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## LÅNGBAN AND ITS MINERALS\*

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In the Province of Värmland (= Wermland), at the north-east corner of Lake Vänern (= Wenner), the largest inland lake in Sweden, lies the town of Kristinehamn (= Christinehamn). Fifty-three kilometers distant in a northerly direction is the town Filipstad, which is the most suitable starting-point for a visit to the Swedish manganese mines which have acquired an international reputation from a mineralogical standpoint, viz., Nordmark with Jakobsberg, Långban and Pajsberg with Harstigen. The Nordmark area lies about fifteen kilometers north of Filipstad, and Långban twenty kilometers NNE of the town. Both of these areas may be reached by rail. To reach the Pajsberg area, which lies ten kilometers NE of Filipstad, it is necessary to go by motor car from Persberg station or by boat across Lake Yngen.

There is, however, no object for mineralogists to visit the two outer areas, Nordmark and Pajsberg, as no minerals have been found there for more than thirty years. At Pajsberg—including Harstigen—operations were definitely abandoned in the middle of the nineties, as the small existing quantities of manganese ore then seemed to be exhausted. Such was also the case at Jakobsberg, though there a fresh attempt was made, but the results were not very encouraging. The mines at Nordmark are still being worked, but only for iron ore, and at the present time no minerals of unusual interest have been discovered. While the two extreme links in the chain of the Värmland workings—

\* We are herewith publishing the first of a new series of articles on famous mineral localities. From time to time we hope to print others describing mineral occurrences at Binnenthal, Laurion, Mr. Vesuvius, the Kola Peninsula, Casapalca and the French Creek Mines. Those promising to prepare manuscripts include Messrs. F. N. Ashcroft, H. S. Washington, A. Pelloux, A. E. Fersmann, Hugh E. McKinstry and George Vaux, Jr.

It has even been suggested that with the low third class tourist rates offered by steamship companies some of the more active mineralogical clubs might consider seriously trips to a number of these famous foreign localities. *The Editor.*

Pajsberg-Harstigen in the extreme southeast and Nordmark-Jakobsberg in the northwest—have thus fallen into the background, the central one, Långban, has advanced to an important position, which is probably without parallel.

The ores of the Långban mines lie imbedded in a dolomite field, whose length in a direction from north to south is three kilometers and its maximum breadth about nine hundred meters. It is surrounded by leptite (=granulite) and granite, together with some diorite and diabase. Only in the immediate vicinity of the ores, especially on their under-side, is the dolomite pure. Otherwise it is mixed with calcium and magnesium silicates, mostly actinolite, which is sometimes altered to serpentine. Only a small part of the dolomite area, about fifteen hectares, is ore-bearing. Here the ore forms stocks or masses, which have no great extension above-ground, but below the surface may attain a length and breadth of one hundred meters and forty meters, respectively, with considerable thickness. Each body of ore of any size contains iron and manganese ores in about equal proportions, but each type of ore is distinctly separated so that we are not in the presence of manganese-bearing iron ores or iron-bearing manganese ores. Individualization has proceeded so far that it is only in exceptional cases that the two types of ores are in contact. As a rule they are separated by layers of dolomite or leptite. In spite of this striking separation, it happens at times, that outcrops of one type of ore extend into the other, and it is often in connection with such outcrops that the most characteristic minerals are encountered.

The iron ores consist of both hematite and magnetite, the latter in much smaller amounts—about one-fifth of the total. The hematite is finegrained, sometimes schistose, and is generally quite pure. The magnetite is usually coarse-grained or dense and appears for the most part as an envelope enclosing the hematite masses. The manganese minerals, also, are of two types, hausmannite and braunite, of which the former is to be regarded as the principal ore. It generally forms isolated grains or crystals more or less closely grouped in the dolomite. The braunite, on the other hand, generally occurs in compact masses. These, however, are comprised, especially in the case of ores recently collected, of an intimate mixture of the two minerals. Small portions may consist of hausmannite alone, but braunite has not been observed alone.

## MINERALS FROM LÅNGBAN, SWEDEN

Akrochordite (a)	Långbanite (a)
Allactite (b)	Lead
Allanite	
Amphibole	Magnetite
Apophyllite	Magnetoplumbite (a)
Aragonite	Malachite
Armangite (a)	Manganosite
Atopite (a)	Mangan-vesuvianite (b)
Azurite	Margarosanite
	Melanotekite (b)
Bäckströmite (a)	Micas
Barite	Molybdenite
Barylite (a)	Molybdophyllite
Barysilite (b)	
Berzeliite (a)	Nasonite
Bismuth	
Bornite	Ochrolite (b)
Braunite	
Bromellite (a)	Pectolite
	Periclase
Calcite	Pinakiolite (a)
Chalcocite	Pyrite
Chalcopyrite	Pyroaurite (a)
Chlorite	Pyrobelonite (a)
Copper	Pyrochroite
	Pyroxene
Dixenite (a)	
	Quartz
Ekdemite (b)	Quenselite (a)
Epidote	
	Realgar
Feldspar	Rhodonite
Finnemanite (a)	
Fluorite	Sarkinite (b)
	Scheelite
Galena	Silver
Ganomalite (b)	Sphalerite
Garnet	Sphenomanganite (a)
	Svabite (b)
Hausmannite	Swedenborgite (a)
Hedyphane	
Hematite	Talc
Hisingerite	Tephroite
Hyalotekite	Thaumasite
Hydrocerussite	Tilasite (a)
	Trigonite (a)
Inesite	Trimerite (b)
Karyinite (a)	
Kentrolite	Weslienite (a)

Up to the present time all the minerals found at Långban have been divided into two classes, viz., (A) those that may be considered as being fairly well established, and have received a name and place in the determinative system; and (B) those whose present known properties are limited to the knowledge gained by a more or less superficial examination. These latter are indicated by numbers in a special collection of types.

The names of those under class (A) are given above, those that have been found only at Långban being indicated by "a," and those which have also been found in other Värmland occurrences, but not elsewhere, being indicated by "b."

These eighty-one independent minerals have been found within an area of fifteen hectares and in mines in which only one attains a depth of a hundred and eighty five meters. About a quarter of them (twenty one) are found only there, and an additional twelve in other Värmland manganese mines. Can this be paralleled elsewhere?

But the picture of the mineral wealth of Långban which is gained merely from a consideration of the minerals comprising class (A) is by no means complete, however closely it may seem to approach a record. On the contrary, it shrinks into insignificance in comparison with the minerals of class (B), for at the Stockholm Högskola there is a collection of 412 numbers, and at Riksmuseet another of 24, making in all 436 types. It is true that of these 13 have lately been examined and therefore are not to be counted among the numbers of class (B). But there remain 423 unknown minerals awaiting examination. These figures speak for themselves.

All the minerals belonging to class (B), with the exception of those at Riksmuseet, which are of a somewhat older date, have been collected within the last ten years, and as there is no reason to believe that the occurrences formerly were less numerous than now, we can obtain some idea of the number of minerals that have escaped detection during the centuries that the mines have been worked at Långban. The intense collecting activity that prevails at the present time is due to two reasons; in the first place, and naturally, to a greater knowledge and alertness on the part of those who come in contact with the products of the mines (the capacity to use the simpler instruments, such as the magnifying glass etc.), and in the second place, to the absence of

restrictions, so that the collector retains his finds and has them at his disposal. Formerly at Långban, as at other places, it was thought to be to the interest of science to decree that everything found should be disclosed to the authorities. But the zeal for collecting was thereby dampened.

In enumerating the list of minerals there have been included only those types individualized by crystallization or those whose homogeneity was beyond all doubt. Nevertheless, it is possible that, upon closer examination, a number here listed will be found whose claim to independence may be questioned. But there will certainly not be many such cases. Among the Långban minerals, too,—even when they are regarded as *known*—there are a great variety of types and development of forms. Thus at Riksmuseet there is a collection of at least fifteen distinct types of crystals of barite from Långban. Something similar is met with in the case of many other common minerals, such as pyroxenes, amphiboles, garnets, calcite, etc.

A considerable number—about one-third—of the unknown minerals are found in such small quantities that a regular and complete examination will not be possible. But everything new, however insignificant, has been collected, for that which on one occasion may present itself very sparingly, on another occasion may be found abundantly, and at Långban mineralogical surprises are the order of the day.

The elements which predominate in the composition of the rare Långban minerals are Mn, Pb, Ba, As and Sb. Besides, it is worthy of note, that lead in its native state occurs in considerable quantities, and arsenic and antimony are present in their lower forms of oxidation. Further, it is noteworthy that traces of phosphorus can not be found in these mines.