

1. HISTORY OF MINERALOGICAL STUDIES

17. In the vicinity of the Sarany town. Photo: A.A. Evseev. July 23, 2014.

18. View to the Rudnaya mine from the side of the main dump. Photo: M. Lodzinski, July 2005.

19. **Uvarovite** on chromitite (with old label). Image 3.3 x 5 cm. Specimen: Fersman Mineralogical Museum, Russian Academy of Sciences, #31373; the Prince P.A. Kochubey collection, acquired in 1913. Photo: M.B. Leybov.

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he Saranovskoe chromite deposit is located in the Gornozavodsk district, Perm Krai 5 km of the Laki railway station at the western margin of the Sarany town.

Discovery and the first stage investigation of the deposit were accompanied by permanent embarrassments because of its complexity and poor geological opening together with scarcity of knowledge typical for this time.

The deposit discovered by prospectors from the nearby Biserskoe Plant in the early 19th century was considered to be a magnetite deposit; a green mineral found in the ore was mistaken for the copper mineral dioptase (ashirite) recently discovered in the Kazakh steppe. A large ore lot was brought to the South Kama plant in the vicinity of Perm to smelt copper. Natural failure resulted in the sending material to St. Petersburg for investigation. H. Hess, chemist, found that it was a silicate containing Cr and named it uvarovite in honor of S.S. Uvarov, the Minister of Education and President of Russian Academy of Sciences.

Three stages of mineralogical study of the deposit are distinguished: initial up to 1930s, second associated with the deposit exploration in 1930–1940s by I.A Zimin and S.A Vakhromeev, and third from 1960 to present, when the more detailed mineralogical studies have been performed.

The initial stage is associated in the first place with the discovery and study of uvarovite that was produced in that time. The chemical composition of this mineral was examined by many mineralogists and chemists: H. Hess, F.P. Komonen, and N.I. Koksharov.

Carl Zerenner, manager of the Biserskoe Plant, who visited the then Saranovskoe mine (at present this location belongs to the Biserskoe or Yuzhno-Saranovskoe deposit), described the deposit for the first time in 1843. His book published in Paris in 1851 has not been translated into Russian so far. Zerenner found that chromite ores are hosted as layers in serpentinite, and he noted the occurrence of rhodochrome, asbestos, talc, quartz, uralite, galena, Cr-Pb ore (crocoite?) and two unknown minerals.

Kontkevich (1880) and Krasnopol'sky (1889) reported the mineralogy of the most abundant rocks. In 1914, AE. Fersman indentified here Cr-bearing diaspore, named as saranite, and perovskite (Fersman, 1920).

The second stage is associated with exploration of the Saranovskoe deposits in the early 1930s by Vakhromeev and Zimin, the well-known Ural geologists, who described some new minerals for the deposit in their reports for 1932, 1935, and



20. Cr-bearing **clinochlore** (with original label where it was named as "rhodochrome"). 7 x 5 cm. Museum of Evolution at the Uppsala University #MMU362002, obtained from August Krantz in 1845. Photo: J. Kjellman.

22. **Uvarovite** on chromitite. 9 × 10 cm. *Reich der Kristalle* Museum (Munich, Germany), #13308, the Duke Leuchtenberg Collection. Photo: M.B. Leybov.



21. **Uvarovite** on chromitite (with original label). Image width 3 cm, specimen size 4.5 x 6 cm. Specimen: Senckenberg Naturhistorische Sammlungen Dresden (SNSD), Museum für Mineralogie und Geologie (MMG) #Min 3581 BaS, Richard Baldauf collection, bought from Mineralienhaus Droop, Dresden-Plauen, before 1922. Photo: J. Wazeck.

23. **Uvarovite** on Cr-bearing chlorite. 7 x 8 cm. Specimen: Mineral Museum at the University of Bonn (Germany). Photo: M. Zedschak.



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24. Crust of **uvarovite**. 26 x 19 cm. Specimen: American Museum of Natural History #10659, 1901; collection: C.S. Bement. Photo: J. Newman.

25. **Uvarovite** on chromitite. 33 x 14 cm. Specimen: American Museum of Natural History #109899, from Gary Null, 2003. Photo: J. Newman.

26. Lamellar contact twin of titanite.3.2 x 1.5 x 0.2 cm.Specimen and photo: C.J. Stefano.

27. **Uvarovite** crystals (up to 0.2 cm) on chromitite. Image width 3.8 cm. Specimen: Mineralogical Museum of Humboldt University #2004-1571. This sample was a donation to Gustav Rose, probably around 1856-1858 together with various suites of rock samples from the Ural mountains. Photo: R.T. Schmitt.









28. Herman I. **Hess** (1802–1850), who first determined the chemical composition of uvarovite.

29. Alexander E. **Fersman** (1883–1945), who first described perovskite and Cr-bearing diaspore in the Saranovskoe deposit.

30. Igor A. **Zimin** (1909–1992), who investigated the structure, ores, and mineralogy of the Saranovskoe deposit during 1931–1939, and discovered many new minerals for this object.

31. Sergey A. **Vakhromeyev** (1899–1985), who investigated ore and host rocks mineralogy in 1932–1936, and found several new minerals for this deposit.

1936. Vakhromeev concentrated his attention on the mineralogical study of ores and ore minerals. He found abundant sulfide minerals; described pyrite, pyrrhotite, pentlandite, and chalcopyrite from immiscible droplets in dolerite; and presumably indicated identified a mineral that he believed to be platinum. Zimin (1938, 1954), the outstanding researcher of the Saranovskoe deposit, indentified and characterized the most important mineral assemblages; he discovered and described a Cr-bearing variety of amesite; and studied some other minerals. The number of the Saranovskoe minerals including those wrongly determined reached 41. In 1951, G.A. Il'insky, student of Leningrad University and future well-known mineralogist, composed a handwritten list of the Saranovskoe minerals, in which he included for the first time nontronite, Cr-bearing rutile, rhodochrosite, aragonite, dolomite, and siderite, and described unusual forms of coarse-crystalline vein antigorite. The generalized article by Zimin included in Mineralogy of the Urals (1954) concerning mineralogy of the Saranovskoe deposit is the most important for this period. Unfortunately, this book was classified as secret and this article has been inaccessible even for specialists until now. From the late 1940s to early 1970s, no mineralogical information was obtained despite sporadic exploration and diamond prospecting in the district.

The third stage started in the early 1960s, when Abramovich (1961), Perm mineralogist, published the compositions of the Saranovskoe carbonate minerals and stichite, magnesium and chromium carbonate-hydroxide. Varlakov *et al.* (1970) described vein antigorite and its pseudomorphs after carbonates. Ivanov (1970, 1990) identified unusual rocks in the massif including phlogopite ultramafics, abundant ultramafic pegmatites, and rare postmagmatic rock named as saranovite; described rhodingite; characterized mineralogy of various assemblages; and showed the link of hydrothermal vein mineralization to dolerite dikes rather than to the Alpine type of mineral formation as suggested before (Vertushkov, 1937; Vertushkov and Kobyashev, 1975). A new mineral species shuiskite, the chromium analog of pumpellyite, was discovered and new and rare Cr-bearing varieties of some minerals: titanite, chlorites (corundophyllite, sheridanite), pumpellyite, and redledgeite were described for the first time in Russia (Ivanov, 1975; Ivanov and Shilova, 1978; Ivanov *et al.*, 1981, 1996; Ivanov and Bushmakin, 1998).

Volchenko *et al.* (1974) identified borovskite and in 1975 they published an extended list of the new for the deposit PGE minerals. However, no any identi-



35. Anatoliy F. Bushmakin (1947-1999) who participated in studies of uvarovite and redledgeite.

36. Albert A. Bronnikov (1927–1994), a geologist of the Rudnaya mine who contributed in investigations of the geology and mineralogy of the deposit.

37. Vyacheslav I. Kuznetsov (born in 1939), a geologist of the Rudnaya mine who contributed in investigations of the geology and mineralogy of the deposit.









41. Ilya I. Chaikovsky (born in 1965), who actively investigates the mineralogy of the deposit.

42. Talgat G. Fattykhov (born in 1950), a mining engineer and collector of minerals of the Saranovskoe deposit who actively assisted in investigation of its mineralogy.

43. Eduard A. Fishchenko (born in 1962), a collector of minerals from the Saranovskoe deposit who actively assisted in investigation of its mineralogy.











32. Sergey G. Sustavov (born in 1954), who first described guyanaite, grimaldiite, and chromceladonite at the deposit.

33. Vladimir A. Popov (born in 1941), who investigated many minerals from the Saranovskoe deposit.

34. Valeriy I. Kaynov (born in 1944), who participated in studies of shuiskite and chromspinel minerals.



38. Taťyana Alexandrovna Shilova (born in 1937), who investigated the mineralogy of serpentinites, chromitites and host rocks of the Saranovskoe deposit in 1974-1978.

39. Ernst M. Spiridonov (born in 1938) who actively investigated the mineralogy of the deposit.

40. Alexander N. Fishchenko (born in 1937), a collector of minerals from the Saranovskoe deposit who actively assisted in investigation of its mineralogy.

