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## Tin in Africa

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Because of its hardening effect on copper, tin was used in bronze implements as early as 3,500 B.C., although the pure metal was not used until ~600 B.C. In Nigeria, bronze artefacts from three sites in the Anambra State have been dated to the 9<sup>th</sup> century AD. Bronzes dated between the thirteenth and nineteenth centuries have been excavated in northern South Africa, Botswana and Zimbabwe. Significant African tin production began at the beginning of the 20<sup>th</sup> century and maximum output was reached in the late 1970's. Since then production has declined to less than 2% of world output.

In Africa, 5 episodes of tin enrichment are recognised: (1) Archaean small-scale deposits on the Man Shield, the Congo Craton, the Zimbabwe Craton and the Kaapvaal Craton; (2) Palaeoproterozoic deposits in the Birimian of West Africa, the Ubendian Belt in Central Africa and the Bushveld Complex in South Africa; (3) early Neoproterozoic in the Kibaran Belt of Central Africa, the Kamativi Belt in Zimbabwe, and in the Orange River-Namaqua Province of Namibia/South Africa; (4) late Neoproterozoic to early Palaeozoic belts of ~600-500 Ma age, that resulted from the amalgamation of Gondwana. Rare metal mineralisation in granites and pegmatites is common on the African Nubian Shield, including in Ethiopia, Somalia, Sudan, Saudi Arabia and Egypt; on the West African shield in Nigeria; in the Kibara belt of Rwanda and DRC; in the Mozambique Belt of eastern Africa and the Damara Belt in Namibia; (5) the Mesozoic ring complexes of the Jos Plateau in Nigeria. Also, Pleistocene to Recent alluvial concentrations derived from granites and pegmatites of varying ages occur especially in DRC and Nigeria. Tin provinces occur in Nigeria, South Africa and Namibia. These are areas where cassiterite occurs in rocks of very different ages. For example, in Nigeria, cassiterite occurs in Panafrican pegmatites, Mesozoic ring complexes and in Pleistocene alluvial deposits.

In the DRC there has been a long history of tin production, although recently mining has declined due to instability and political/religious clashes which, since the mid-1990's, left the commodity control to armed groups. Nevertheless, in 2007-2008 the cassiterite export was estimated at 18,000-25,000 tons and, after the government ban on all mineral exports in 2010 was lifted in 2012, the country is now the leading African tin producer, with an output of ~3000 t in 2013. In Rwanda, primary mineralisation and alluvial deposits have been mined since the early 1930's. In the 1970's, state-controlled companies took over and only since 2007 mining licences have been granted to private national/international companies, although most of the mines operate at the artisanal scale. The average annual tin export between 2009 and 2013 was 4,955 tons, although in 2013 only ~2000 t were produced. In Nigeria tin has been mined on a commercial scale since 1904 and before the discovery of oil, tin was the major source for foreign exchange in the country. Tin production boomed during the 1950s, reaching 12,000 Mt/yr, but the subsequent depletion of subsurface deposits, coupled with a downturn of the tin price, led to a reduction of production from ~3,800 Mt in 1979, to less than 3,200 Mt in 1981, and then to 203 Mt in 1995. There has been a cyclic trend in the last 10 years with a production rising from 790 Mt in 2002 to 1,818 Mt in 2006, then dropping again to a minimum of 229 Mt in 2007. In 2013 the total tin production was 570 Mt

but was estimated as 500 Mt in 2014. Extensive alluvial cassiterite resources underlie the Ngell basalts of Plateau State. In northern Morocco, the Achmmach tin prospect discovered in 1985, is hosted in NNE striking vertical tourmaline-rich or quartz veins that carry minor sulphides. Anticipated production from the resource of 8.45 Mt grading 0.78% tin is expected in 2016.

Reported smelter production of tin metal ceased in Nigeria in 2005 and in Rwanda in 2006, and no formal tin smelter is operational in Africa since this date. In 2012, African tin mine production decreased by about 26% compared with that of 2011 and by 2014 the total tonnage was ~127,500 although the Abu Dabbab project started production in Egypt and Achmmach in Morocco is now also set to produce. In 2014 the DRC accounted for 59% of African tin mine production, Rwanda, 23%; Nigeria, 9%; and Egypt, 6%. No refined tin was produced in 2012.

