MINERALS FIRST DISCOVERED IN THE KOLA REGION: HISTORICAL OVERVIEW AND STATISTICS

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The Kola region is renowned for being one of the most famous mineralogical treasuries in the world. The region includes numerous remarkable localities, of which many are unique in their mineralogical diversity and peculiarity. Although today it is one of the most mineralogically studied parts of Russia, the region continues to yield new results, with regular discoveries of new mineral species. This article provides a brief overview of these new mineral discoveries in the Kola region, with some statistical data which the authors have considered of interest.

The Kola region covers the entire Kola Peninsula bound by its geographical constraints and the adjacent Russian part of northeastern Scandinavia to the west. Administratively, it is presently Murmansk Oblast, of which the northwestern geographical compound?? of Northern Karelia is a part. The latter contains the famous mineralogical sites of Vuorijarvi, Alakurtti and Sallanlatva. The Kola region and the Murmansk Oblast are hereby considered synonymous. The 144,902 sq km area of the Murmansk Oblast constitutes a mere 0.85% of the entire territory of the Russian Federation. Nevertheless, it is here that more than 260 mineral species were first discovered, contributing 40% to the overall number of 650 minerals with type localities in Russia. This is second to about 720 minerals in the USA. Table 1 contains **264** mineral species first discovered in the Kola region. Indeed, this number cannot be considered absolutely precise, given the disputed status of several minerals (such as e.g., yftisite-(Y), natrofairchildite and lomonosovite-beta). Either way, the above number is accurate to plus or minus 3 mineral species. It means that, other than by the USA and Russia itself, the relatively small Kola region is surpassed in the number of first discovered minerals only by Germany (~320 species) and Italy (~290 species), leaving behind Canada (~220), Sweden (~170), Australia (~150) and all the remaining countries of the world, with newly discovered minerals not exceeding 120 species each.

Overall, the Kola region accounts for over 5% of the all known mineral species today. Let us now consider the background of these minerals.

Geologically, the Kola region occupies the northeastern part of the Baltic shield. However, the majority of the new minerals are not genetically related to Precambrian rock formations. Instead, they occur in the massifs of alkaline intrusions which were formed during the Palaeozoic tectonic-magmatic activation. The distribution of minerals first discovered in Kola is uneven, both territorially and genetically.

For instance **238** out of 264 minerals have been discovered in the Palaeozoic alkaline complexes. Of these, **205** are found in the two famous agpaitic giants of the Khibiny and Lovozero massifs, often considered as a united Khibiny-Lovozero complex. Further, **36** of these minerals were discovered in minor massifs of the alkaline ultrabasic formation. The apparent discrepancy between the total sum of these groups of minerals and the given total of 238 lies in the simultaneous recording of three minerals at two different alkaline massifs. The resulting arithmetic mismatches are evident to any attentive reader of this article.

Given such an impressive number of minerals, the list of alkaline massifs in which they were discovered, is rather short:

- Khibiny (1327 sq km) yielded **115** mineral species, a world record for a single geological region;
- Lovozero (650 sq km) produced **107** new species, of which 17 were simultaneously recorded both at Khibiny and Lovozero;
- Kovdor has **20** new minerals;
- Vuorijarvi has **10** new minerals;
- Afrikanda has **3** new minerals;
- Turii Cape has **1** new mineral;
- Sebljavr has **1** new mineral;
- Lesnaya Varaka has **1** new mineral;
- Sallanlatva has **1** new mineral.

Table 1. ***Minerals First Discovered at the Kola Region for 1894–2012 (in Chronological Order)***

№	Mineral Species	Formula	Localities	Year	Authors, Publications
1	Lamprophyllite	$(Sr, Ba)_2(Na, Fe, Mn)_3Ti[(Ti, Fe)_2O_2(Si_2O_7)_2](OH, F)_2$	**Khibiny-Lovozero Complex** *Lovozero*; *Khibiny*	1894	Ramsay W. Fennia. 1890, 3, 7, 57 pp. Hackman V. Fennia. 1894, 11, 2, P. 119–130.
2	Manganoneptunite	$KNa_2Li(Mn, Fe)_2Ti_2Si_8O_{24}$	**Khibiny-Lovozero Complex** *Khibiny*: Mannepakhk Mt.	1923	Kurbatov S.M. DAN, 1923, ser. A, P. 59–60 (Rus).
3	Yuksporite	$(K, Ba)NaCa_2(Si, Ti)_4O_{11}(F, OH) \cdot H_2O$	**Khibiny-Lovozero Complex** *Khibiny*: Hackman valley; Yukspor-lak Pass; Vuonnemiok river valley	1923	Kostyleva E.E. Trudy of North Sci. Expedition. No 8, Vol. 16. Khibiny Tundras. Moscow-Petrograd, 1923, P. 52–53, 71, 73. DAN, 1923, ser. A, 3, P. 71–78. (Rus).
4	Loparite*	$(Na, REE)(Ti, Nb)O_3$	**Khibiny-Lovozero Complex** *Khibiny*: Malyi Mannepakhk Mt.	1925	Kuznetsov I.G. Izv. Geo. Committe., 1925, 44, 6, P. 663–682. (Rus).
5	Fersmanite	$(Na, Ca)_4Ca_4(Ti, Nb)_4[Si_2O_7]_2O_8F_3$	**Khibiny-Lovozero Complex** *Khibiny*: Eveslogchorr Mt.	1929	Labuntsov A.N. DAN, 1929, ser. A, 12, P. 297–301. (Rus).
6	Murmanite	$Na_2Ti_2Si_2O_9 \cdot nH_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Chinglusuai river valley; Raslak Cirques	1930	Gutkova N.N. DAN, 1930, ser. A, 27, P. 731–736. (Rus).
7	Chkalovite	$Na_2[BeSi_2O_6]$	**Khibiny-Lovozero Complex** *Lovozero*: Malyi Punkaruaiv Mt.	1939	Gerasimovskii V.I. DAN, 1939, 22, 5, P. 263–267. (Rus).
8	Lovozerite	$Na_{2-x}CaZrSi_6(O, OH)_{18}$	**Khibiny-Lovozero Complex** *Lovozero*: Muruai river valley	1939	Gerasimovskii V.I. DAN, 1939, 25, 9, P. 753–756. Trudy of Geol. Sci. Institute, 1940, 31, P. 9–15. (Rus).
9	Nordite-(La)	$Na_3Sr(La, Ce)ZnSi_6O_{17}$	**Khibiny-Lovozero Complex** *Lovozero*: Chinglusuai river valley	1941	Gerasimovskii V.I. DAN, 1941, 32, 7, P. 496–498. (Rus).
10	Lomonosovite	$Na_2Ti_2Si_2O_9 \cdot Na_3PO_4$	**Khibiny-Lovozero Complex** *Lovozero*: Chinglusuai river valley	1950	Gerasimovskii V.I. DAN, 1950, 70, 1, P. 83–86. (Rus).
11	Belyankinite	$Ca_{1-2}(Ti, Zr, Nb)_5O_{12} \cdot nH_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Tul'bnyunuai river valley	1950	Gerasimovskii V.I., Kazakova M.E. DAN, 1950, 71, 5, P. 925–927. (Rus).
12	Belovite-(Ce)	$NaCeSr_3(PO_4)_3F$	**Khibiny-Lovozero Complex** *Lovozero*: Malyi Punkaruaiv Mt.	1954	Borodin L.S., Kazakova M. E. DAN, 1954, 96, 3, P. 613–616. (Rus).
13	Beryllite	$Be_3SiO_4(OH)_2 \cdot H_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Karnasurt Mt.	1954	Kuz'menko M.V. DAN, 1954, 99, 3, P. 451–454. (Rus).
14	Shcherbakovite	$NaK(K, Ba)(Ti, Nb)_2Si_4O_{14}$	**Khibiny-Lovozero Complex** *Khibiny*: Rasvumchorr Mt. (Apatite Cirque)	1954	Es'kova E.M., Kazakova M.E. DAN, 1954, 99, 5, P. 837–840. (Rus).
15	Nenadkevichite	$Na_{3-x}(Nb, Ti)_2[Si_4O_{12}](O, OH)_2 \cdot 2\text{-}4H_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Karnasurt Mt.	1955	Kuz'menko M.V., Kazakova M.E. DAN, 1955, 100, 6, P. 1159–1160. (Rus).
16	Labuntsovite-Mn	$Na_2K_2Mn_{1-x}Ti_4(Si_2O_{12})_2(O, OH)_4 \cdot 6H_2O$	**Khibiny-Lovozero Complex** *Khibiny*: Yum'egor Pass. *Lovozero*: Kuftn'yun Mt.	1955	Semenov E.I., Burova T.A. DAN, 1955, 101, 6, P. 1113–1116. (Rus).
17	Kupletskite	$K_2Na(Mn, Fe)_7Ti_2Si_8O_{24}(O, OH, F)_2$	**Khibiny-Lovozero Complex** *Lovozero*: Kuivchorr Mt.; Lepkhe-Nel'm Mt.	1956	Semenov E.I. DAN, 1956, 108, 5, P. 933–936. (Rus).
18	Vinogradovite	$Na_4Ti_4AlSi_6O_{23}(OH) \cdot 2H_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Lepkhe-Nel'm Mt.; Kuftn'yun Mt.; Kitkn'yun Mt.; Karnasurt Mt.; Mannepakhk Mt. *Khibiny*: Takhtarvumchorr Mt.; Kukisvumchorr Mt.	1956	Semenov E.I., Bonshtedt-Kupletskaya E.M., Moleva V.A., Sludskaya N.N. DAN, 1956, 109, 3, P. 617–620 (Rus).
19	Zirconolite**	$CaZrTi_2O_7$	**AUM** *Afrikanda*	1956	Borodin L.S., Nazarenko I.I., Rikhter T.L. DAN, 1956, 110, 5, P. 845–848. (Rus).
20	Lithiophosphate	$Li_3(PO_4)$	**REGP** *Voron'i Tundras*: Okhmyl'k Mt.	1957	Matias V.V., Bondareva A.M. DAN, 1957, 112, 1, P. 124–126. (Rus).
21	Gerasimovskite	$(Mn, Ca)(Nb, Ti)_5O_{12} \cdot nH_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Malyi Punkaruaiv Mt.	1957	Semenov E.I. Tp. IMGRE, 1957, 1, P. 41–59. (Rus).
22	Manganbelyankinite	$(Mn, Ca)(Ti, Nb)_5O_{12} \cdot nH_2O$	**Khibiny-Lovozero Complex** *Lovozero*: Kedykverpakhk Mt.	1957	Semenov E.I. Tp. IMGRE, 1957, 1, P. 41–59. (Rus).
23	Seidozerite	$(Na, Ca)_8(Zr, Ti, Mn)_8(Si_2O_7)_4(O, F, OH)_8$	**Khibiny-Lovozero Complex** *Lovozero*: Muruai river valley	1958	Semenov E.I., Kazakova M.E., Simonov V. I. Zap. VMO, 1958, 87, 5, P. 590–598. (Rus).
24	Fenaksite	$KNaFeSi_4O_{10}$	**Khibiny-Lovozero Complex** *Khibiny*: Yukspor Mt. (Material'naya Adit)	1959	Dorfman M.D., Rogachev D.L., Goroshchenko Z.I. *et al.* Tr. MM, 1959, 9, P. 152–157. (Rus)
25	Canasite	$K_3Na_3Ca_5Si_{12}O_{30}(F, OH)_4 \cdot H_2O$	**Khibiny-Lovozero Complex** *Khibiny*: Yukspor Mt. (Material'naya Adit)	1959	Dorfman M.D., Rogachev D.L., Goroshchenko Z.I., Uspenskaya E. I. Tr. MM, 1959, 9, P. 158–166 (Rus).
26	Cafetite	$CaTi_2O_4(OH)_2$	**AUM** *Afrikanda*	1959	Kukharenko A.A, Kondrat'eva V.V., Kovyazina V.M. Zap. VMO, 1959, 88, 4, P. 444–453 (Rus).