer of crude oil, and the main importer of white products while the oil marketing companies are responsible for the distribu-

tion of refined products. In addition, the TPDC is responsible for product distribution within the country to areas not covered by the oil majors.²⁶

All exploration by the oil majors is done on the basis of *production sharing agreements* (PSA's) with TPDC and government for any future production.

In 1985 TPDC employed capital of 3.66 GTZS on which they generated a revenue of 4.62 GTZS and made a before tax profit of 1.5 GTZS.²⁷ In that year grants received from government for projects stood at 1.23 GTZS of which 64% was for the Songo Songo Oil Gas Exploration Project.²⁸

V. THE MINING INDUSTRY BY MINERAL

A. Diamonds

Diamonds are by far the most important mineral in terms of both gross and export value, since 1945 when they replaced gold. By 1959 diamonds contributed two-thirds of the total value of mineral production, and by 1986, 81 percent (Table 6).

Diamonds were first exploited near the Mabuki kimberlite pipe south-east of Mwanza immediately following the First World War where the deposits overlying the pipe were worked from 1925 to 1931, when the underlying kimberlite was determined to be uneconomic. Between 1926 and 1940 diamonds were also exploited from a variety of gravel deposits including Usongo (Nzega) and, Kisumbi and Uduhe, near Shinyanga.²⁹

In 1940 Dr J T Williamson started mining gravels at Mwadui, north of Shinyanga and in the fifties production from this operation averaged 350 kcarats/an increasing to 500 kcarats in 1959. The adjacent claims were worked by Alamas Ltd which produced about 14 kcarats/an in the fifties. By 1967 there were six diamond producers: New Alamas (1963) Ltd (33 kcarats), Williamson Diamonds Ltd: 882 kcarats,

Kahama Mine Ltd (Nyanhwale Mine) 11.5 kcarats and three small-workers (5 carats), with a total of 926.8 kcarats.³⁰

Production peaked in 1971 at 971 kcarats and has steadily declined since then to 113 kcarats in 1987, down by 88 percent. Production from 1960 is presented in Table 10 and from 1935 in Figure 2.

A UN study on the diamond exploration potential of Tanzania, done in 1985, concluded that further kimberlite exploration would be justified and recommended that 25 known diamond-bearing kimberlite pipes in the Mwadui area should be re-sampled.³¹

B. Gold and silver

Between 1930 and 1944 gold was the premier export worth 24 MTZS in 1940 (41 million 1987 USD). Production fell to less than half the 1941 peak of 4.4 t during the Second World War (Figure 2) then recovered to a peak of 3.32 t in 1960 before falling off to virtually zero by the early seventies (Figure 2). The main reason for this decline was the fixed gold price of 35 USD/oz which in reality was declining at the rate of inflation in the United States. Figure 2 displays the decline in deflated 1987 USD,

from 9.5 USD/gram in 1940, to an all-time low of 3.1 USD/gram in 1970, a fall in real terms of 67%.

From 1971 gold went onto the open market and the price rose dramatically in real terms, almost nine-fold in the decade from 1970 to 1980 when it reached an all-time high of 27.37 1987 USD per gram. It then fell to a low in 1985 before recovering to 13.9 USD/g in 1987 (Figure 2). Nevertheless, the 1987 price was 450% higher than the 1970 price in real, deflated, US dollars.

From Figure 2 it is apparent that gold production in Tanzania wholly failed to respond to the rapid increases in real price registered since 1970. It was also during this period that Stamico was formed to develop the mining industry along the principles of socialism and self-reliance as enunciated in the Arusha Declaration of 1967. In 1987 officially registered gold production was 201 kg, most of which came from DTT buying and Buck Reef mine.

Before 1940, a significant proportion of gold production came from numerous small workers, but they could not survive the constantly falling real price of the forties, so by the fifties almost all of the production came from a few, me-

dium scale, operations, namely Saza and Ntumbi (Lupa), Mukwamba (Mpanda), Geita and Mawe Meru (Mwanza) and Buhemba and Kiabakari (Musoma).³²

Almost all of the production has come from seven well defined areas, namely:

- 1) The Lupa Goldfield
- 2) The Mpande Mineral Field
- 3) The Ruvu River Placer Deposits
- 4) The Iramba-Sekenke Goldfields
- 5) The South-west Mwanza Goldfields
- 6) The Nzega Goldfield
- 7) The Musoma Goldfield

Areas 3) to 5) are also jointly called the Lake Victoria Goldfield.

1) The Lupa Goldfield

This field is located in the south-west of the country in Mbeya district, north-east of the town with the same name. It is bounded by the Rukwa fault in the north-west and the Usango fault in the north-east. The geology is complex consisting of metamorphic rocks (gneisses) of Archaean age intruded by dolerites, granodiorites and diorites. The gold occurs in both auriferous reefs and allu-

Table 10

Diamond production: 1960 - 86

Year	60	61	62	63	64	65	66	67	68	69	70	71	72	73
kcarat	526	668	637	572	634	742	925	882	655	731	637	971	595	464
% change		+27	-5	-10	+11	+17	+25	-5	-26	+12	-13	+52	-39	-22
Year	74	75	76	77	78	79	80	81	82	83	84	85	86	87
kcarat	453	479	401	376	282	307	256	272	262	243	266	236	161	113
% change		-2	+6	-16	-6	-25	+9	-17	+6	-4	-7	+9	-11	-31

Source:

Williamson Diamonds Ltd: 1988b

vial deposits. Due to the scarcity of water, novel methods of recovery using dry-blowers were developed in the thirties.³²³

Alluvial production from this field peaked in 1936 at 1.25 t and reef production peaked in 1941 when 1.01 t was produced. By 1959 a mere 90 kg were produced and in 1963 the last reef mine, Ntumbi, closed. The reef operations produced an almost equal amount of associated silver, usually 80-90% that of gold.

The two principal reef operations, New Saza and Ntumbi, had very high grades, 8 and 19 gm/t of gold respectively and, in addition, New Saza ore contained 7.6 gm/t of silver. Following the closure of the formal mining operations, informal production took over and currently there are several thousand small scale operators in well-established mining communities, but none of their production is registered. It is believed to be sold privately at two to three times the official price.

In 1970 the USSR started an aid program to reassess the Lupa and Mpanda fields. They were active in the area for several years and installed a washing plant which is still operated on a small scale. The prospects are generally very low grade alluvial deposits (0.2 g/t), but a recent report suggests that there is potential in the old reef mines for grades less than 6 gm/t which should be reassessed in the light of current gold prices which are three times higher, in real terms, than when the reef operations closed.³⁴

Reserves at Ntumbi, estimated by Technoexport of USSR, are 450 kt containing 13.5 gm/t Au. They also estimated 530 kt of reserves at Gap Mine containing 10.1 gm/t Au.

Lupa Gold Mines Ltd was set up by Stamico for the exploitation of the Lupa field with aid from the USSR (Technoexport) who supplied the credit and the equipment for Lupa Gold Mine. In 1986 it had no turnover, but had re-

ceived 35 MTZS from its parent, Stamico. In the same year it had a debt to Stamico of 4.3 MTZS and was still paying off the USSR credit.³⁵

One of the four proposals for funding by the UN Revolving Fund put forward by their recent study of the SADCC region was for an investigation of the Lupa Goldfield to determine reserves at an estimated cost of 3.25 MUSD over three years.³⁶

2) The Mpanda Mineral Field

This mineral field is situated at Mpanda about 110 km east of Lake Tanganyika and is connected by a branch line to the central railway line running from Dar es Salaam to Kigoma. It started out as an alluvial gold field in the thirties, but by 1950 had become a lead and copper producer, though with significant by-product of gold. This mineral field was reassessed by Technoexport (USSR) in the early seventies who concluded that the area offered potential for both precious and base metals, but no concrete follow up was carried out by Stamico. By 1986 Stamico had spent 2.3 MTZS on the Mpanda Gold Development Project and lent it 0.85 MTZS.³⁷

3) The Ruvu River Placer Deposits

These alluvial gold deposits are located south of Morogoro in the centre-east of the country on the Ruvu River. From 1934 to 1942 1 271 oz of gold were extracted from these sands, but since then not much interest has been shown in them.

4) The Iramba-Sekenke Goldfield

This small field is located in Singida Region in the Nyanzian System (greenstone) in the centre-north of the country. The principal mines were Sekenke, which produced most of the gold from the area, and Kirondatal. The former started production in 1909 and produced about 4.4 t of gold from quartz veins before closing in the fifties.

A prefeasibility study of this field was done by Stamico with inconclusive results. In 1986 Stamico spent 637 kTZS on the Sekenke Gold Field Development Project. At present there are no immediate plans for the development of this field, even though a UN report done in 1986 concluded that both Sekenke and Kirondatal mines and adjacent areas warranted further appraisal.³⁸

5) The South-west Mwanza Goldfield (South Lake Victoria)

This field is located about 100 km south-west of Mwanza and is a zone of widespread mineralisation in two areas of Nyanzian rocks which form part of a greenstone belt which continues around Lake Victoria to Kenya. The field used to have 30 to 40 gold mining operations.

The principal mining area was around Geita, particularly Geita Mine, which reached a depth of 400 metres, and Lone Cone Mine. The mines closed in 1964/5 due to low prices.

Recently the area around the old Geita and Lone Cone Mines has been reappraised by UNDP which diamond drilled two prospects in the area and concluded that there were excellent possibilities for high grade mineralisation in the area, particularly for open pit exploitation, and recommended that further drilling be undertaken as a matter of urgency.

Several mining companies have displayed interest in the area including Cluff Minerals (UK) who have open pit heap leaching operations in Zimbabwe.

The Stamico Buckreef Mine is also in this area and was rehabilitated with SIDA (Sweden) aid believed to be about 11 MUSD. It has a hydrothermal vertical reef about 8 m by 600 m and has a good shaft, mill and concentrator, but has no developed ore reserves as there are no resources to develop the reserves. It is shut down 80% of the time due to a lack of diesel and/or other inputs. In 1986 it was still experiencing

metallurgical problems and only managed to operate at 5% of capacity.³⁹

According to some observers it was designed and built by non gold miners using inappropriate South African technology. Although the ore grades 5 to 8 g/t gold, much of it is in pyrite which goes to the tailings dump. An appraisal of the operation done in 1984 concluded that the mine's economic potential was good and that it should be further invested in, but by 1987 it was still a marginal gold producer.⁴⁰

In 1986 the Buck Reef Gold Mining Company Ltd had a turnover of 10.1 MTZS and had received funds totalling 126 MTZS (3.3 MUSD) from its parent, Stamico. In the same year it had debts with Stamico of 32 MTZS and the SIDA development grant to Buckreef, via Stamico, totalled 11 MTZS.⁴¹

The second mining area in the Mwanza field is the Mawe Meru-Rwamugaza area, particularly the Mawe Meru Mine (quartz reef) which closed in 1952 due to reserves depletion.

Also in the South-West Mwanza Field is the Bulyanhulu deposit, also known as Kahama, considered to be the most promising gold prospect in the country. Exploration and the feasibility study was done by Stamico in partnership with a Finnish elevator manufacturer (Kone Oy).

The seam averages 4.27m thick and reserves are estimated at 4.332 Mt containing 10.76 g/t Au, 12.05 g/t Ag and 0.66% Cu. The planned production rate of 150 kt of ore per annum would produce a matte containing 1.6 t of gold, 1.8 t of silver and 900 t of copper, worth, in 1988, 23.6 MUSD. Placer Dome (Canada) are likely to invest in the development of this choice prospect.

Kone Oy are shareholders in Kahama Gold Mines Company Ltd, a Stamico subsidiary. In 1986 Stamico spent 5.3 MTZS on the development of Kahama/Balyankulu Gold mines and

the company owed Stamico 4.4 MTZS.⁴²

6) The Nzega Goldfield

This field is located between the South-West Mwanza and the Iramba-Sekenke Goldfields. This principal operation was Canuck Mine which, between 1945 and 1953, extracted 34 kt of ore containing 232 kg of gold and 21 kg of silver. Other producers in the area included Ulaga-Mirwa, Igusule and Mahene. Small-scale miners have recently started exploiting what appear to be good prospects at Nzega-Ndogo and Matinje.

7) The Musoma Goldfield

This field is located on Nyanzian rocks extending north-east from Lake Victoria, between Mwanza and Musoma, and was once the premier goldfield in the country (1930s). The main producers were, first the Buhemba Mine, and later the Kiabakari Mine. Other operations were Ikungu, Mara and Kilima-fedha.

The only current operation is the retreatment of the old Buhemba dump by cyanide leaching of about 100 t/day, producing about 40 kg/annum. The reserves (dump) are estimated at about 1 Mt containing 1.5 g/t gold in pyrite. This is a demonstration operation and forms part of the Dar Tadine Tanzania - Stamico activities in Tanzania. In 1986 it produced 56.6 kg of gold.⁴³

Dar Tadine Tanzania Ltd (DTT)

In 1976 Tanzanian Government incurred a major exploration expenditure of 10 MUSD by carrying out an extensive aero-geophysical survey of the country, done by Geosurvey (FRG). Shortly after completing the work Geosurvey was declared bankrupt and was bought by a Geneva-based, Islamic-funded company called Dar Tadine Al Umma. The main share-holding in this company is from interests in the Gulf states. Dar Tadine Tanzania is

owned by Dar Tadine Al Umma and loaned the Tanzanian government 10 MUSD to pay Geosurvey to release the geophysical data from their survey.

DTT has also been involved in an experimental project with Stamico whereby DTT sends teams of purchasers into the illegal gold mining areas to buy the gold at open market prices. Under the agreement Stamico receives one-third of the gold and two-thirds is kept by DTT. To make up for the difference between the parallel market price and the official price, DTT is allowed to import consumer goods and sell them at "free market" prices. This project was an attempt to give the small workers a legal, safer, status.⁴⁴

In 1984 the *Commonwealth Secretariat for Technical Cooperation* (CFTC) assisted Stamico in the drawing up of a *production sharing agreement* (PSA) with DTT for exploration licences for gold prospecting in five greenstone belts (Singida, Geita, Rwamagaza, Musoma and Mara). In particular they have been looking for gold in the dambos/mbugas (wet lands) without much result.

In the Geita and Rwamagaza areas there are mobile loose knit communities based on small-scale gold mining. In order not to destroy these communities DTT has agreed to allow the small scale miners to continue under DTT supervision, but all gold sales must be made to DTT. These form part of the 1:2 product sharing agreement between DTT and Stamico.

A 1988 UN assessment of the gold mining potential of Tanzania noted that one of the reasons why there had been little activity, since the new mining policy was brought into effect, was that:

... "In 1984... (DTT) ...with no experience in mine development was given three year exclusive rights over areas which covered about 80% of the most attractive gold prospects of northern Tanzania.

This effectively shut out other investors whilst... (DTT) ...made little effort to explore or develop its prospects."⁴⁵

In September 1987 a Parliamentary enquiry into activities of DTT was set up which recommended that the DTT concession should be suspended.

Small-scale (artisanal) gold miners

Small scale miners are active on all of these gold fields and it is estimated that about one to two tonnes of reef gold (bullion) is smuggled to Burundi annually as the official price is less than half the black market price. The gold is recovered by using mercury resulting in a thriving black market for mercury.

In 1982/3 the Dept of Mines installed two model plants to serve the small scale miners, one at Chunya (Lupa Field) and one at Buziba (Geita), but neither are operating. The idea would be for the small scale miners to bring ore to these plants for treatment.

Gold mining potential

Tanzania clearly has significant gold mining potential in all of the areas listed above. Operations ceased in most of them at a time when gold prices were at historically low levels and hence the cut-off grades that determined their closure were relatively high, in some cases as high as 6-8g Au/t. Current gold prices are three times higher, in real terms, than the average for 1950 to 1960 (Figure 2), and many of the closed operations would now be economically viable and warrant reassessment.

The current small scale operations are only exploiting ore with visible gold. There therefore exists potential for exploiting the non-visible gold ore and refractory ore in the small scale zones. In some areas the small-scale miner's dumps run at 2-6 g/t and the rubble at 1-8 g/t and could supply the feed for a cheap leach operation.

C. Salt

Salt has been produced from solar pans along the Tanzanian coast and from brine springs at Uvinza for centuries and, in modern times, has always been

an important mineral in terms of value of output. In 1926 three thousand tonnes were sold with a value of 342 kTZS, fourth after diamonds, gold and mica, and by 1959 production had risen

Table 11
Selected gold prospects in Tanzania

Goldfield	Prospect/mine	Reserves	Grade/s
Kahama	Bulyanhulu	4.33 Mt	10.8 g/t, 12 g/t Ag
	Jubilee Reef		3.2 to 8 g/t
Geita	NE Extension		2 to 5 g/t
	Nyamulilima		6.4 g/t over 12m, 9.2 g/t over 8m
Mwanza	Buck Reef	0.6 Mt	7 to 10 g/t
	Mawe Meru		7.3 g/t
	El Dorado		12.7 g/t, 1.2 g/t Ag
Iramba-Sekenke	Ramugaza	1.0 Mt	5.8 to 20 g/t
	Ililika		44.4 to 120 g/t
	Sabura		10.5 g/t
	Sekenke Mine		2.9 g/t to 28.7 g/t
	Sekenke Tails	0.2 Mt	2 g/t
	Kirondatal		9 g/t
Musoma	Kiabakari		6 g/t
	Maji Moto		7 to 13 g/t
	Simba Sirori		10 g/t
	Buhemba Tails	1.0 Mt	1.5 g/t
Nzega	Kibumai		10 g/t
	Canuck Mine		2.4 to 26.8 g/t
	Nzega-Ndogo		5 to 20 g/t
Lupa	Matinje		about 10 g/t
	Saza	1.46 Mt	7.8 g/t
	Gap	0.52 Mt	10.1 g/t
	Razorback	0.12 Mt	5.3 g/t
	Maperi	0.09 Mt	11.5 g/t
	Chapa-Chipoka	0.23 Mt	7.8 g/t
	Manzis	0.05 Mt	7.7 g/t
	Galena	0.05 Mt	8.8 g/t
	Ntumbi	0.45 mt	14.1 g/t
	Nigel	0.14 Mt	7.0 g/t

Source:
UN, 1967; IMR SADCC Mining Databank

ten-fold to 30 kt worth 5 MTZS, fifth after diamonds, gold, lead and copper (Table 6).

After independence production was further expanded and by 1967 35 kt were produced worth 7.2 MTZS of which 11 kt (2.9 MTZS) were exported. Production peaked ten years later in 1976 at 58 kt before falling to a mere 21 kt in 1985, down by two-thirds. Production recovered somewhat in 1986 and in 1987 41 kt were produced worth 89 MTZS of which 14% was exported.

National demand for salt is about 100 kt/an and local capacity is about 50 kt/an which can be broken down as follows: small-scale marine pans 10 kt, medium-scale marine pans 20 kt and brines 20 kt.

Nyanza Salt Mines (T) Ltd

Originally a private company in which the NDC took a controlling interest in the 1960s which was later transferred to Stamico (83%). It is located at Uvinza in Kigoma District and the operation is based on the exploitation of underground brines. Sodium chloride constitutes about 91% of the dissolved solids, potassium chloride about 2.5% and the rest (about 6.5%) is made up of sulphates and chlorides of calcium and magnesium.⁴⁶ The springs are thought to be related to the Great East African Rift system.

In 1986 Nyanza Salt Mines had a turnover of 41.6 MTZS, 32% down on 1985, and received funds of 56.9 MTZS from its mother company, Stamico. In the same year it owed Stamico 17.9 MTZS and the 83% shareholding was valued at 0.93 MTshs. It only managed to operate at 35% of capacity in 1986 and it made a loss of 20 MTZS.⁴⁷

The original capacity of the "grainer" operation was 18 kt/an. A new 60 kt/an vacuum plant built by IDECO SRL (Italy) for PVD refined salt came on stream in the second half of 1987. In addition there is a solar salt works with a capacity of 10 kt/an.

Coastal Salt Works Company Ltd

In 1986 the Stamico subsidiary, Coastal Saltworks Company Ltd, had a turnover of 7 MTZS and produced over 1 kt of salt. In that year Stamico spent 56 MTZS on the company (Appendix I) and it was owed 11 MTZS by the company.⁴⁸

The company aims to establish plants all along the coast based on the evaporation of sea water in solar pans with a final capacity of 100 kt/an. The Stamico Sadani salt works project based north of Bagamoyo should come on stream in the near future and have a final operational output of some 40 kt/an in 1992. The Changwahela salt works and the Kitame salt works are both under development.

Small-scale salt paners operate all along the coastline at Bagamoyo, Dar es Salaam (Kunduchi, Temeke), Lindi and Mtwara, and are supported by the Commissioner for Mines via a team of experts who visit the villagers and advise on production methods, carry out feasibility studies and advise on purchase of equipment. The producers can get loans from the bank on the recommendation of the ministry. Production from these operations is approximately 10 kt/an.

Also worth mention are the immense rock salt resources presently not exploited at Kilwa on the southern coast. The deposit is part of a dome structure with gypsum at the top underlain by anhydrite followed by an unknown thickness of rock salt.

Once all the current projects are fully operational the total national production capacity of salt should be in the order of 150 kt/an worth more than diamond production, half of which will be destined for regional export markets (Zaire, Zambia, Malawi, Ruanda, Burundi and Uganda). The Sua Pan soda ash project in Botswana is projected to produce a surplus of 600 kt/an of salt which will clearly limit Tanzania's development of a regional market to the south.

D. Phosphate

Phosphates occur in three broad types in Tanzania:

- a) Apatite (Zizi marble and Mbeya, Ngualla and Mbalizi carbonatite)
- b) Guano (bat and bird guano)
- c) Phosphate in lake beds (Minjinju)

Historically guano was the first phosphate to be exploited. Exploitation the Sukamawera (bat guano) deposit, from 1934 to 1957, resulted in 3 kt of guano worth 230 kTZS.⁴⁹

Minjinju

This deposit, located near Lake Manyara Arusha district, occurs interbedded with clays deposited around the Minjinju gneiss Kopje which was presumably once a small island in a larger lake Manyara with prolific birdlife. The bird guano was then leached into the surrounding lake sediments (clays).

It was first assessed in the late fifties by New Consolidated Gold Fields Ltd who delineated approximately 10 Mt of ore with an average grade of 20% P₂O₅ occurring as two types, a friable (soft) phosphate containing 18.5% P₂O₅, and a hard siliceous phosphate containing 21.4% P₂O₅, in roughly equal proportions. The soft ore was readily amenable to upgrading to 28% P₂O₅ by dry screening, resulting in a product suitable for direct fertiliser application.⁵⁰

In 1966/7 the deposit was reassessed by the Japanese Consulting Institute on behalf of the NDC and it concluded that exploitation was indeed feasible.⁵¹ Further work carried out in 1981 estimated 2.2 Mt of soft ore reserves.

Stamico set up the Minjinju Phosphate Company Limited to exploit the deposit and the construction of the plant was completed by Kone Oy Corp. (Finnish) in 1983, in part (21%) financed by a soft Finnish loan. Production finally commenced, after numerous delays, on a small scale in 1984 when 14.6 kt of phosphate was produced.

The rated capacity of the plant is 100 kt/an of concentrate from 165 kt of ore. In 1985 21 kt were produced and by 1986 output had fallen to 18 kt (18% of capacity) worth 36 MTZS. The drop in production was attributed to a shortage of railway wagons for the long haul to Tanga, 500 km away.⁵²

The ore is upgraded by dry screening to 30% P₂O₅ and the concentrate is transported to the Tanga fertilizer factory by road and rail where it is treated with acid made from imported sulphur to make double and triple phosphate fertilizers.⁵³

In 1987 the Minjinju Phosphate Company had an accumulated loss of 463 MTZS, had a turnover of 36 MTZS and had received funds 65 MTZS from its parent, Stamico.⁵⁴ In addition, the company contributed over one million Tshs to Stamico's running costs ("management fees"). The company's liabilities exceeded its assets by 1.0 GTZS and the auditors concluded that it could not continue without external financial support.

A major limitation to operating at full capacity (100 kt/an) would be the currently low capacity of the Tanga Fertilizer plant which is in need of rehabilitation. A project to this end is in the pipeline, whereupon the Minjingu operation will be brought up to full capacity.

Panda Hill

This carbonatite ring complex, located near Mbeya in the south-west of the country, contains both apatite (P) and pyrochlore (Nb) reserves.

In the 1970s Stamico undertook a prefeasibility study of the deposit which is situated close to the Tazara railway (0.5 km). A South African company did work on the deposit in the 1950s when concentrates containing 80% apatite were produced on a laboratory scale.

Reserves less than 1450m depth are estimated at 91 Mt containing 3.4% P₂O₅ and 0.35% Nb or 71 Mt at 4.0% P₂O₅ and 0.40% Nb.⁵⁵

Zizi

The Zizi apatite marble deposit is located fifty km south of Kisaki in Morogoro district and is about 30 m thick with a strike of over 1.2 km. The rock grades from 4.5 to 10.5% P₂O₅ and reserves are put at 2 Mt of rock per 30 m of depth. Beneficiation tests yielded a concentrate containing 25% P₂O₅.⁵⁶

Pyrite

Related to phosphate production is a Stamico project for the exploitation of pyrite for the manufacture of sulphuric acid to treat the phosphate concentrate at the Tanga fertiliser plant.

Stamico carried out the exploration of the Samena pyrite deposit (Geita district, near Buck Reef Mine). Small-scale opencast exploitation is planned for the supply pyrite to the Tanzania Fertilizer Company Ltd in Tanga, but nothing concrete has been done. In 1986 Stamico had spent 1.89 MTshs on the Samena Pyrites Exploration Project and 206 kTZS had been loaned to the project. For the same year Stamico declared an income from the project of 193 kZS for management fees.⁵⁷

E. Cement materials, gypsum & sand

Cement grade limestone deposits occur all along the coast in the belt of marine sedimentary rocks (corals) of Tertiary age and limestones of Jurassic and Cretaceous age. Suitable deposits also exist in the interior, but are much less frequent. There are three quarries under Saruji Corporation supplying a total of around 700 kt/an of limestone to the cement plants at Wazo Hill, Tanga and Mbeya. A private company, Mwaweni, operates a small quarry for the production of lime in Tanga and there are artisanal lime producers (for paint, cement, agriculture) scattered throughout the country

All cement production is from Saruji and since independence output has almost doubled. (Table 12).

Gypsum

Between 10 and 20 kt/an of gypsum is produced by small scale miners for the three cement plants. These operations are based around Mkomazi and Makanya (north-west of Tanga) where the small-scale operations exploit gypsum lacustrine deposits containing 60-80% gypsum. Other gypsum deposits are located at Msagali, Itigi and Mtegu (Harris: 1961). Saruji's five year plan, 1986/7 to 1990/1, projects gypsum demand from the cement plants to increase from 35 kt to 49 kt, all to be supplied by small-scale operators.⁵⁸

Kilwa Gypsum

A major rock gypsum and anhydrite resource is situated a Kilwa 20 km from the coast in the south near the Songo Songo gas field. It is a dome shaped structure penetrating limestones. The dome consists of gypsum at the top, underlain by a zone of anhydrite (to 100 m depth) followed by an unknown sequence of rock salt (to 10 000 ft). In the mid-fifties the structure was drilled by BP/Shell (3 holes) to a depth of 3 000 m.

In the late seventies Stamico drilled the formation (gypsum/salt) to 400 m and proven reserves over a small area of the deposit were determined to be 5 Mt containing 85% gypsum. Stamico also completed the pre-feasibility study, but currently the project is on ice. Local demand for gypsum runs at 60 to 80 kt/an, but there could also be other markets in the region. By 1986 Stamico had spent 1.9 MTZS on the Kilwa Gypsum Development Project and it had an outstanding loan of 543 kTZS to Stamico.⁵⁹

F. Coal

Despite Tanzania's considerable coal resources there has been virtually no exploitation (Table 7). A major deterrent

has been that the deposits are extremely isolated, mainly in the south-west of the country. The advent of the Tazara railway in 1975, linked this area to the coast (Dar es Salaam) and opened up possibilities for coal exploitation which are just beginning to be realised.

The coalfields are all of Karoo age and tend to have fairly high ash contents. The following are the main areas:

- 1) Ruhuhu Coalfields
- 2) Songwe-Kiwira Coalfield
- 3) Galula Coalfield
- 4) Ufipa Coalfield
- 5) Mhukuru Coalfield

- 6) Mbamba Bay Coalfield
- 7) Njuga Coalfield

The Ruhuhu Coalfields

These fields are the largest, contain the best grade coals and are located in Songea district in the Ruhuhu River valley running south-west to Lake Nyasa. It consists of two fields: the Ngaka and the Ketawaka-Mchuchuma coalfields. They were extensively surveyed by the *Colonial Development Corporation* (CDC) between 1949 and 1953. The coal is average Gondwana type bituminous coal with an ash content of around 15%, volatiles around 25% and a calo-

rific value of 12 to 13 thousand BTU/lb.⁶⁰ Proven reserves estimated by the CDC were 187 Mt at Mchuchuma and 98 Mt at Ngaka.

The development of this field has been considered in the context of a steel industry based on the nearby Liganga titanomagnetite iron ore deposits (see section on iron and steel). In this regard a prefeasibility study was done by Stamico on the Muchuchuma coalfield financed through GTZ (West German aid).

Songwe-Kiwira Coalfield

This field is situated at the extreme north-western end of Lake Nyasa on the Malawi border in Rujewa district. It is the most accessible of all the fields and is the only field to have been exploited, albeit at an extremely low level, at Ilima. It was investigated by the CDC from 1955 to 1957 when some 20 Mt of reserves of bituminous coal were delineated. The seams are thin with intercalated mudstones and shales which results in high ash contents for bulk samples.⁶¹ Further investigation of this field by a team from China estimated reserves at Ivogo to be 50 Mt.⁶²

Three mines in the basin are being developed to supply coal to tea and tobacco farming, the Mbeya Cement Company and the Southern Paper Mill. By 1985 Stamico had allocated 623 MTZS to the development of the Songwe-Kiwira Coal Project, representing 80% of total development expenditure.⁶³

The Ilima Colliery, which has operated privately for many years (about 10 kt/an) is undergoing expansion. The rehabilitation program underway will increase output to 20 kt/an. In 1986 the Ilima Colliery Project had a turnover of 4 MTZS, owed Stamico 5.6 MTZS on development loans and Stamico derived 194 kTZS of its income from the colliery.⁶⁴

The Kiwira Colliery is a new mine being developed by Stamico with Chi-

Table 12
Tanzania cement production (kt)
(Tanzania Saruji Corp)

Year	TPCC	TCC	MCC	Total	Capacity	% Capacity
1972	236.96			236.96	120	198
1973	190.00			190.00	314	61
1974	296.40			296.40	314	94
1975	266.00			266.00	314	85
1976	244.40			244.40	314	78
1977	268.88			268.88	314	86
1978	250.69			250.69	314	80
1979	298.84			298.84	520	57
1980	286.41	19.90		306.31	1 270	24
1981	252.99	136.62		389.61	1 270	31
1982	214.71	155.04		369.75	1 270	29
1983	126.02	137.39	10	273.41	1 270	22
1984	171.76	144.78	51.99	368.54	1 270	29
1985	180.56	154.03	41.87	376.46	1 270	30
1986	232.30	162.25	46.85	441.40	1 270	35
1987	281.66	158.94	51.62	492.21	1 270	39
1988	361.19	171.05	62.01	594.25	1 270	47

Notes

TPCC: Tanzania Portland Cement Company (Dar Es Salaam); TCC (Tanga Cement Company); MCC: Mbeya Cement Company.

Source:

Saruji: 1987.

nese assistance and came on stream at the end of 1988 with an initial production of 150 kt/an for the Mbeya cement plant, the Southern Paper Mill and to generate power for the mine, but is experiencing difficulties in securing a market for all of its output. Reserves in the area are estimated at 33 Mt containing 25% to 40% ash.

The Kabulo Coal Development Project is a new Stamico exploration project financed by the IDA to delineate ore reserves for the opening up of an opencast mine to produce 350 kt/an. Reserves estimated thus far are 25 Mt containing 30-40% ash. In 1986 Stamico spent 75 MTZS on the project which had a debit of 1.9 MTZS to its parent.⁶⁵

Other coalfields:

There are currently no plans for the development of the other coalfields (Galula, Ufipa, Njuga, Mhukuru and Mbamba Bay) as they are isolated and tend to have high ash contents.⁶⁶

G. Tin and tungsten

All production of tin and tungsten has come from the Karagwe Tinfield, in Bukoba district in the extreme north-west corner of the country, on the Rwanda border. The cassiterite placers from pegmatites have been mined by small workers since 1924 and peak production of concentrates was reached in 1966 when 482 t worth 8.8 MTZS were produced. Tungsten production from the Karagwe field came from two operations, Karugu and Chamunyana, and production of wolframite concentrate peaked in 1950 at 42 t.⁶⁷

There are five principal tin zones, the Murongo area comprising Murongo, Pitember Reef, Ilama, Rwamakombe, Irama and Rwamatete; the Rugasha area comprising Nyakatuntu, Rugasha, Rushasha and Kagando; the Kagaga-Bihanga area; the Katera-Lwamosi-Kafulu area and, finally, the Kyerwa area comprising Kigarama, Compaan's

Mine, Rwabushoga, Kikkides' Reef, Kaboreshoke, Nyarumbura, Flat Spur and Grey Tin Creek.⁶⁸

During peak production in the mid-sixties the main operator was Kyerwa Syndicate Ltd, a subsidiary of Straits Trading Company (Singapore), which produced about one-third of total output.⁶⁹ Production fell rapidly in the late sixties due to falling prices and by 1970 only 50 tonnes were produced, all from small scale operators. The real price of tin rose significantly from 1970 under the ITC, to 1984 when it collapsed. During this period Stamico failed to take advantage of the historically high prices (in 1979 they were 125% higher than 1970, in real terms) by expanding production.

In 1982/3 the Mines Department set up a small-scale model plant in the Kyerwa area for the local small scale operators to bring their ore to for concentration, but the shortage of water for washing the pegmatitic material has limited the effectiveness of this facility and by 1986 no ore was treated. In 1986 Stamico registered a cost of 628 kTZS for the Kyerwa Tin Buying Unit.⁷⁰

H. Kaolin

There are numerous kaolin deposits in Tanzania, but most are impure and of no commercial value. There are two main types of economic kaolin clays, those in sedimentary rocks and those in areas of weathering of felspathic rocks.⁷¹

Pugu Hills

The principle sedimentary deposit is of Upper Miocene age and is located at Pugu Hills, twenty km west of Dar es Salaam. The deposit was exploited for a few years in the early fifties by the Pugu China Clay Company Ltd (New Consolidated Gold Fields Ltd). Later, in the late seventies, it was investigated by Austroplan (Austria) funded by Austrian state aid. This study, completed in 1981, delineated 11.25 Mt of kaolin reserves in a small area (Table 13).

Currently Stamico runs a small treatment plant at Pugu which was installed by a Japanese company in the early seventies as a pilot plant for the production of glass sand with kaolin as a by-product. The operation is composed of Pugu Kaolin I (the current pilot plant) and Pugu Kaolin II which is at the investment stage.

The rehabilitation of Pugu Kaolin I will be done with assistance of the Austrian overnment, while the ADB will going to provide a loan for the development of Pugu Kaolin II with a capacity of 30 kt/an of high grade kaolin. The deposit is near the coast and rail, giving it good export possibilities.

In 1986 Pugu Kaolin Mines Ltd had turnover of 8.8 MTZS on production of 2.3 kt for the domestic market (25% of capacity). In the same year Stamico had funded it to the amount of 32 MTZS, had loaned it 8.7 MTZS and received an income from it of 0.7 MTZS.⁷²

Table 13

Pugu kaolin reserves

Type A	3.96 Mt	Grade: 83-98% kaolinite
Type B	7.30 Mt	Grade: 49-73% kaolinite
Total	11.25 Mt	

Source:

Austroplan 1981

There are also several deposits of kaolin from surface weathering of feldspathic rocks, including the Matamba area (NW Njombe district) and the Malangali area (SW Iringa district), but none of these has been exploited.⁷²

I. Meerschaum

A meerschaum (sepiolite) deposit near Lake Amboseli in Masai district was discovered in 1953. The Tanganyika Meerschaum Corporation Ltd was formed to exploit the deposit and to manufacture smoking pipes. It is currently 57% owned by Stamico.

Since 1981 there has been no production due to the flooding of the quarry (rise of the water table) and imports of meerschaum from Somalia have been resorted to in order to keep pipe manufacture going. The meerschaum occurs in lenses at a depth of 3 to 6 m in dolomitic limestone overlain by bentonitic clays and reserves are considered adequate.

The bentonite clays have found limited use as foundry clays but is not of oil drilling (Wyoming) quality without treatment (ion exchange).

In 1986 the Corporation had a turnover of 9.2 MTZS from pipe manufacture from imported meerschaum. In the same year it had a long-term loan to Stamico of 1.3 MTZS, short-term loans to the value of 2.6 MTZS and general debts to Stamico of 4.6 MTZS on which interest payments were 0.9 MTZS.⁷³

J. Gemstones

Most of the gemstone occurrences are in the highly metamorphosed late Archean gneisses, schists, marbles, granulites and charnockites of the Mozambique Belt (Ubendian). There is a particular concentration of occurrences in the north-east, south of Moshi and Arusha at Merelani and Umba.

Historically a wide variety of semi-precious stones have been exploited including garnet (Namaputa, Uluguru & Ukaguru Mountains), ruby and sapphire

(Umba, Morogoro), chrysoprase and amethyst (Amani, Itosa, Kilosa), moonstone (south Pare Mountains, Zoissa), kornerupine (Mkata), zircon (Umba, Singida), emerald (Lake Sereri), aquamarine (Olala-Serengeti) and tourmaline (Morogoro, Mpwapwa, Merelani). Of particular interest is a gem form of clinzoisite known as Tanzanite which occurs at Merelani near Moshi.

Tanzania Gemstone Industries Ltd (TGI) (100% Stamico) was set up to coordinate all gemstone activities in Tanzania. It used to operate several nationalised gemstone mines which have since stopped producing. In an attempt to revitalise the gold and gemstone industry, the new mining policy will allow nationalised mines will be put up on tender (for privatisation) and private dealers will now be able to obtain a licence to buy providing that they sell legally.

The new policy will also allow up to 70% forex retention for the importation of essential inputs/spares and for the import of consumer goods as an incentive for the workers. The new system will apply to both gemstone and gold producers. To date there has not been much interest by private capital in investment in the small scale gemstone operations. Only two companies have shown interest: Marco Trade and Mayotte (Thai). Illegal gemstone mining is widespread and it is hoped that the new system will encourage these operations to become legal.

In 1986 TGI had a turnover of 12 MTZS and in 1985 646 kg of coloured gemstones were produced worth 8.1 MTZS. In 1986 it had a short-term loans from Stamico of 1.5 MTZS, had received funds of 1.2 MTZS, had a debt of 3.8 MTZS and owed interest of 0.4 MTZS.⁷⁴

Stamico also has several gemstone development projects underway: By 1986 it had spent 1.7 MTZS on the Manyara Emeralds Project, 2.3 MTZS on the Merelani (Tanzanite) Project and

0.4 MTZS on the Umba Project (various gemstones). In addition TGI is undertaking a study, financed by the Tanzania Investment Bank, on an emerald deposit in the Sumbawanga area.

K. Soda ash

Tanzania possesses substantial resources of sodium salts in the brine and salts crusts of the Central African Rift salt lakes.⁷⁶⁵

Lake Natron:

The main resources of this type are at Lake Natron on the Kenyan border where, in the mid-seventies, the Japan International Cooperation Agency organised a team which investigated the deposit. They estimated soda reserves to be about 136 Mt converted to sodium carbonate and concluded that exploitation was viable with a purification plant at the lake and exports via the port of Tanga.⁷⁶

At that time (1976) they estimated the total investment, for one million tonnes per annum, to be 320 USD (590 1987 USD), including plant (66%) and infrastructure (rail, port, storage, etc). Foreign exchange earnings in 1976 would have been 80 MUSD for exports of 1 Mt of purified natural soda, of which 66 MUSD would have been consumed by the operation for essential forex inputs, leaving a net forex earning of 14 MUSD.⁷⁷

The Stamico Lake Natron Soda Project is considering small scale exploitation of the deposit in stages from 30 kt to 60 kt for the domestic market. The main obstacle to its development is its isolation (580 km to Tanga). A large investment on infrastructure would be needed (rail, road and port).

In 1986 the Lake Natron Soda Project had a turnover of 695 kTZS and Stamico had spent 21 MTZS on the project which owed Stamico 1 MTZS and paid Stamico 0.4 kTZS for services.⁷⁸

There are other soda ash deposits at Lakes Balangida and Eyasi and sub-surface brines in the Bahi Depression.⁷⁹

An investigation of the soda salts in the lakes of the Eastern Rift (Natron, Eyasi and Balangida) was one of the four proposals for funding by the UN Revolving Fund put forward by their study in 1988, at an estimated cost of 1.5 MUSD.⁸¹⁰

The Sua Pan soda ash project in Botswana will produce 300 kt/an of sodium carbonate, 100 kt/an of potash and 600 kt/an of salt. This project will clearly limit the regional market to the south for any soda ash development in Tanzania.

L. Magnesite

Magnesite deposits are fairly common in Tanzania. It occurs in small veins in ultrabasic rocks and is often very pure.⁸¹ Production peaked in 1966 at 4.5 kt. mainly from the Chambogo mine, but since 1970 production has been low (less than 1 kt/an) and erratic (Table 7). There are four main magnesite areas:

- a) Chambogo and Lobolosoit
- b) Gelai
- c) Merkerstein Hill
- d) Haneti and Itiso

Chambogo

The Chambogo deposit is situated near Same in the Pare district and occurs as veinlets in serpentine. The deposit is high grade and reserves are estimated at 1.5 Mt containing 46.4% MgO. It is on the line of rail Tanga-Arusha and the deposit was worked in the sixties as an open-cast operation by Tanganyika Magnesite Mines Ltd and exported to Europe. The burnt reject from the kilns was used locally for fertiliser. Pre-feasibility study of the deposit was done by Stamico costing 0.9 MTZS. In 1986 a sample was sent to Government Metallurgy Laboratory in Zimbabwe for

testing, but no concrete results have as yet been received.

Lobolosoit

This deposit is in the same area as Chambogo but has never been exploited. It was investigated by Stamico which had, by 1985, spent over one million TZS on the project. They carried out beneficiation tests and concluded that the deposit could be upgraded to "dead-burned" grade magnesite, but not easily to the higher, LD, grade. A concentrate containing 47.8% MgO and 1.2% SiO₂ was produced. Reserves have been estimated at 3 Mt containing 45.3% MgO.⁸²

b) Gelai

This magnesite deposit is located around Mt Gelai at the south-east end of Lake Natron in volcanic soils. The inferred reserves are 115 tons and the deposit was exploited on a small scale in the 1950s by Industrial Minerals Ltd and exported to Kenya.⁸³

c) Merkerstein Hill

This exceptionally pure deposit is situated in Masai District where the magnesite occurs in serpentinites and was briefly exploited in the early 1950s.⁸⁴

d) Haneti and Itiso

These deposits are located north of Dodoma in a chain of serpentinitised ultrabasic hills. The main magnetite occurrences are at Iyobo, Mwahanza Hill and Mnakra Hill (45.3 per cent MgO), but have not been systematically assessed.⁸⁵

There are also several other smaller magnesite occurrences scattered around the country.

M. Iron and steel

Iron ore:

Traditional iron smelting generally used soft haematitic ores such as the bog ores at Ufipa, but these deposits are usually too small for modern exploitation. The

main large resources are of titaniferous magnetite, of which there are several:

- a) Liganga
- b) Chunya
- c) Hundusi
- d) Mbalala

a) Liganga

This titaniferous magnetite deposit is located in south-western Tanzania (Njombe district) near the Ruhuhu coal deposits and forms part of the Liganga-Mchuchuma project for steel production and as such comes under the NDC. The techno-economic evaluation study of the project was done by M/S Lurgi (FRG) in 1983/4 financed by a UNIDO grant and concluded that the project was technically and financially feasible.

The projected envisages that Liganga iron ore pellets will be fed into a SL/RN direct reduction plant using Mchuchuma coal to produce sponge iron with 92% metallisation, which will be rolled into steel products. Initial production capacity is planned at 0.5 Mt of steel per annum (mainly strips and plate) increasing to 1.0 Mt after the year 2000. The project will comprise: Liganga Iron Ore Mine, Beneficiation Plant, Pelletisation Plant, Mchuchuma Colliery, Coal Washing Plant, SL/RN Direct Reduction Plant, Ladle Furnace, Continuous Caster and Steel Rolling Mills.

The 1987 cost of these facilities (for 0.5 Mt/an) was estimated at 715 MUSD and the supportive infrastructures at 1.1 GUSD comprising: 160 km of road (Madaba-Manda), 300 km of rail (Mlimba-Manda), thermal power plant (300 MW), townships, power transmission grid, telecommunications systems and "offsites". Over 16 years the project will save between 1 154 MUSD and 1 762 MUSD.⁸⁶

Dolomitic limestone flux will come from the Msorwa/Msewe deposit which has estimated reserves of 100 Mt. The Liganga iron ore reserves are estimated at about 200 Mt with 45 Mt indicated

by drilling containing 51% Fe, 12.8% Ti, 0.67% V.⁸⁷ By 1986 Stamico had spent slightly over one million TZS on the Liganga Mchuchuma Iron Ore Project.⁸⁸

The main obstacle to the realisation of this ambitious project is in the mobilising of the necessary finance which is difficult as, although the forex saving aspect is accepted, the project's ability to actually generate forex by exports is highly contentious, especially as there is already a steelworks in the region (Ziscosteel in Zimbabwe) with a capacity of 1 Mt and which is struggling to export.

b) Chunya

Assessment of the Itewe iron ore deposit at Chunya (Mbeya) was done by a Chinese team at the same time as an assessment of the Kiwira coalfield for a proposed steelworks (1978). Reserves have been put at 50 Mt containing 32% Fe. Mainly due to the low grade, the prefeasibility study of the project was negative. In 1986 Stamico's expenses on the Chunya Iron Ore Development Project amounted to just under two million TZS.⁸⁹

c) Hundusi

These titaniferous magnetite bodies are located in the western Uluguru mountains, forty kilometres south of the central railway. One group, Hundusi, was investigated in 1955 and inferred reserves were put at 8 Mt containing 40% Fe, 6% Ti in a seam 10 m thick, dipping at 40%.⁹⁰

d) Mbalala

This magnetite deposit is located in Mpanda District about eight km east of Lake Tanganyika. In view of its small size and high titanium content (around 9%) with about 32 Mt of reserves grading 28-32% Fe, this deposit is not considered to be of importance and has not been fully investigated.⁹¹

In addition to the titaniferous magnetite deposits there are also banded manganese ironstone occurrences in the Mpanda district. At one of these, Kansanga, reserves have been estimated at 1.5 Mt of low grade (30% Fe) per metre of depth.⁹²

N. Mica

Tanzania has numerous scattered mica containing pegmatites in the Usagaran and Ubendian systems of the Arcaean. They have been exploited and exported since 1902 on a small scale. The workings are generally small labour intensive operations. The main area is Morogoro along the line of rail. The region is very hilly with isolated mica pegmatites.

The Mines Department is endeavoring to encourage the small scale miners by helping them obtain artisanal equipment (crowbars, sledge-hammers, picks, shovels, etc). The main shortages at present are the lack of portable compressors (for pneumatic drills) and explosives due to forex constraints. Stamico has located a buying unit in Morogoro in an attempt to solve the small scale miners sales problems and in 1986 Stamico registered funds to its Mica Development Project of 885 kTZS.⁹³

O. Heavy mineral sands

Deposits of heavy mineral beach sands occur at various locations along most of the coastline containing ilmenite, rutile, zircon and kyanite. These deposits have been studied in several areas particularly the coastline between Bagamoyo and Dar es Salaam where reserves have been put at 664 kt. The most important deposit is located at Msibati on the extreme southern coastline, south of the port of Mtwara where reserves of 3.6 Mt have been reported.⁹⁴

Shortly after its formation, Stamico formed the Beach Sands Mining Company Limited with Geomin of Rumania and exploration was carried out by the

joint venture in 1974/5 in several locations. During these studies 50 Mt of heavy mineral sands were delineated containing ilmenite, rutile, zircon, kyanite and garnet in quantities similar to the beach deposits exploited in Australia.⁹⁵

In 1985 Stamico reported funds of 271 kt to the Beach Sands Mining Company and a short term loan (9%) of 1.5 Mt to it and further debts of over one million TZS.⁹⁶ As this company has no production it is not clear how the funds to repay these debts to Stamico will be generated.

One of the four proposals for funding by the UN Revolving Fund put forward by their 1988 study was for an investigation of the coastal beach sands at an estimated cost of 630 kUSD.⁹⁷

P. Base metals

Base metals (Cu, Ni, Zn, Pb) mainly occur in the Archaean and Bukoban rocks of Tanzania. Historically several base metals have been mined, principally from the Mpanda mineral field.

The Mpanda Mineral Field (Pb, Cu, Au, Ag)

This field is located in the centre-west of the country in the Ubendian metamorphic rocks and displays lead-copper-gold-silver mineralisation, particularly in the Mukwamba Shear. From 1950 to 1960 the Mukwamba Mine, owned by Uruwira Minerals Ltd, produced about 94 kt of lead concentrates containing lead, copper, gold and silver. The ore contained 2.22% Pb, 0.61% Cu, 74 gm/t Ag, and 1.56 gm/t Au, but it was almost completely mined out by 1959.⁹⁸ In the early seventies a Soviet team (Technoexport) reassessed this deposit and concluded that further reserves could still exist.

Nzega (Pb, Zn, Cu)

The Nzega Mineral Field is located in the centre-north of the country in Nzega District. Stamico has been carrying out

exploration for Pb/Zn, Cu and Au/Ag in the area and by 1986 they had spent 2.5 MTshs on the Nzega Base Metal Exploration Project.⁹⁹

Kabanga (Ni, Co, Cu)

The Kabanga deposit extends from Burundi into the Ngara district in the north-west. It is a nickel-cobalt deposit and was first surveyed by a UNDP team in the seventies. The final report was presented in 1979, but thus far no interest has been shown by mining companies due to the low world market prices for these base metals until recently. At current prices this could be considered an attractive prospect for further exploration. Preliminary reserve figures follow in Table 14.

Q. Natural gas and petroleum

Natural gas

a) Songo Songo

This deposit is located in the vicinity of Songo Songo Island, 20 km off Kilwa-Kivinje. It was surveyed during four exploration periods, from 1975 to 1985, by AGIP, the Oil and Natural Gas Commission of India and several contractors, financed by, TPDC, Norad, the Indian Government, the World Bank, the European Investment Bank and the OPEC Fund. Thus far nine holes have been sunk and the current estimation of gas resources are shown in Table 15.

The *Kilwa Ammonia Company* (Kilamco) has been set up to exploit the Songo Songo gas deposit using a standard ("off the shelf") Kellogg plant (Stamicarbon Process, NH₃/Urea). Semi-commercial pledges for the plant have thus far been secured from OPIC (USA, Overseas Private Investment Corp), IFC (WB, International Finance Corp) and the CDC (Commonwealth Development Corp). The proposed company will have a debt to equity ratio of 3:1 (equity = 106 MUSD). The proposed equity breakdown is shown in Table 16.

The export credits of 334 MUSD, from several governments and organisations, have been secured. In 1986 the funders insisted on an endorsement of the project by the World Bank. An appraisal was done in 1986/7 and it concluded the project was viable even when using the most pessimistic technological and marketing forecasts.

The proposed Kilamco plant will produce 1 560 t/d of NH₃ from which 1 725 t/d of urea will be made, resulting in annual sales of 180 kt of NH₃ and 530 kt of urea. The domestic market for urea is 10 kt/an which is expected to increase to 20 kt/an once urea is freely available (5% of Kilamco output). It is planned for the Tanga fertiliser company to expand into the production of compound fertilizers which will consume 20 kt/an of NH₃. The regional NH₃ market has been estimated at 25 kt/an.

The Kilamco plant should be on stream by 1993 if it goes ahead and work starts in the first quarter of 1990.

Options other than a urea/NH₃ plant for the utilisation of the Songo Songo gas have also been considered, principally the domestic utilisation option to replace fuel imports and power. In 1983/4 the World Bank did a study on several other options and a new World Bank financed study on potential gas use in the Dar es Salaam area was done in 1987.

It is estimated that the Songo Songo reserves are large enough to supply the Kilamco plant as well as utilisation in Dar es Salaam and in this respect the Italian government has already committed funds (58 MUSD soft loan) for a pipeline from Songo Songo to Kilwa Kivinje to Kilwa Masoko and the contractor (Snamprogetti) has agreed to oversize the submarine section (Songo Songo - Kilwa Kivinje) so as to be able

Table 14
Preliminary reserves for the Kabanga deposit

Ni grade	0.5% - 1.0%		1.0% - 1.5%		>1.5%
Indicated	16 Mt	@.71%	3 Mt	@ 1.12	2.8 Mt @ 2.31 %
Extrapolated	10.1 Mt	.70%	1.8 Mt	1.13	3.2 Mt @ 2.69 %
Total	26.1 Mt	.70%	4.8 Mt	1.12%	6.0 Mt 2.51 %

Source

UNDTCD, 1988

Table 15
Songo Songo natural gas reserves

Type	Reserves
Proven	726 Gft ³ (20.74 Gm ³)
Probable	157 Gft ³ (4.49 Gm ³)
Possible	223 Gft ³ (6.37 Gm ³)
Total	1 106 Gft³ (31.60 Gm³)

Source:

TPDC, 1988

Table 16
Proposed Kilamco equity

TPDC	54%
Transammonia	14%
Kellogg	10%
OPIC et al	9%
IFC	9%
CDC	3%

to cater for both the Kilamco and possible future supply to Dar es Salaam.

b) Mnazi Bay

A second gas deposit is located at Mnazi Bay in the south near Mtwara. It was also discovered by AGIP, in 1982, who relinquished the concession in 1985. Possible reserves are estimated at 600 Gft³ (17 Gm³). At present there are no plans for its development.

Petroleum exploration

Pre-independence (1950s) BP drilled four dry holes along the coast, but left 1959. The first post-independence activity was 10 years later when AGIP came in to look at the coastal sedimentary basins. In the same year (1969) the *Tanzania Petroleum Development Corporation* (TPDC) was formed to monitor oil exploration and it also took a share in the Dar es Salaam refinery (TIPER).

In 1980 a new petroleum act was passed which more clearly established the framework for oil exploration and production. It also included safety clauses for the contractor with respect to nationalisation. Since the new act was passed there has been extensive exploration activity:

In 1981 Shell/Esso sunk three holes in the Selous (Rufiji basin) and the *International Energy Development Corporation* (IEDC) sunk three holes along the coast. The IEDC was later joined by BHP (Australia), Elf Aquitaine (France) and *Kuwait Foreign Petroleum Exploration Company* (Kufpec). Their concessions were all relinquished after the initial four year licence period.

In 1985 Shell/Esso did a seismic survey of the Mandawa Basin and in 1987 Amoco did a survey of the Rukwa and Usangu Basins (see map). In 1986 Amoco did a seismic survey of Lake Tanganyika and in 1987 Mobil Oil proposed an investigation of Lake Nyasa. In 1987 Hunt United Corp. showed interest in Lake Eyasi on the eastern

branch of the East African Rift. Oil exploration areas in 1987 are presented in Map 3. To date no oil has been struck in Tanzania.

Even though most of the sedimentary basins have had some sort of exploration activity, only 19 deep holes (excluding Songo Songo) have been sunk over this vast area. There is therefore still the potential for hydrocarbon discoveries.

Oil refining

The *Tanzanian and Italian Refinery* (TIPER), located in Dar es Salaam, has a design capacity of 750 kt/an of Iranian and/or Iraqi light crudes and includes the following units: a topping unit, a catalytic reformer, a naphtha/kero treatment unit and a merox unit for light naphtha. Currently the refinery caters for about 60% of domestic demand for refined products and diesel and kerosene have to be imported.¹⁰⁰

Construction of the new Bitumen Plant at TIPER started in 1988 and it will produce 30 kt/an of mainly road surface grade bitumen from excess residue fuel oil. It will include an airblowing unit for the production of other grades of bitumen and should be operational in 1991.¹⁰¹

R. Other minerals

Tanzania has numerous other mineral occurrences that have not been exploited because they have yet to be assessed or because they have been determined to be uneconomic or merely because there has been no organisation with the will and ability to develop them.

Uranium deposits near Tukuyu in the south in Mbeya district were surveyed by Uranus (FRG) in the early eighties, but were not followed up due to the depressed market for uranium. Bauxites have been reported in Usambara Mountains containing 57.7% Al₂O₃ and the Western Uluguru Range.^{102,103}

Large tonnages of good quality diatomaceous earths have been reported at Kagera in Bukoba district containing 75 to 77% silica while the development of a travertine marble deposit in Mbeya district is planned by Stamico.^{104, 105} Scattered vermiculite deposits in pegmatites used to be worked by small scale miners in the Morogoro district, but all production has since ceased.¹⁰⁶

Tanzania possess several asbestos deposits, most of which are of the amphibole type (anthophyllite, tremolite and actinolite) rather than white, chrysotile, asbestos.¹⁰⁷

Locations include Ikorongo (Musoma), Mbembe (Morogoro), Rubeho (Mpwapwa) and Haneti (Dodoma) but none have been developed due to the extremely weak market for asbestos.

A low grade bentonite deposit located at the south-east end of Lake Natron was exploited in the late fifties by Industrial Minerals Ltd and there may be further resources in certain "mbugas" (wet lands) in volcanic terrains.¹⁰⁸

Graphite deposits are widely distributed in metamorphosed Archaean rocks in Nachingwea District, Eastern Uluguru Mountains, Tanga District and Mpwapwa District.¹⁰⁹ In the early eighties Afina Pencils Ltd mined graphite in Morogoro District for the manufacture of pencils.

One of the carbonite complexes, at Wigu Hill south of Morogoro, is reported to have high levels of rare earth oxides and is one of the projects put forward by the recent UN Revolving Fund study for further investigation at cost of just over one million USD.¹¹⁰

Tanzania also has reasonable kyanite resources, niobium resources and talc resources. A draft mineral resources list is presented in Appendix II.

VI. Legislation

A new Mining Act was passed in 1979 which covers all aspects of prospecting

and mining. Under Tanzanian law all mineral rights are vested with the state.

Following the spirit of the Arusha Declaration of 1967, the State progressively took over the national mining industry so that by the mid-seventies the private mining sector had all but disappeared. The collapse of the minerals sector from 1967 onwards amply demonstrated that the state was not able to develop or manage this sector, particularly their complete failure to take advantage of the rapidly rising real price of both gold and tin in the seventies. The 1979 Act was therefore designed to allow foreign mining companies to participate with the state in the development of the minerals sector, particularly for medium to large scale mining operations.

To date no international mining houses have been attracted by the new legal regime. This is in part due to the depressed state of most minerals in the eighties, but in the case of gold it can only be that the act is still considered to be too restrictive by the mining TNC's.

A new Model Gold Mining Agreement will be applied in 1989 which will supercede the Mining Law. In the Model Agreement all royalties and taxes are negotiable. Until 1987 the state had a monopoly over the marketing of all gemstones and gold. This led to a thriving parallel market at more than double the official price. In 1987 the marketing regulations were eased in that small mines may now sell to licensed private dealers. In addition authorised operations will be allowed to retain up to 70% of their export earnings to cover essential imports.

The 1979 Mining Act caters for three kinds of licenses: a Reconnaissance Licence, a Prospecting Licence and a Mining Licence. A reconnaissance licence has a specified period (up to one year), usually covers large areas and does not allow any subsurface (drilling, pitting) exploration without prior ap-

proval. It may be renewed for a second year, but confers no rights to the holder for the obtaining of a prospecting licence.

A prospecting licence allows the holder to prospect for specific minerals for an initial term of up to three years after which 50% of the area is forfeited for a further two year extension. The granting of a prospecting licence includes provision for the state to acquire a majority interest in any subsequent mining operations, but under the regulations an agreement may be drawn up in which the state may guarantee not to exercise its equity rights until after an agreed time period, as is the case with the Placer Dome agreement on the Kahama prospect.

The section of the Mining Law that deals with the right of the state to a majority interest in any mining operation is currently under review.

When the holder of a prospecting licence discovers an economic deposit the Act gives the holder first option for the obtaining of a mining licence, on condition that he submits an acceptable plan for the exploitation of the deposit. Only a company incorporated in Tanzania may obtain a mining licence.

Under Section 15 of the Act, the Minister has wide powers to consider other systems not covered by the Act as witnessed by the unorthodox DTT (see section on gold) gold exploration, production and marketing arrangement. This flexibility allows for the tailoring of regulations to fit any given investment initiative.

VII. Discussion

Unlike many of the ex British possessions to the south, Tanzania has never been a major mining country. Its potential always has, and for some time to come will, lie with its agricultural sector. Nevertheless the role that the minerals sector has played since the independence of the country in 1961 has been well below its potential, both in

terms of forex generation and the production of mineral inputs to the domestic economy.

From 1961 through to the late seventies international prices for most base and industrial minerals kept pace with the terms of trade reflecting strong industrial growth and mineral demand in the OECD countries. During this period no new major mining operations opened up in Tanzania. On the contrary, many folded. From 1980 international prices fell reflecting the global capitalist crisis and possibilities for the development of new export minerals in Tanzania all but disappeared, but the recent revival of base metal prices, particularly nickel, has created new opportunities, particularly for the Mpanda and Kabanga deposits.

Real gold prices steadily fell throughout the sixties with the fixed 35 USD/oz price causing all of Tanzania's medium scale producers to fold. In 1968, towards the end of the decline, the Annual Report of the Mineral Resources Division predicted that

"...there may soon be an upward revision of the long-held international price of gold, but this rise will be too late for the major producers of gold in Tanzania..."¹¹¹

That year, 1968, the gold price rose to 40 USD/oz and by 1972 had gone up to 58 USD/oz.¹¹² The same report continued that:

"...a gold subsidy scheme evolved under Government policy before 1966 might have saved the major members of the industry from final closure".¹¹³

The question, though, is not why the gold mines closed in the sixties, but rather why they did not reopen with the rapidly increasing real prices in the seventies. The answer appears to lie with the rapid expansion of state intervention in the economy following Arusha Declaration of 1967. This resulted in the

creation Stamico, which lacked the professional and managerial personnel to bring new mines (or old mines) into production. The private sector was not interested in opening up new operations as they feared that they might lose their investment after the nationalisation of private operations in line with the Arusha Declaration.

It is apparent that Stamico has displayed a marked inability to either keep nationalised operations running or to bring new mines into production, even during periods of buoyant prices such as those for tin from 1970 to 1985 and gold from 1972 to 1980 and, to a lesser degree, to the present. The principal problems experienced by Stamico and its subsidiaries appear to be a dearth of experienced and competent managerial personnel to both run existing operations and to get new projects operational. In addition, the national shortage of foreign currency affects Stamico's subsidiaries' ability to acquire essential operating inputs and to raise new capital for the initial investment in new projects. The new forex retention scheme for forex generators should particularly benefit the mining industry where most production is exported.

Stamico's performance for non-export, and therefore non-international price minerals, for the domestic market is just a disappointing. Salt production has stagnated as has phosphate output, and coal mining has never got off the ground. Saruji Corporation's efforts have been much more successful and, in the thirteen years since its formation, limestone (and cement) production has almost doubled.

The recent liberalisation policy is bound to also affect the mining sector, but it is hoped that the failure of the state in this sector will lead to the development of an indigenous mining sector rather than opening the doors to foreign capital and the formation of a comprador bourgeoisie or a stratum of state bureaucrats that, having failed to de-

velop the minerals sector themselves, will survive by taking a cut from the foreign run operations.

Tanzania does not possess the type of large-scale, high return deposits that would interest the major mining houses. On the contrary, it has substantial and varied resources of industrial and agricultural minerals that need to be developed to supply the local economy. It also has significant gold resources and resources of various pegmatite minerals that lend themselves to small to medium scale exploitation, a scale that indigenous technology and managerial expertise can handle, possibly in partnership with small foreign concerns.

In this regard it is hoped that the thousands of illegal gold and gemstone miners will be legalised by giving them a reasonable price for their product and by changing the mining law to give them some sort of legal tenure. Once legal, their efforts need to be supported by the state as they form the most viable base for the development of an indigenous mining industry.

Regional initiatives

There is virtually no cooperation between the minerals sector of Tanzania and any of the other SADCC states,

The SADCC states



though several possibilities exist. The foremost would be if the Kilamco ammonia/urea plant got off the ground and started supplying the region's needs which constitute but a small proportion of its total projected output. Mozambican and Angolan natural gas resources are also being investigated for the production of ammonia/urea.

Tanzania's soda ash resources at Lake Natron could also supply certain regional imports, though the Sua Pan project in Botswana is more likely to become the regional source as plans for its development are well advanced.

Tanzanian plans to penetrate the regional market for salt might also be dashed by the Sua Pan project in Botswana which will produce a by-product of 600 kt of salt per annum, well above the regional demand.

The Pugu Kaolin deposit could substitute for current regional imports from South Africa and both Tanzania and Mozambique could supply the regional market for activated carbon from coconut shells for gold recovery.

The development of the Tanzanian gold resources could benefit from Zimbabwe's extensive experience in the mining of very similar deposits. Some of Stamico's setbacks in this regard, such as Buckreef, are partly attributable to the implementation of inappropriate technology. In this regard Tanzania could do well by first looking for partners for joint mining ventures in the region before considering foreign nationals or dubious companies like Dar Tadine of Switzerland or the Gulf.

The 7-1980 show

Notes:

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³ Bank of Tanzania (BT): *Tanzania: Twenty Years of Independence (1961-1981)*, BT, Dar-es-Salaam, 1983.

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⁵ Ibid.

⁶ Ibid 1988.

⁷ UNIDO, op cit.

⁸ UNDTCD, United Nations Department of Technical Cooperation for Development: *Mineral Exploration, Evaluation and Development Planning. United Republic of Tanzania. Project Findings and Recommendations*, Project URT-81-035/1, UN, New York, 1988.

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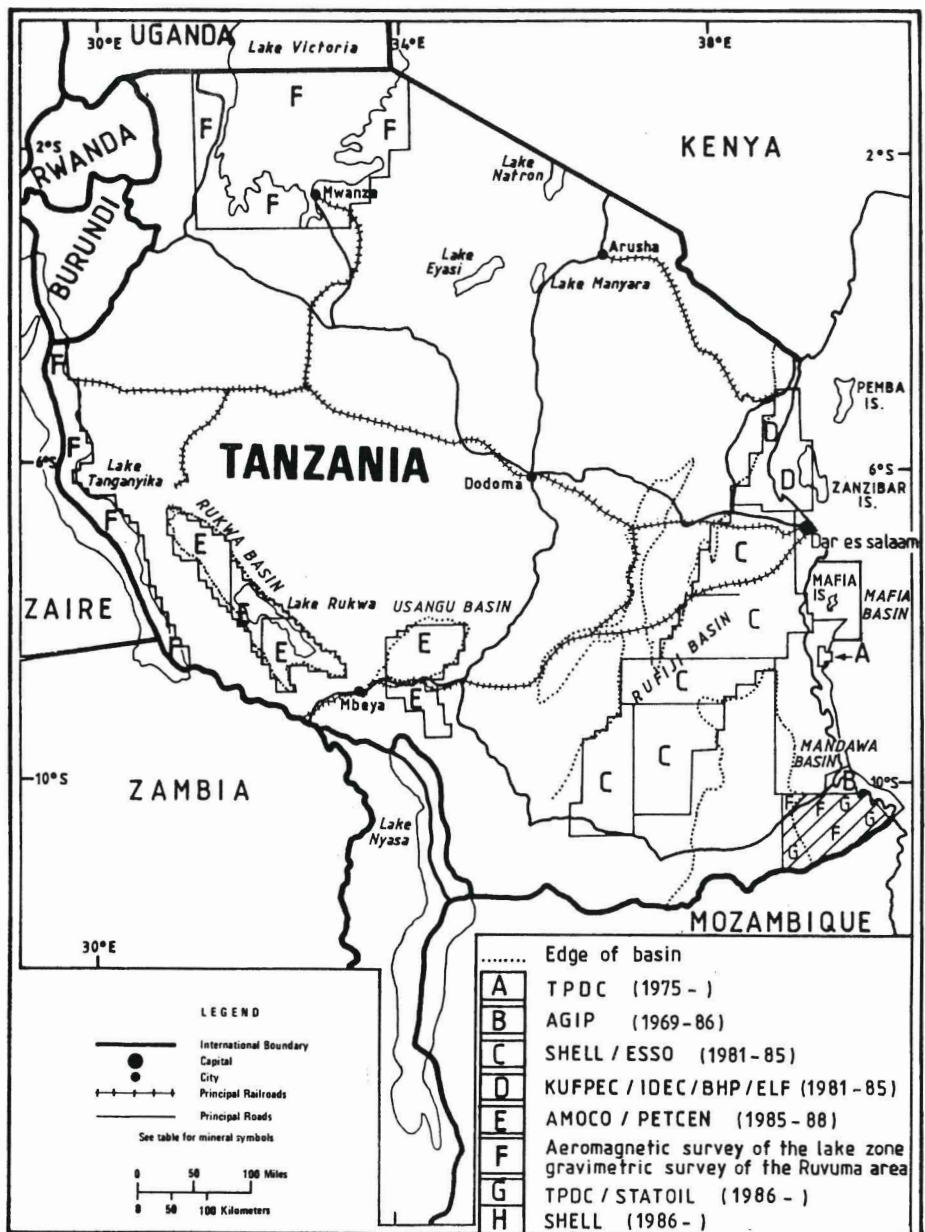
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Map 3
Tanzania
Hydrocarbon exploration activity



Appendix I
Staminco expenditure on subsidiary companies and projects

Stamico funding (MTZS)

	Subsidiary Companies	1984	% Total	1985	% Total	1986	% Total	% Chg*
1	Buckreef Gold Mines	96.4	33.8%	109.8	31.5%	125.8	31.0%	30%
2	Minjinju Phosphates Co.	73.3	25.7%	83.1	23.8%	93.6	23.1%	28%
3	Nyanza Salt Mines	33.8	11.9%	47.3	13.6%	56.9	14.0%	68%
4	Coastal Saltworks	29.7	11.6%	44.2	9.7%	56.0	13.8%	89%
5	Lupa Gold Mines Ltd.	33.2	10.4%	33.8	12.7%	34.8	8.6%	5%
6	Pugu Kaolin	15.5	5.4%	23.9	6.9%	31.6	7.8%	104%
7	Kahama/Bulyankulu Gold	1.6	.5%	4.8	1.4%	5.3	1.3%	238%
8	Tanzania Gemstone Indust.	1.2	.4%	1.2	.4%	1.2	.3%	0%
9	Beach Sands Mining Co.	.27	.01%	.27	.01%	.27	.07%	0%
10	Mkomazi Mining Co.	.03	.11%	.03	.00%	.03	.01%	0%
11	Tanzania Magnesite Co.	.30	.10%	.00	.08%	.00	100%	
	Total	285.3	100.0	384.4	100.0%	405.5	100.0%	42%

Development projects

1	Songwe/Kiwira Coal	161.1	74.6%	426.4	85.6%	623.3	80.3%	287%
2	Kabulo Coal	1.1	4.5%	4.7	3.4%	75.2	9.7%	6 498%
3	Ilima Colliery	20.6	.5%	24.0	.9%	28.8	3.7%	40%
4	Lake Natron Soda Ash	9.8	9.5%	17.0	4.8%	21.1	2.7%	116%
5	Nzega Base Metal Expl.	.3	.2%	1.7	.2%	2.5	.3%	882%
6	Mpanda Gold	2.3	.1%	2.3	.3%	2.3	.3%	0%
7	Merelani Project	2.3	1.1%	2.3	.5%	2.3	.3%	0%
8	Mineral Expl. General	2.3	1.1%	2.3	.5%	2.3	.3%	0%
9	Chunya Iron Ore	2.0	1.1%	2.0	.5%	2.0	.3%	0%
10	Samena Pyrite Expl.	.5	.6%	1.2	.3%	1.9	.2%	290%
11	Kilwa Gypsum	1.9	.9%	1.9	.4%	1.9	.2%	0%
12	Manyara Emeralds	1.7	.9%	1.7	.4%	1.7	.2%	0%
13	Mabuki	1.4	.8%	1.4	.3%	1.4	.2%	0%
14	Meerschaum Project	1.3	.6%	1.3	.3%	1.3	.2%	0%
15	Lobolosoit Magnesite	.3	.5%	.9	.2%	1.1	.1%	272%
16	Liganga Mchuchuma Iron	1.0	.1%	1.0	.2%	1.0	.1%	0%
17	Magnesite Study	.9	.4%	.9	.2%	.9	.1%	0%
18	Mica Project	.9	.4%	.9	.2%	.9	.1%	0%
19	Fertilizer Raw Materials	.7	.3%	.7	.1%	.7	.1%	0%
20	Sekenke Gold Field	.6	.3%	.6	.1%	.6	.1%	0%
21	Kakofa Gold	.5	.2%	.6	.1%	.6	.1%	18%
22	Kyerwa Tin Buying Unit	.6	.3%	.6	.1%	.6	.1%	1%
23	Rwamagaza Gold Expl.	.6	.3%	.6	.1%	.6	.1%	0%
24	Longido Project	.5	.2%	.5	.1%	.5	.1%	0%
25	Umba Project	.41	.19%	.41	.08%	.41	.05%	0%
26	Union Carbide	.09	.04%	.09	.02%	.09	.01%	0%
27	Decorative Stone	.08	.04%	.08	.02%	.08	.01%	0%
28	Salt Refinery	.08	.03%	.08	.02%	.08	.01%	0%
29	Gold Buying	.07	.03%	.07	.01%	.07	.01%	0%
30	Saza Gold Project	.06	.03%	.06	.01%	.06	.01%	0%
31	Maweni Lime Stone	.04	.02%	.04	.01%	.04	.01%	0%
32	Chunya Project	.04	.02%	.04	.01%	.04	.01%	0%
33	Abrasive Project	.029	.013%	.029	.006%	.029	.004%	0%
34	Chambogo Magnesite	.000	.000%	.026	.005%	.026	.003%	nap
35	Coal Development	.013	.006%	.013	.003%	.013	.002%	0%
36	Shinyanga Lime Works	.002	.001%	.002	.000%	.002	.000%	0%
	Total:	215.9	100.0%	498.3	100.0%	776.1	100.0%	260%

* percentage change 1984 - 1986.

Source: Staminco: 1987 & 1988.

Appendix II

Mineral	Location	Size	Grade
Bauxite	Uluguru Mountains	—	34% Al ₂ O ₃
Bentonite	Sinya & Minjinju	large	
Beryl	Pegmatites, widespread	—	
Calcite	Coast region	—	
Coal	Songwe-Kiwira, Mbeya	59 Mt	25-40% ash
	Kabulo	25 Mt	30-40% ash
	Muchuchuma, Songea	187 Mt	14% ash
	Ngaka, Songea	98 Mt	
	Muhukuru, Songea	8 Mt	
	Mbamba Bay, Songea	small	
	Galula & Ufipa	small	
Copper	Same & Mpanda	—	
Corundum	Kagera	—	
	Mleha & Ilende	—	
Diamonds	Mwadui, Shinyanga	30 Mt	.04 cts/t
Diatomite	Kagera, Bukoba	—	75% Si ₂ O ₃
Felspar	Pegmatites, widespread	—	
Gold	Kahama, Lupa, Mbeya	4.33 Mt	10 g/t
	Iramba-Sekenke	—	
	Mwanza	—	5-8 g/t
	Musoma	1 Mt	1.5 g/t
Graphite	Nachingwea	—	
	Uluguru Mountains	—	40% graphite
Gypsum	Itigi, Dodoma	—	60% gypsum
	Kilwa	5 Mt	85% gypsum
	Pare	—	60% gypsum
Iron Ore	Chunya, Mbeya	40 Mt	
	Liganga, Mbeya	78 Mt	50% Fe
	Hundusi, Uluguru	8 Mt	40% Fe
Kaolin	Pugu, Kisarawe	11.5 Mt	60-90% kaolin
	Matamba, Njombe	Several Mt	
Kyanite	Pare Mountains	—	30% kyanite
Lead	Mpande	—	2.2% Pb
Limestone	Wazo Hill	22 Mt	50% CaO
	Tanga	45 Mt	52% CaO
	Mbeya	72 Mt	50% CaO
	Coral, coast	vast reserves	
Magnesite	Chambogo, Same	1.5 Mt	46% MgO
	Lobolo, Same	3 Mt	45% MgO
	Merkestein, Masai	arge	10% magnesite
Meerscham	Amboseli, Arusha	28 kt	
Mica	Pegmatites, widespread	—	
Nickel	Kabanga, Ngara	—	
Niobium	Panda Hill, Mbeya	71 Mt	0.4% Nb
Phosphate	Minjinju, Arusha	10 Mt	18.5% P ₂ O ₅
	Panda Hill, Mbeya	71 Mt	4% P ₂ O ₅ .4% Nb
	Zizi, Kisaki	—	10.5% P ₂ O ₅
Pyrite	Samena, Geita	—	
Rare Earths	Wigu Hill, Morogoro	—	10-20% RE oxides
Salt	Coast (solar)	renewable	
	Nyanza, Uvinza (brine)	60 kt/an	
Soda Ash	Lake Natron	136 Mt of NaCO ₃	
	Lake Balangida	0.6 Mt of mixed salts	
	Lake Eyasir		
Tin	Karagwe (pegmatites)	—	65% cassiterite
Titanium	Beach sands	50 Mt	rutile/illmenite
Tungsten	Karagwe (pegmatites)	—	1% wolframite
Vermiculite	Morogoro (pegmatites)	—	
Zircon	Dar es Salaam-Bagamoyo	—	5% zircon

Sources: UNIDO: 1982, Harris: 1961, Jones: 1983, MEP: 1987b