



Mineral deposits and metallogeny of Fennoscandia



Edited by Pasi Eilu

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This book aims to give the first comprehensive explanation of the metallogenic areas of Fennoscandia, which have recently been described in the Metallogenic Map of the Fennoscandian Shield. The Fennoscandian metallogenic map shows the extent of presently known metallogenic areas. They are defined by the presence of metal mines, deposits, favourable bedrock geology, and by indications from geophysical and geochemical surveys. The following metals are included: Ag, Au, Be, Co, Cr, Cu, Fe, Li, Mn, Mo, Nb, Ni, Pb, Pd, Pt, Rh, REE, Sc, Sn, Ta, Ti, U, V, W, Y, Zn and Zr. The potential for exploration and mining is expressed by two types of areas: 'Areas of good exploration potential' include most of the known occurrences, past and present mines, and bedrock assumed to contain more deposits. Areas with the 'highest potential for new discoveries' are specifically indicated within these domains.

There are 168 major metallogenic areas within Fennoscandia. Of these areas, 47 are entirely or mostly in Finland, 40 in Norway, 40 in Russia, and 41 in Sweden. These include 24 areas that cross international borders. In terms of metal groups, there are 48 areas showing potential predominantly for ferrous metals (Fe, Mn, Ti, V, Cr), 36 for copper, zinc and/or lead, 31 for precious metals (Ag, Au, Pd, Pt), 30 for nickel or cobalt, and 11 for metals mostly used in modern, advanced technologies ('high-tech metals' Li, Nb, REE, Ta, Zr).

More than 30 major genetic types of metal deposits are known from Fennoscandia. According to past production and present resources, the most significant types and areas include: apatite-iron ore (Kiruna), BIF (Kostomuksha), carbonatite and peralkaline intrusion-associated rare metals (Kola Province), black shale-hosted U (alum shales in Sweden), mafic intrusion-hosted Ti-Fe±V (Tellnes), mafic to ultramafic-hosted Cr (Kemi), magmatic Ni-Cu-PGE (Pechenga, Portimo), orogenic gold (Kittilä), porphyry Cu-Au (Aitik), VMS (Bergslagen, Skellefte, Vihanti-Pyhäsalmi, Caledonides), and the somewhat enigmatic cases of Outokumpu Cu-Co and Talvivaara Ni-Zn.

Most of the known metal endowment of Fennoscandia was formed in just a few distinct events, the most important of which was the Svecofennian orogeny at ca. 1.9–1.8 Ga, accounting for an overwhelming majority of deposits and genetic types. Other significant metallogenic episodes were 1) ca. 2.8 Ga deposition of BIFs; 2) 2.45–1.92 Ga rifting, which produced mafic to ultramafic hosted Cr, PGE and Ni; 3) 2.1(?)–1.95 Ma black shale and ophiolite-related processes producing the proto-ores of the Talvivaara and Outokumpu types; 4) mafic intrusion-hosted ilmenite in the Sveconorwegian Orogen at 930–920 Ma; 5) Palaeozoic (Caledonian) rifting to collision-related sandstone-hosted Pb-Zn, black shale-hosted U, VMS and magmatic Ni-Cu deposits; and 6) 380–360 Ma carbonatite and peralkaline-related deposits (Kola and Northern Karelia).

The metallogenic areas are described by known metal deposits and areas of potential for future discoveries in the Fennoscandian Shield. Thus, this publication can be used in selecting strategic areas for mineral exploration as well as for research in economic geology. Importantly, this book will also serve as a tool for land-use planning and political decision-making, as it gives indications of the areas that have the greatest potential for future metal mines in northern Europe, fulfilling the requirements set by the raw materials policy of the European Union, and for similar objectives set by the countries in the region. The work was carried out in a joint project of the national geological surveys of Finland, Norway, Russia (VSEGEI and SC Mineral) and Sweden.

Keywords (GeoRef Thesaurus, AGI): metallogeny, metallogenic provinces, mineral resources, metal ores, mining industry, Fennoscandian Shield, Paleozoic, Precambrian, Fennoscandia, Finland, Sweden, Norway, Russian Federation

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This book is the first ever compilation of mineral deposits and metallogenic areas in Fennoscandia. It describes the major metal deposits and all metallogenic domains in Norway, Sweden, Finland and NW Russia. Deposits and metallogenic areas defined by the following metals are included: Ag, Au, Be, Co, Cr, Cu, Fe, Li, Mn, Mo, Nb, Ni, Pb, Pd, Pt, Rh, REE, Sc, Sn, Ta, Ti, U, V, W, Y, Zn, and Zr. The metallogenic areas are tracts of probable future metal ore discoveries in northern Europe. The publication can be used in selecting strategic areas for mineral exploration and for research in economic geology. It also is an instrument for land-use planning and political decision-making. Thereby, it acts as a tool for fulfilling the requirements set by the raw materials policy of the European Union and by the countries in the region. This is a joint product of the geological surveys of Finland, Norway, Russia (VSEGEI and SC Mineral) and Sweden.

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