

ECA/NRD/WCA/5

UNITED



NATIONS

ECONOMIC COMMISSION FOR AFRICA

Final Report of the Regional Workshop  
on the Role and Prospects of Copper and  
Aluminium in African Development

Lusaka, Zambia

27 February - 2 March 1985

21128

Distr.  
LIMITED

ECA/NRD/WCA/5  
2 March 1985

Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Regional Workshop on the Role and  
Prospects of Copper and Aluminium  
in African Development

27 February - 2 March 1985  
Lusaka, Zambia

FINAL REPORT

# OPENING OF THE WORKSHOP

1. The regional workshop on the role and prospects of copper and aluminium in African development was convened by the United Nations Economic Commission for Africa (ECA) in Lusaka, Zambia, from 27 February to 2 March 1985. The workshop was convened pursuant to one of the recommendations of the first Regional Conference on the Development and Utilization of Mineral Resources in Africa, held in Arusha, United Republic of Tanzania, in February 1981.
2. The workshop was opened by the Hon. N.D. Sifwa, Minister of State for Mines of the Republic of Zambia, who, after welcoming the participants, commented that despite Africa's considerable endowment in copper and aluminium resources, the region had not benefited as much as it should from the development of those minerals. The main factors which militated against the contribution of copper and aluminium towards increased economic development and growth in the African region included: Africa's financial, technological and market dependence on the developed countries for the development of its mineral resources; the adverse terms of trade between the mineral producers and the developed countries which produced manufactured goods from those same minerals; fluctuations in mineral prices; protectionist measures by developed countries against imports of semi-processed and processed metal products from developing mineral-producing countries; and the near absence of intra-African trade in minerals and mineral products.
3. Owing to market saturation by mineral products in the developed countries, the future demand for minerals depended on the developing countries, where the consumption of minerals was at present minimal.<sup>2</sup> Increased intra-African trade in minerals and mineral products to support African economic development would enhance the contribution of copper and aluminium to the rapid socio-economic growth of the region.
4. The Minister underlined the importance of increasing the training of African mineral development specialists in African institutions; of making increased use of African institutions for technical services to the mineral industries of the region to respond to the needs of the majority of the African population.
5. On behalf of the Executive Secretary of ECA, Mr. P.N. Mwanza, Director of the Natural Resources Division of ECA, thanked the people, party, and Government of Zambia and all the institutions and individuals who had made the convening of the workshop a reality.
6. Mr. Mwanza noted that although major bauxite and copper mining industries had existed in the African region for a number of years, there had been no significant development of secondary industries making aluminium and copper-based products for consumption in the African region. Small national markets for aluminium and copper-based products, the lack of complementary resources at national levels (raw materials, energy, financial resources, technology, etc), and the failure by many African countries to appreciate the benefits to be derived from the increased utilization of aluminium and copper in their development activities might be some of the explanations for the present state of the African aluminium and copper industries.

7. He suggested that, on the basis of internal needs, African countries should co-operate in the establishment of facilities making aluminium and copper-based products for consumption in their economies. He further suggested that detailed surveys of African potential markets for aluminium and copper-based products, existing African facilities for making such products, including their capacities and distribution, and the financial and other implications of establishing and operating African multi-country fabricating facilities based on aluminium and copper should be conducted to enable African countries to decide how best to co-operate in the development and utilization of their aluminium and copper. The surveys could be undertaken on a regional basis; they might be conducted by existing multinational development institutions, or by an African association of aluminium and copper development. The proposed association could include potential and existing African producers of bauxite, alumina, aluminium and copper; African potential and existing producers of energy; and potential African consumers of aluminium and copper-based products.

#### ELECTION OF OFFICERS

8. The workshop unanimously elected the following officers:

Chairman	- Zambia
Vice-Chairman	- Ivory Coast
Rapporteur	- Malawi

9. It was agreed that the officers thus elected and the ECA secretariat would constitute the Drafting Committee for the preparation of the final report of the workshop.

#### ATTENDANCE

10. The following countries were represented by official delegations to the workshop: Ivory Coast, Madagascar, Malawi, the United Republic of Tanzania and Zambia. The following organisations were represented by observers: the United Nations Industrial Development Organization (UNIDO), the United Nations Development Programme (UNDP), the Organization of African Unity (OAU), the Southern African Development Co-ordination Conference (SADCC) Mining Sector, the East and Southern African Mineral Resources Development Centre (ESAMRDC), the Institute of Mining Research (Zimbabwe), Zambia Industrial and Mining Corporation (ZIMCO), University of Zambia, Reserves Minerals Corporation (Zambia), the Metal and Marketing Corporation of Zambia (MAMECO), and Zambia consolidated Copper Mines (ZCCM).

#### ADOPTION OF AGENDA

11. The following agenda was adopted by the workshop:

1. Opening of the workshop
2. Election of officers
3. Consideration of papers on copper

4. Consideration of papers on aluminium
5. Any other business
6. Adoption of the report of the workshop
7. Closure of the workshop.

#### PROCEEDINGS OF THE WORKSHOP

##### Copper resources of Africa

12. In a paper presented for the ECA secretariat by a representative of the Zambia Consolidated Copper Mines, it was pointed out that although copper deposits had been identified in 33 African countries, the major deposits were mainly south of the equator. In particular, over 90 per cent of the currently known copper resources in Africa were in the Zambian-Zairean copper belt. Despite the application of modern methods of prospecting in many countries, no significant new copper deposits had been located.

13. The paper recommended that a better method of disseminating information about copper resources in the region should be devised to improve co-ordination by African countries in the development of those resources. Frequent liaison between ECA, OAU and relevant inter-governmental and national institutions in Africa, through a body such as the proposed African council for mineral resources development, might improve such dissemination and enhance African co-operation in mineral resources development.

14. In the general discussion which followed the presentation of the paper, the participants underlined the need for a more detailed evaluation of the small copper deposits which occur in several countries in Africa; the development of small-scale copper development industries based on these resources; improved mining and processing technologies so that high copper recovery rates could be achieved both from primary ores and past tailings; and improved dissemination of information on copper resources in the region to assist development planning at national and multi-country levels.

##### The role and prospects of copper in African development

15. In presenting the paper, a representative of the ECA secretariat noted that although Africa possessed a huge store of copper resources (largely located in Zambia and Zaire) and produced a large share of the copper entering international trade, the consumption of copper in the African region was negligible compared with other regions.

16. While it would seem that the demand prospects for copper-based products in the African region were bright, existing copper fabricating facilities in the region appeared underutilized largely because of small national markets. Hence, it was argued, the existing copper fabricating facilities in Africa should be reorganized to serve subregional and regional needs. Where demand and other factors dictated the establishment of new African copper fabricating facilities, such factors as the availability of copper and the possibility of establishing multi-country facilities whose establishment and production costs could be shared should be considered.

17. During the discussion which followed, participants called for market surveys to determine the capacities of African copper fabricating facilities the quantities and ranges of copper products manufactured; the consumption of copper and future prospects in the region, etc. Research aimed at ways of increasing the consumption of copper in the African region should also be undertaken. Likewise, market surveys should be undertaken so that optimum levels of output from the existing copper fabricating facilities could be achieved.

Copper/nickel deposit at Samapleu-Gangbapleu: discovery and development prospects

18. A representative of the Ivory Coast informed participants of the discovery of the SAMAPLEU-GANGBAPLEU copper nickel deposit as a result of prospecting work initiated some ten years ago. The deposit was of sulphide copper, and preliminary analysis of collected samples had shown that the ore contained about 5.3 per cent copper and 2.4 per cent nickel. Additional work was planned in order to estimate the size of the reserves and the possibility of developing by-products such as palladium.

19. In response to questions by the author of the paper regarding particulars of the deposit, some participants advised him that the Ivory Coast might benefit from the experience of Zambia and Zaire in the field of copper.

The manufacturing potential of copper-based products in the African region - a preliminary review

20. A paper presented for the ECA secretariat by a representative of Zambia Consolidated Copper Mines pointed out that although the Zambia/Zaire copper belt had been associated with copper production for the last fifty years, there had been no significant development of secondary industries producing copper-based products for consumption in the African region. Since there was little information at the regional level on the demand for copper-based products, a market survey should be undertaken to determine the needs of the region. Such a survey could also evaluate existing national copper-fabricating facilities and propose how they could supply copper-based products for other countries.

21. The establishment of a regional mechanism to undertake market surveys, disseminate information on copper development in the region, promote the standardization of copper-based products, and encourage co-operation by the countries of Africa in the development and utilization of copper resources was proposed.

22. The participants in the workshop endorsed the proposals outlined in paragraph 21 above.

Mineral wastes as a resource for the recovery of metal values in Zambian copper mining operations

23. In a paper presented by Mr. S.K. Mwenechanya, Manager, Mining Industry Technical Services, ZCCM, it was pointed out that more than fifty years of commercial mining activity on the Zambian copper belt had generated a considerable volume of wastes which were estimated to contain more than seven million tonnes of copper.

24. Efforts to recover copper from these resources were now being made, and newer techniques applied to the treatment of these materials. Among the technologies for treating dump materials were dump leaching of low-grade sulphide and oxide materials and the refloatation of residual sulphides contained in the leach.

25. Participants enquired about the causes of copper losses at various stages of mining, concentrating, smelting and refining and were informed that these occurred at the mining, grinding, processing, and smelting stages. These difficulties were essentially metallurgical problems resulting from the complexity of the ore.

26. The author of the paper informed the meeting that copper recovered by tailing reprocessing was contributing roughly 80,000 tonnes of copper yearly to Zambia's overall production.

Selective flotation of complex sulphide ores of copper, zinc and lead

27. A representative of the Organisation of African Unity, in a paper on the flotation of complex sulphide ores, said that selective flotation depended on a knowledge of the surface physical and chemical properties of the substances to be separated, their behaviour in the presence of reagents and their sensitivity in a given environment (oxydizing, reducing or neutral).

28. Flotation tests had been carried out on two kinds of copper sulphide: primary (CuS) and secondary (Cu<sub>2</sub>S). Primary sulphides had been represented by a sample of chalcopyrite, secondary sulphides by chalcocite.

29. In the case of Chalcopyrite flotation, the important features were the natural floatability of chalcopyrite, the functions of oxygen and of the potential applied, the effects of the flotation medium, the exact role of the froth agent, and the relationship between the behaviour of the particles (depending on their size) and the chemistry of the solution.

30. The flotation of chalcocite with xanthate was governed by the potential applied and the flotation medium. The roles of oxygen and the pH of the solution were not clearly understood.

31. There were two aspects to the flotation of zinc sulphide ores (blendes):  
a) zinc sulphides responded poorly to mercaptan collectors (thioles) b) they could be activated and made to float in mercaptans if treated with solutions of copper and other heavy metals. The process of floating blende demonstrated

the following: a) activation results from an exchange of ions between copper and zinc; b) de-activation is brought about by cyanide dissolving copper as a copper-cyanide complex; c) depression of the blende by reagents containing zinc salts is due to the formation of deposits of complex forms of hydrophilic zinc on the blende surface.

32. The activation and deactivation phenomenon was governed by strong chemical reactions which yielded final products; depression, on the other hand, was the combined effect of physical and chemical bonds which were responsible for changes at the surface of the mineral.

33. Research into the fundamentals of the zinc flotation process should, therefore, concentrate on depression.

#### The aluminium sector in developing African countries

34. A paper presented by the ECA secretariat said that Africa was endowed with abundant, rich bauxite deposits whose exploitation, in West Africa in particular, was likely to be sustained in view of world demand for the high-grade crude bauxite available in that subregion. Deposits in other parts of Africa, though of economic interest, were in locations too remote and lacking the infrastructure to be brought into production at a time of over-supply and idle mine production capacity world-wide.

35. The prospects for growth in feed materials for the bauxite/aluminium industry, including the allied sector of semi-fabricated and finished products, were limited world-wide. However, in the case of Africa there was some scope for increased production, mainly of bauxite but to a lesser extent of alumina and aluminium, thanks to the continent's high potential for cheap hydro-electric power.

36. Although Africa could embark on a competitive expansion of aluminium smelting, project implementation would be constrained by the capital intensive character of the industry, the scarcity of funds, an over-supply of aluminium world-wide and the availability of bauxite from new mines, together with additional alumina plants and large aluminium smelters coming on stream in other third world countries.

37. The paper underlined that industrial development and the large electrification schemes under way throughout the region made for a local market ready to absorb increased quantities of semi-fabricated and finished products; the greater demand could be met, by the integrated aluminium industry in Africa providing it developed at a commensurate rate until the year 2000.

38. During the discussion which followed, participants suggested that African countries should strive to achieve greater participation in the bauxite/aluminium industry alongside the transnational corporations which were expected to remain in a controlling position. It was noted that geopolitical factors might be responsible for the shift of interest and capital investment in the bauxite/aluminium sector from Africa to other parts of the world since other conditions seemed to be as favourable and attractive nowadays in Africa as in any other third world or industrialized country.



Development of the aluminium industry in Africa -- a preliminary paper

39. A paper presented for the ECA secretariat by a representative of the Minerals Commission of Ghana described the uses of aluminium in social and economic development, potential for the manufacture and utilization of aluminium in Africa, the possible distribution of aluminium-based industrial units in the region, the costs of establishing such industries, and opportunities for co-operation by African countries in the aluminium industry.

40. Because of the huge capital costs involved in projects in the upstream stages of the aluminium industry, and because not all African countries had the complementary resources to develop an integrated aluminium industry, there was a strong need for co-operation in the joint development of aluminium related projects. Co-operation in the development of alumina refineries and aluminium smelters could make aluminium metal available to the co-operating States, and such metal could be used both by existing plants and by potential new ones. It was emphasized that only when the African aluminium industry was based on local bauxite/alumina, energy and other inputs could the industry have maximum impact on African development.

41. In the discussion which followed, many participants emphasized the need for co-operation by African countries in the development of the region's aluminium industry, and there were calls for detailed regional surveys covering the present status of the aluminium industry, the potential demand for aluminium-based products, and other factors which could lead to the increased development and use of aluminium in Africa.

42. It was further stressed that the promotion of multi-country projects in the aluminium industry must be based on detailed feasibility studies which showed the viability of the projects concerned. It was felt that such feasibility studies could attract potential investors from both within Africa and elsewhere. Some participants expressed the view that African multi-country projects might be more attractive to investors (local or foreign) than national ones.

Aluminium in the Ivory Coast and its contribution to national and sub-regional development

43. In a paper presented by a representative of the Ivory Coast the workshop was informed that the aluminium consumed in the Ivory Coast was imported and that annual aluminium imports between 1975 and 1983 had varied between 8,100 and 13 300 tonnes, the peak having occurred in 1978. In value annual aluminium imports had ranged from 2,500 to 11,300 million CFA francs. The primary source of supply within Africa was Cameroon.

44. Annual aluminium exports over the same period had ranged in volume between 630 and 1,700 tonnes, the maximum occurring in 1979, and in value between 440 and 970 million CFA francs. Since peaking in 1979, exports had diminished year by year.

45. The Ivory Coast had simple technological facilities for processing aluminium. IVOIRAL and ALCANIVOIRE were the two main companies which handled most of the tonnage. These processing companies were suffering the effects of the prevailing economic crisis and their future was uncertain. ALCANIVOIRE had ceased operations and IVOIRAL was only surviving thanks to the wide variety of aluminium goods it produced. Data for 1975 to 1983 showed that most of the aluminium consumed locally went to the building industry, largely for cladding. The cost of aluminium cladding was fairly high and galvanised sheets, of lesser quality but much cheaper, were offering stiff competition. This situation needed watching since, at the present stage in the country's development, many iron and steel products could compete with aluminium.

#### Bauxite Resources of Malawi - A Review

46. The situation with respect to potential resources and exploration efforts to develop Malawi's bauxite sector were outlined by the representative of that country. The meeting was informed of in-depth geological investigation carried out by different exploration companies, leading to the conclusion that the Mulanje deposit represented the most important target in the SADCC region, although of low tonnage.

47. Although considered uneconomical in 1973 because of inadequate power supply and transport problems, it appeared that at the moment (1985) the possibility of power supply from Cabora Bassa (Mozambique) and the existence of the Malawi/Nacala railway link would make exploitation more attractive.

48. In view of high initial capital costs, joint regional development of the bauxite resources stretching across the Malawi-Mozambique border should be encouraged.

#### Production of Aluminium Sulphate from Zambian Indigenous Non-Bauxite Raw Materials

49. A representative of the School of Mines of the University of Zambia, Mr. J.B. Mwalula, briefed the meeting on laboratory experiments conducted in the Department of Metallurgy and Mineral Processing at the School. Research had shown it was technically feasible to produce aluminium sulphate from local clays using locally available sulphuric acid.

50. The paper emphasized that the expected output of aluminium sulphate could meet the requirements of Zambia and other countries in the sub-region for water treatment, tanning, paper sizing, dyeing, and other applications.

51. Local production could therefore replace the aluminium sulphate currently imported from abroad, thereby saving on foreign exchange and creating employment in the country.

52. Participants commented that further investigation at the pilot plant scale was an indispensable step before considering industrial production. The possibility of producing alumina, as feed material for aluminium production, from the surplus aluminium sulphate was also mentioned.

53. The possibility of producing aluminium from excess aluminium sulphate as a raw material for the production of aluminium was also considered.

#### ADOPTION OF THE REPORT

54. The draft report of the workshop was adopted with a number of amendments.

55. A vote of thanks to the Government of Zambia was moved by the representative of Ghana on behalf of the participants.

56. The Chairman then declared the workshop closed.