Cu-Zn-Co ORE DEPOSIT AND KIMBERLITES AT LUIKONLAHTI

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The Luikonlahti Cu-Zn-Co mine

The first indications of copper mineralization at Luikonlahti were found the Geological Survey of Finland during regional bedrock mapping surveys in the early 1900's. An outcrop of the main orebody was subsequently discovered by a private prospecting company, Malmikaivos Oy, in 1944. Extensive research and test mining was carried out after World War II, when the main target for exploration were the reasonably high nickel contents of the outer contacts of serpentinite lenses within the Outokumpu assemblage. Nevertheless, insufficient tonnages and the remote location caused all exploration activity in the area to be suspended for the next ten years.

When drilling resumed, this time with better techniques, it was found that the main orebody continued at depth, while two additional smaller ore bodies were also discovered (Figs. 5, 6). Ore reserves were estimated at eight million tons of copper ore containing: Cu 1.1% (in chalcopyrite); Zn 0,6% (in iron sphalerite); Co 0.1% (in Co-pentlandite and in the lattice of pyrite and pyrrhotite) and S 18% (mainly in pyrrhotite). Dimensions of the main ore were: maximum width 80 m, depth 480 m and length 700 m. The dip of the ore body was nearly vertical, allowing the use of low cost mining methods, while the ore mineralogy of the ore was favorable for producing high grade mineral concentrates. Production commenced in 1968 after mine development, construction of railroads, power lines, roads and other infrastructure and continued until 1983. Annual production was of the order of half a million tons of ore and after three years of open pit mining, operations continued underground using a sublevel caving method. About 220 people were employed in various aspects of mining operations and the mine had a major impact on the local economy. Five different mineral concentrates were transported by rail to domestic smelters: copper, cobalt and zinc to several Outokumpu smelters, pyrrhotite to the sulfuric acid plant built by Kemira Oy at Siilinjärvi and roasted iron oxide from Siilinjärvi to the Rautaruukki iron furnaces at Raahe. Mining at Luikonlahti was carried out by the Finnish paper company, Myllykoski Oy, which was at that time the owner of Malmikaivos Oy.

Prospecting continued throughout the duration of mining operations and as the copper ore became progressively depleted, Malmikaivos delineated and evaluated reserves of high quality talc raw material (soapstone) at Luikonlahti. Talc production commenced after modification of the sulfide concentration plant for talc flotation and the application of new jet milling technology for micronizing the products. Talc is an important industrial mineral for the forest products industry. Production of talc started in 1979, at first alternating in shifts with copper ore processing. After closure of the copper mine, mining of a variety of talc products continued at a rate of 80 000 tonnes per year at full capacity.

Kimberlite projects

The first kimberlite pipe in Finland was discovered by Malmikaivos Oy as long ago as 1964 during regional sulfide ore prospecting in the surroundings of the Luikonlahti mine. This strongly magnetic pipe is located about 5 km SW from the mine but the significance of the discovery was not fully appreciated at the time. In the early 1980's two new kimberlite bodies were found during sulfide ore exploration, located some 20 km NE of the mine. The lack of specific diamond expertise in the evaluation of these discoveries led Malmikaivos in 1985 to approach Ashton Mining Limited from Australia for assistance. A technical cooperation and funding agreement was signed between Myllykoski Oy and Ashton Mining in 1986, with Malmikaivos being the company responsible for management of the project. Ashton Mining has had at least two experienced diamond exploration geologists working as members of the Finnish exploration team, with Malmikaivos Oy having provided a well-equipped field laboratory and established a 5 tons per hour bulk testing plant. To date 24

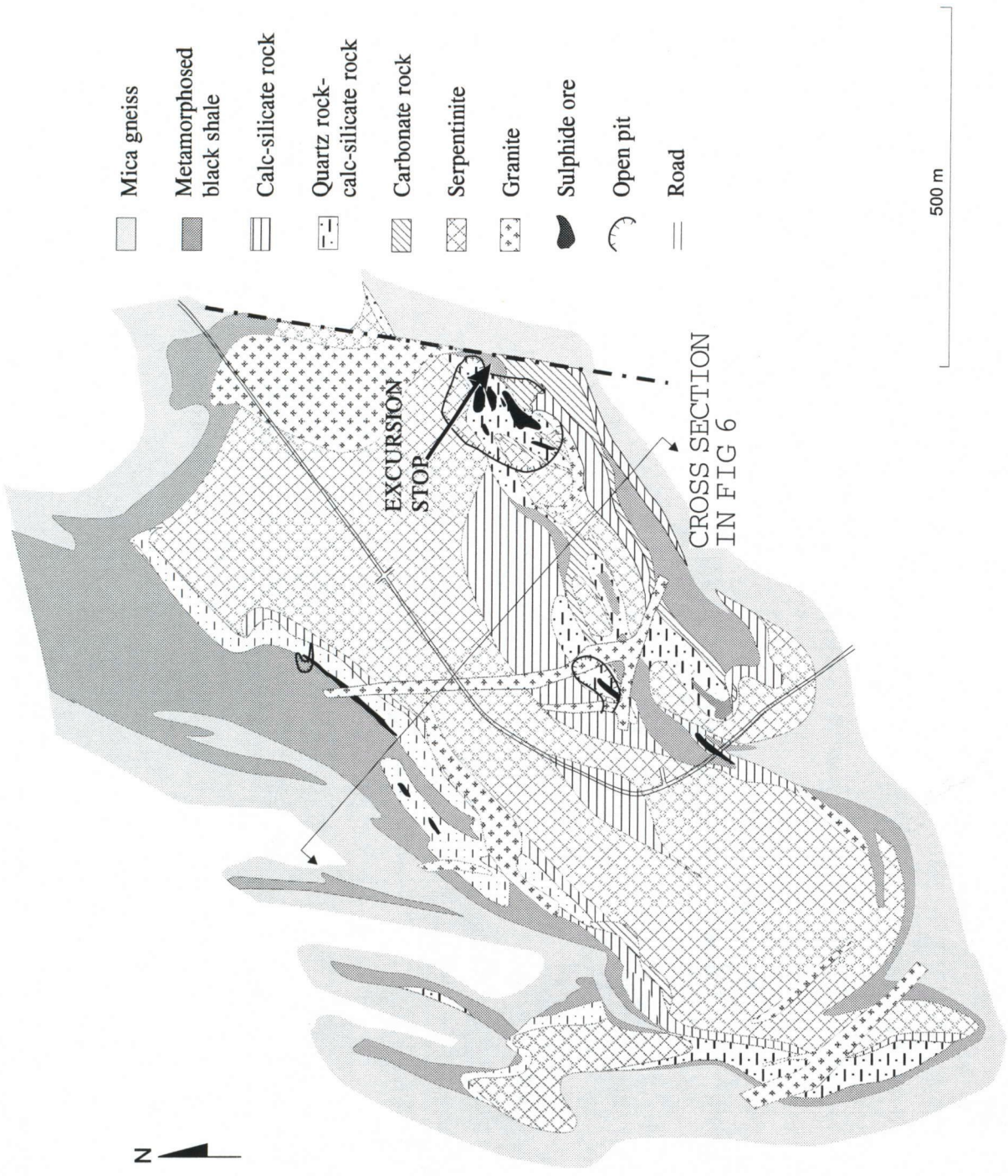

Fig. 5. Geology of the Luikonlahti area.

kimberlite pipes and dikes, mainly from one to four hectares in area have been discovered. All are located beneath some 5–25 m (at one locality 45 m) of recent glacial deposits that mask the underlying structurally complex granitoids and schists of the Baltic Shield. Fifteen of the pipes contain at least micro-diamonds. Preliminary tests on bulk samples from four of the pipes show significant grades, i.e., above 10 carats per hundred tonnes. The quality of stones is comparable with stones from existing diamond mines.

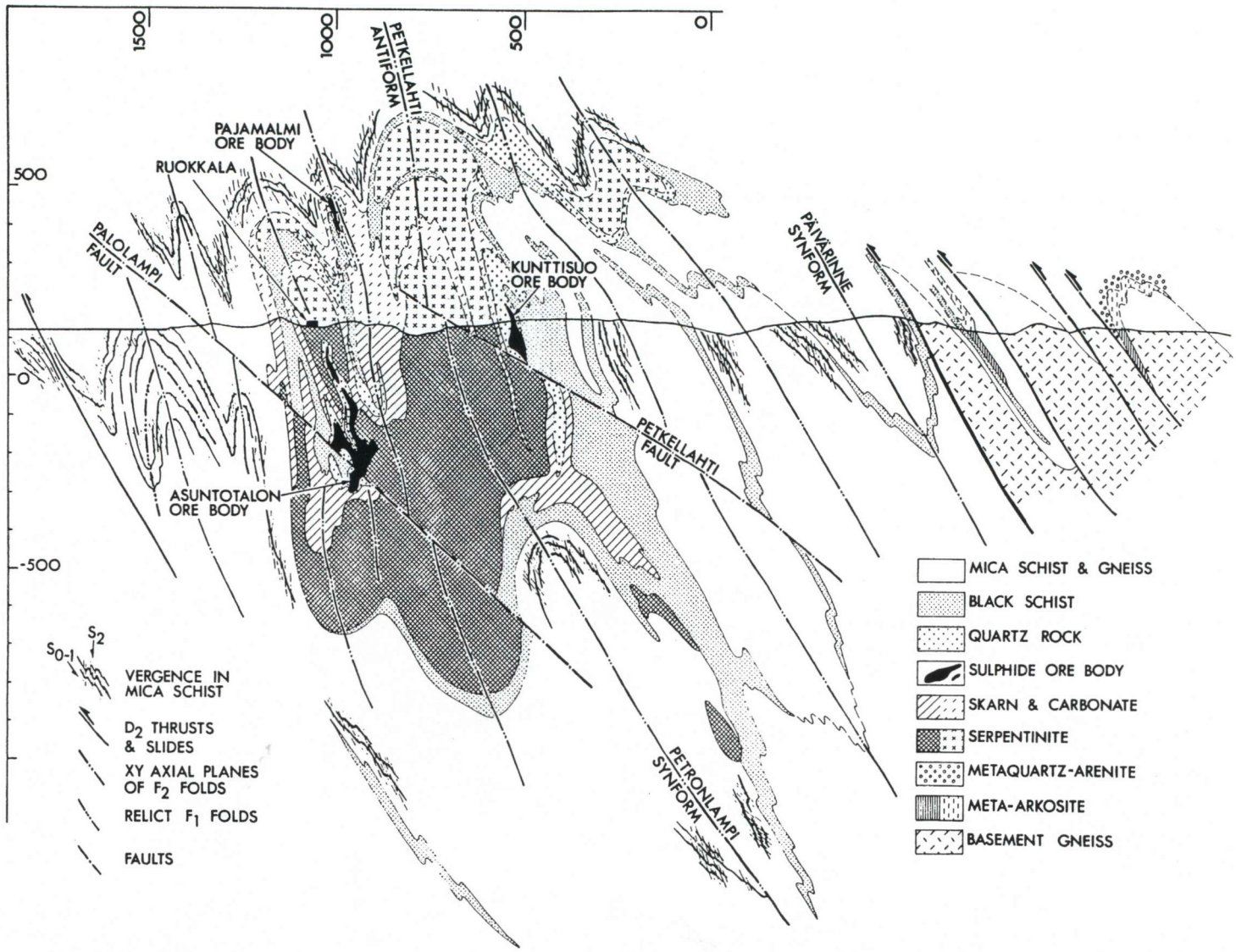

Fig. 6. Cross-section NW-SE looking SW (down plunge). Across the mine site the section is constrained by borehole and stope records to a depth of 500 m below the surface. The rest of the section is constructed by projection of information from the surface and other serial sections along paraboloid trajectories reflecting the x-y profile of the F_2 folds, controlled by the L_2 intersection lineations (from Park, 1988b).