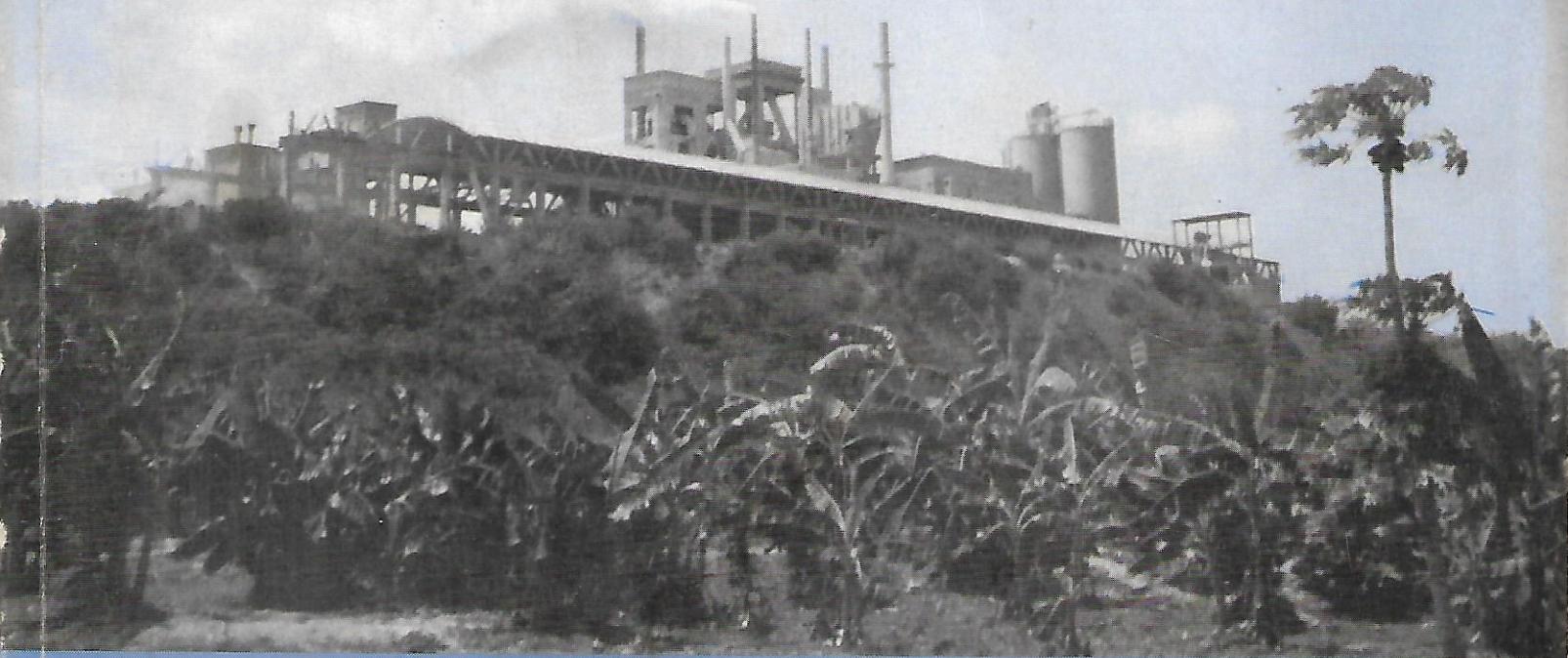


R. H. KIMAMBO

DEVELOPMENT OF THE NON-METALLIC MINERALS
AND
THE SILICATE INDUSTRY IN TANZANIA



VOLUME I

BASIC CONCEPTS, STRATEGIES AND ACHIEVEMENTS

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I INTRODUCTION

1. GENERAL STATEMENT

Mankind must have realized the importance of minerals in very early times. We are told that man used cinnabar ochre and red hematite as pigments long before smelting was devised. Gemstones, native copper, gold and silver were highly valued as ornaments, as was metal for making simple implements. It is reported that mankind started making ceramic articles using industrial mineral as early as 15,000 BC. The clay products industry was well known in Egypt by 14,000 BC. It is also recorded that the Phoenicians made glass very early in history. Knowledge of the process of smelting silica sand to form glass crystals was used by the Phoenicians, Egyptians and Mesopotamians in 6,000 BC. Window glass is mentioned as early as 290 AD and mirrors were first manufactured around 1,300 AD.

The Arabs learnt from the Phoenicians and by the 10th Century BC glass goods from Aleppo were well known. In fact it is claimed that the Arabs were able to conquer the whole of Europe via Palermo and Venice in the 12th Century due to their advanced glass technology.

The Egyptians used some kind of cement for the construction of pyramids as far back as 4,000 BC. The Greeks and Romans used volcanic tuff mixed with lime as cement material.

Manufacture and use of limestone as plaster and mortar, dates way back to 400 BC. It is reported that the Pyramids of the Cheops for example, were built with plaster mortar at least 4,000 years ago. Even in those ancient times it was no problem to drive off the water content from the calcium sulphate to form usable building plaster. Since the Industrial Revolution this industry has undergone considerable adjustment to produce higher quality uniform products, using modernized production methods. Use of lime as mortar is apparently mentioned by Marco Polo, an engineer who lived during the reign of Augustus between 27 BC and AD 14.

Use of "industrial rocks" by mankind must have started way back in the "stone age" when he made shelters, tools and weapons out of stone. The Greeks and Romans made drinking cups from large crystals of fluorite and other rocks. Stone for construction goes back thousands of years before Christ to the building of the pyramids, etc. The construction of cities, roads, bridges, ports, air-fields and factories have only been achieved through use of rocks and minerals.

In Africa, the smelting of iron, long before the arrival of the European, is a well known fact. In other parts of the world mining activities stimulated the development of say, the railway for hauling ore, and the steam engine for pumping water and for ventilation systems. We also recall the role of Spanish America's gold in the development of the European economy and the exploration of the world. Today minerals, particularly industrial minerals, continue to contribute substantially to the development of mankind.

In developed countries such as the USA, for example, each person "consumes" about 11 tonnes annually of non-metallic rocks and minerals, which are used for construction purposes and as inputs into various industries. What is today known as Ordinary Portland Cement has a relatively short history. For many generations natural stone, wood, bricks and lime mortar must have remained the major construction materials until the technology for the manufacture of modern cement was invented less than two centuries ago. This important construction material owes its existence to the English master mason,

Joseph Aspdin, who, in 1824, discovered that when a specific mixture of lime and clay was sintered, it converted into an excellent binding agent – cement. Following this discovery many improvements took place in the construction industry and the role that concrete plays in today's highly advanced construction industry can only be appreciated by glancing at the huge structures that appear in major cities such as New York, Paris, Tokyo, etc.

In Tanzania, Chittick (1970) and Mturi (1974), have shown that very advanced masonry and architectural use of coral limestone and lime mortar were already developed and used for the construction of mosques, tombs and other buildings in the ancient towns of Zanzibar, Kilwa and Bagamoyo by the 12th and 13th centuries. In fact, Kilwa continued to be an important well-constructed trading town for several centuries, and when Vasco Da Gama, the first European to sail to the East African Coast, passed through in 1498, he noted "good buildings of stone and mortar" where he estimated "there may be 12,000 inhabitants" (M. Amin, D. Willets, P. Marshall, 1984). In Zanzibar, some of the stone buildings constructed during this early Arab-influence period can still be seen today. For example, the mosque built using coral stone in "the walled city of Kazimkazi" in South-West Zanzibar, about 1,100 AD, is still well preserved today and reflects a highly developed architectural ability and skill in the use of stone during those early times. These skills appear to have spread to other Islamic/Swahili settlements along the Eastern Coast during the 14th to 19th centuries (Mturi, 1975). This early construction using finely cut and fitted stone is reported to have been well advanced during the reign of Sultan Seyyid Majid when the building of what is now known as Dar es Salaam city started in the 1860's. The so-called "Old Boma" is apparently one of these early construction works (Sutton, 1970). Mturi (1975) has reported evidence of existence of a pottery industry in Tanzania under the early coastal Islamic/Swahili communities as early as 13th–15th centuries.

Stone and lime mortar were used in the early construction work. The use of cement in Tanzania goes back to only less than a century ago, after the German occupation of the country. The necessity to apply modern construction technology to the building of railways, roads, bridges, etc, during the German administration, brought about the use of high strength construction materials, such as high quality concrete. Although no consumption figures for the early years of German administration are available, it can be assumed that considerable quantities of aggregate, sand, stone and cement were used by the Germans particularly at the start of the century when the construction of the railway lines as well as the construction of buildings took place. The information available shows that in 1913 as much as 14,000 tonnes of cement were imported by the Germans for constructions purposes. Early German buildings around Ocean Road area and other places are still in sound condition today. The consumption of cement after World War I rose from 5,000 tonnes in 1923 and reached a peak of 28,679 tonnes valued at 115,325 Pound Sterling in 1929, but declined to an average of about 11,000 tonnes between 1932 and 1935 and rose again to about 24,000 tonnes in 1938 before declining to about 7,000 tonnes during World War II, between 1940 and 1944. After World War II consumption went up again, reaching 113,000 tonnes in 1950 and a peak of 164,000 tonnes in 1955, and maintaining an average of about 125,000 tonnes between 1956 to Independence.

After Independence, availability of cement remained constrained until local production from the Wazo Hill plant started in 1966 when consumption went up and by 1967 had reached 240,000 tonnes.

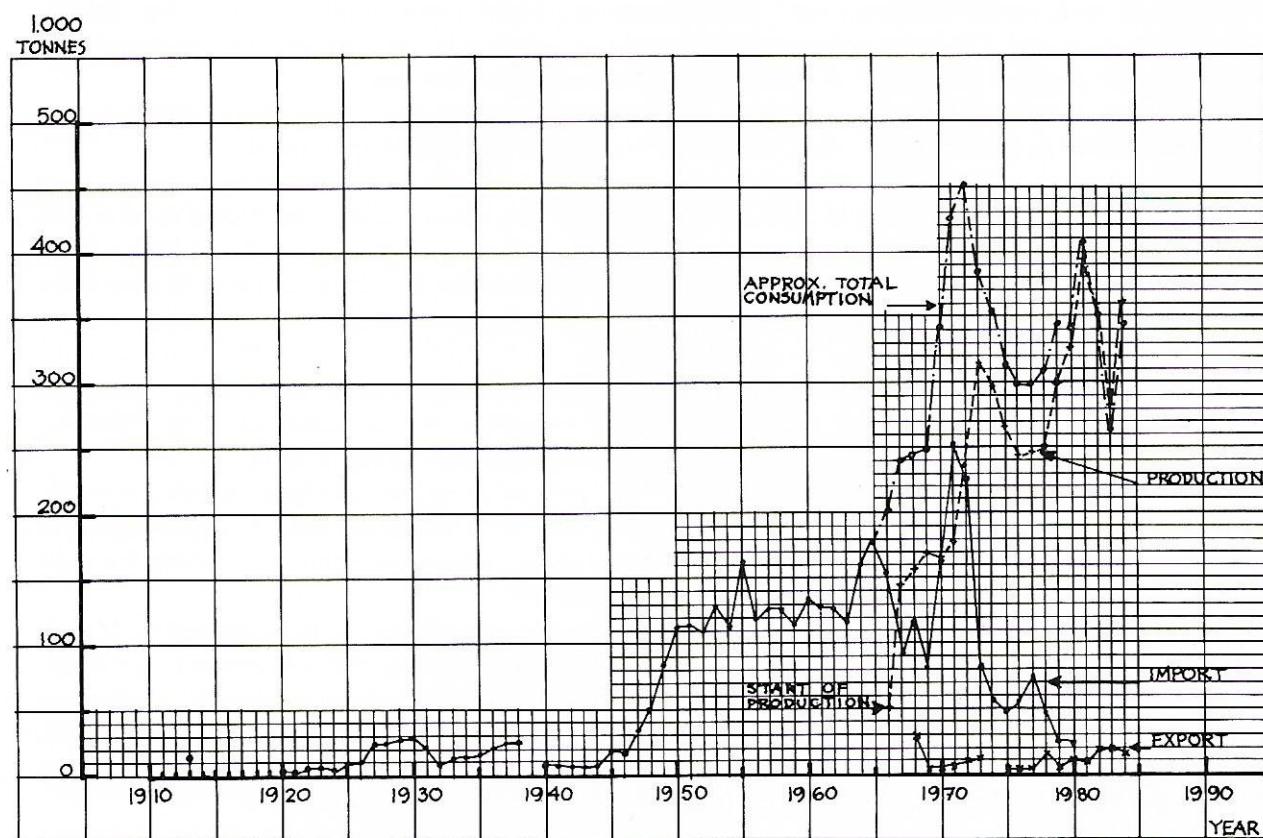
Production of other building materials (sand, aggregate, construction stone, limestone for lime, etc.), also went up and it is estimated that the value of these went up to Pound Sterling 6,553 in 1930, dropping to £ 1,808 in 1940, but rising steadily after the War to £ 116,403 in 1950 and to £ 253,495 in 1958 (Harris, 1961).

After Independence, demand for building and construction materials continued to rise sharply, (although supply remained constrained due to the initiation of major national development programmes under the Five Year Development Plans that followed), consumption of cement rising from 161,000 tonnes in 1964 to 202,000 in 1966, 341,000 in 1970, 443,000 tonnes in 1972 and about 413,000 tonnes in 1982 (Fig. 1).

This rapid rise in demand was further increased and maintained due to the increase in the purchasing power of the local population, thus enabling individuals to construct their own residential houses in both urban and rural areas. According to a study carried out by the Ministry of Lands, Housing and Urban Development, the major towns of Tanzania were estimated to have a shortage of about 300,000 houses in 1982 and it was estimated that by the year 2000 urban population will have increased by more than 1.8 million families, making the additional housing requirement in the urban areas to be more than 2 million.

This in addition to the high and rapidly rising demand for industrial and public utilities, and for construction of modern houses by the rural villages where, according to 1978 census, 85 % of the Tanzanians live. The demand on cement and other building materials will therefore continue to grow rapidly during

Fig. 1



the next several decades. The present cement consumption in the country which works out to be about 20 kg per head annually, which is partly a result of demand restraint, is by far below that of the developed countries where it is over 600 kg per head. Consumption should therefore be expected to rise with development and increase in supply.

Although efforts were made to increase production to cope with the rising demand which had been estimated to be about 1,000,000 tonnes per annum during the early 1980's, supply remained far below demand until recently.

Before Independence not many local Tanzanians had any interest in the mining industry. There were no professional Tanzanians in the field and there were hardly any full time local miners, although there were a number of part-time prospectors mainly dealing with building minerals only. The development of the Mineral Sector and the participation of the local people began to be encouraged by Government after Independence. Convinced of the role which the local population could play in the development of the sector, the Government decided to arouse local interest by conducting some courses on prospecting. So the first course for local prospectors was launched as an experiment at Morogoro in April, 1960. Soon after this period the number of local prospectors increased.

Their efforts, however, had been largely confined to alluvial gold production, tin and mica mining, and the winning of building materials and lime. As stated earlier, most of the early local miners or prospectors had taken mining as a part-time activity while farming remained their major preoccupation. During the years that followed, further courses were held at Morogoro and also some mobile courses in the regions. The teaching embraced the very simplest introduction to economic minerals, preliminary examination of a discovery, the pegging of claims and the essential requirements of the law.

These courses which continued to be offered until recently, appear to have been very useful in imparting the basic skills to those who decided to take mining as their full time employment.

Involvement of the local prospector was initially mainly in the production of building materials such as building sand and stone. Pegging of claims requires simple procedure and mining of sand require only simple tools for loading the sand into the lorry, and the financial return on this type of business has been better than many other risky mining activities, since there is little risk involved. In order to give more encouragement and to promote speedy development of the construction industry, the royalty which used to be charged on building sand was abolished in 1964.

The efforts to place special emphasis on the development of building materials particularly, were later reflected in the country's basic policy as per the Arusha Declaration, which states, inter alia, "that the basic needs for the development of our people are food, clothing and housing (shelter)".

Furthermore, the construction of such essential facilities as roads, railroads, bridges, factories, schools, hospitals, irrigation schemes, water dams, hydro-power, etc., all of which are the key requirements to our development, require such construction materials as stone, aggregate, sand and cement for their implementation.

Even then, apart from mining of building sand and stone, the manufacture of building materials such as cement, glass, ceramics and even proper development of stone quarries, did not receive much attention until very recently. The cement industry was first established in Tanzania in mid 1960's following construction of phase I of the Wazo Hill plant which started in 1963 and was completed in mid 1966. Apart from establishment of a medium-sized bottle factory (Kioo Ltd) in Dar es Salaam in mid 1960's, serious development of the glass and ceramic industries did not start until early 1980's.

Recent technological developments have of course enhanced the speed of development and placed the

Author's Biography

Rumisha Henry Kimambo is General Manager of the Tanzania Saruji Corporation in Dar es Salaam, Tanzania. He was born on 15th February, 1934 in Kilimanjaro Region, Tanzania.

He has an extensive professional background and experience in geological field and management. Mr. Kimambo was the first General Manager of the State Mining Corporation of Tanzania from 1972 to 1976 prior to his present job. He has worked as Assistant Commissioner for Mineral Resources (1971 to 1972) and Chief Geologist (1969 to 1971) in the Geological Surveys of Tanzania.

Mr. Kimambo is a graduate in Geology, University of Glasgow, UK 1965, M.Sc. in Mining and Mineral Exploration – University of Mc Gill, Montreal Canada, 1969.

He has attended many short courses, workshops and seminars particularly in the fields of management of public enterprises and development of mineral resources. He is Chariman/Director in a number of Boards and is currently President of the Geological Society of Tanzania.