DISTRICT OVERVIEW

Zambian Copper (+ Cobalt) Belt

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DATA METALLOGENICA

The Zambian Copper Belt and the Cupriferous Arc of the neighbouring Democratic Republic of Congo (DRC) closely coincide with a complex structural zone, the Lufilian Arc, which is normal to the NE-SW trend of, and near the NE extremity of, the elongate, 2000 km long Damaran-Katangan belt of Meso- to Neo Proterozoic sediments that extends all the way to the Atlantic Ocean to the SW.

Traditionally the ore deposits of the Zambian Copper Belt have been interpreted to lie within the Neo-Proterozoic Lower Roan Group (up to 1000 m thick) composed principally of coarse silici-clastics (conglomerate to arkose and siltstone, with lesser carbonates). Some 65% of the mineralisation lies within a finer 0 to 100 m thick unit of generally carbonaceous argillites, carbonatic argillites and interbedded arenites (the Ore Formation) within the coarser clastic succession. A further 25% lies within coarser footwall clastics and the remaining 10% within the coarse hangingwall clastics. Lithologically 60% of the ore is hosted by argillites and 40% in arkose, quartzites and conglomerates.

The Lower Roan is overlain by Neo-Proterozoic carbonates of the Upper Roan (up to 600 m thick) which hosts the Cupriferous Arc deposits of the neighbouring DRC. This unit is in turn followed by up to 600 m of carbonaceous argillites and dolomitic argillites (Mwashia Group) and a very thick sequence (6000 m+) of finer clastics and carbonates, the Kundelungu, with two prominent conglomerate/diamictite units.

The Zambian Copper Belt comprises two NW-SE trending parallel lines of Cu mineralisation some 20 km apart, separated by the Palaeo-Proterozoic basement gneisses, granitoids and schists, and Meso-Proterozoic conglomerates, quartzites and granitoids that make up the Kafue Anticline. The majority of the deposits are in the SW band. Each of these two belts is 5 to 20 km wide and up to 150 km long. The ore grade mineralisation however tends to occupy a linear, often more structurally complex band up to 2 km wide on the SW limb, interrupted by narrow barren gaps and cross folded anticlinal basement cores.

Within the two belts there are some 7 major and 25 minor stratabound deposits. The larger orebodies range from 90 to 580 mt @ 2.4 to 3.6% Cu. Between 1930 and 1987 some 24 million tonnes of copper metal was produced from 1070 mt of ore averaging 2.71% Cu and containing 29 mt Cu. The total mined ore plus reserves/resources has been calculated at 3000 mt @ 2.9% Cu.

This description is based on information available at the time of writing in 2001. It is a summary of published sources, the chief of which are listed below.

Selected references:

Annels A E 1984 - The Geotectonic Environment of Zambian Copper-cobalt Mineralization: *in Journal of the Geological Society of London* v141 pp 279-289

Annels A E 1989 - Ore Genesis in the Zambian Copperbelt, with Particular Reference to the Northern Sector of the Chambishi Basin: *in* Boyle R W, Brown A C, Jefferson C W, Jowett E C, Kirkham R V, (eds), Sediment-hosted Stratiform Copper Deposits: *Geological Association of Canada* Special paper 36 pp 427-452

Annels A E 1979 - Mufulira Greywackes and Their Associated Sulphides: *in Trans. IMM, Section B* v88 pp B15-B23

Annels A E 1974 - Some Aspects of the Stratiform Ore Deposits of the Zambian Copperbelt and their Genetic Significance: *in* Bartholome P (Ed), Gisements Stratiformes et Provinces Cupriferes: *Societe Geologique de Belgique, Liege* pp 235-254

Annels A E, Vaughan D J, Craig J R 1983 - Conditions of Ore Mineral Formation in Certain Zambian Copperbelt deposits with Special Reference to the Role of Cobalt: *in Mineralium Deposita* v18 pp 71-88

Armstrong R A, Robb L J, Master S, Kruger F J, Mumba P A C C 1999 - New U-Pb age constraints on the Katangan Sequence, Central African Copperbelt: *in Journal of African Earth Sciences, Elsevier, Amsterdam* v28, no.4A pp 6-7

Brandt R T, Burton C C J, Maree S C, Woakes M E 1961 - Mufulira: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 411-461

Daly M C, Chakraborty S K, Kasolo P, Musiwa M, Mumba P. Naidu B, Namateba C, Ngambi O, Coward M P 1984 - The Lufilian Arc and Irumide Belt of Zambia, Results of a Geotraverse across their Intersection: *in Journal of African Earth Sciences, Elsevier, Amsterdam* v2, no.4 pp 311-318

Darnley A G 1960 - Petrology of Some Rhodesian Copperbelt Orebodies and Associated Rocks: *in Transactions of the Institution of Mining and Metallurgy* v69 pp 137-173

Ellis M W, Austen A L, Garlick W G, Gane P G, Cornwall F W 1961 - Exploration: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 166-212

Fleischer V D 1984 - Discovery, Geology and Genesis of Copper-cobalt Mineralisation at Chambishi Southeast Prospect, Zambia: *in Precambrian Research* v25, no.1-3 pp 119-133

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt - (Exerpt on Genesis): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 323-352

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Exerpt covering Nchanga): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 256-274

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Excerpt covering the geology only): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 223-243

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt - Mufulira Mine, Zambia (Exerpt on Mufulira only): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 304-323

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Exerpt covering Nkana): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 275-285

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Exerpt covering Roan Antelope and Baluba): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 285-297

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Exerpt covering Chibuluma and Chibuluma West): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 298-304

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Exerpt covering Chambishi): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 249-256

Fleischer V D, Garlick W G, Haldane R 1976 - Geology of the Zambian Copperbelt (Exerpt covering Konkola and Musoshi): *in* Wolf K H, (ed), Handbook of Strata-bound and Stratiform Deposits; II. Regional Studies and Specific Deposits *Elsevier, Amsterdam* v6, Cu, Zn, Pb and Ag Deposits pp 244-249

Garlick W G 1961 - Chambishi: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 281-297

Gunning H C 1961 - The Early Years: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 3-10

Haynes D W 1986 - Stratiform Copper deposits hosted by low-energy sediments: II. Nature of source rocks and composition of metal-transporting water: *in Econ. Geol.* v81 pp 266-280

Haynes D W 1986 - Stratiform Copper deposits hosted by low-energy sediments: I. Timing of Sulfide precipitation - an hypothesis: *in Econ. Geol.* v81 pp 250-265

Hitzman M W 1998 - Petrographic Studies of Ore Shale from the Zambian Copperbelt, Implications for Models of Ore Formation: *in* Geological Society of America, 1998 Annual Meeting *Geological Society of America - Abstracts with Programs* v30, No.7 pp 19-20

Jordaan J 1961 - Nkana: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 297-328

McGowan R 2001 - Towards a New Genetic Model for Precambrian Sediment-hosted Copper Deposits: *in* A brief overview of the Zambian Copperbelt - *Web page extract, from: www.soc.soton.ac.uk/SOES/STAFF/sr1/Ross/RMcGowan_HP.htm* 5p

McKinnon D, Smit N J 1961 - Nchanga: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 234-275

Mendelsohn F 1989 - Central/Southern African Ore Shale Deposits: *in* Boyle R W, Brown A C, Jefferson C W, Jowett E C, Kirkham R V, (eds), Sediment-hosted Stratiform Copper Deposits *Geological Association of Canada* Special paper 36 pp 453-469

Mendelsohn F 1961 - Roan Antelope: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 351-405

Mendelsohn F, Garlick W G, Pienaar P J, Demesmaeker G 1961 - General Geology: *in* in Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 17-56

Richards J P, Cumming G L, Krstic D, Wagner P A, Spooner E T C 1988 - Pb isotope constraints on the age of Sulfide ore deposition and U-Pb age of late Uraninite veining at the Musoshi stratiform Copper deposit, central African Copper belt, Zaire: *in Econ. Geol.* v83 pp 724-741

Richards J P, Krogh T E, Spooner E T C 1988 - Fluid inclusion characteristics and U-Pb Rutile age of late hydrothermal alteration and veining at the Musoshi stratiform copper deposit, central African Copper belt, Zaire: *in Econ. Geol.* v83 pp 118-139

Sweeney M A, Binda P L 1994 - Some Constraints on the Formation of the Zambian Copperbelt Deposits: *in J. of African Earth Sciences* v19 pp 303-313

Sweeney M A, Binda P L 1989 - The Role of Diagenesis in the Formation of the Konkola Cu-Co Orebody of the Zambian Copperbelt: *in* Boyle R W, Brown A C, Jefferson C W, Jowett E C, Kirkham R V, (eds), Sediment-hosted Stratiform Copper Deposits *Geological Association of Canada* Special paper 36 pp 499-518

Sweeney M A, Binda P L, Vaughan D J 1991 - Genesis of the Ores of the Zambian Copperbelt: *in Ore Geology Reviews* v6 pp 51-76

Sweeney M, Turner P, Vaughan D J 1986 - Stable isotope and geochemical studies of the role of early diagenesis in ore formation, Konkola Basin, Zambian Copper belt: *in Econ. Geol.* v81 pp 1838-1852

Unrug R 1989 - LANDSAT-based Structural Map of the Lufilian Fold Belt and the Kundelungu Aulacogen, Shaba (Zaire), Zambia and Angola, and the Regional Position of Cu, Co, U, Au, Zn and Pb Mineralisation: *in* Boyle R W, Brown A C, Jefferson C W, Jowett E C, Kirkham R V, (eds), Sediment-hosted Stratiform Copper Deposits *Geological Association of Canada* Special paper 36 pp 519-524

Unrug R 1988 - Mineralization controls and source of metals in the Lufilian Fold Belt, Shaba (Zaire), Zambia, and Angola: *in Econ. Geol.* v83 pp 1247-1258

Unrug R 1988 - Mineralization Controls and Source of Metals in the Lufilian Fold Belt, Shaba (Zaire), Zambia and Angola: *in Econ. Geol.* v83 pp 1247-1258

van Eden J G 1974 - Deposition and Diagenetic Environment Related to Sulfide Mineralization, Mufulira, Zambia: *in Econ. Geol.* v69 pp 59-79

Winfield O 1961 - Chibuluma: *in* Mendelsohn F (ed), Geology of the Northern Rhodesian Copperbelt *McDonald, London* pp 328-342