THE MINERALOGICAL COLLECTION OF VIKTOR IVANOVICH STEPANOV (1924–1988): ITS MUSEUM VALUE AND SCIENTIFIC AND SOCIAL IMPORTANCE

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V.I. Stepanov's Mineralogical Collection was assembled between 1935 and 1985 and is comparable in its importance with collections of some of Russia's largest Mineralogical Museums. Given the lack of research interest in Mineralogical Museum work and mineral collecting at the time, Stepanov developed his own methodology in working with mineralogical collections. Many of the methods developed by Stepanov proved internationally innovative. This article describes his methodology and provides statistical data on the Stepanov Collection.
3 tables, 13 figures, 11 references.
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It has already been over a quarter of a century since Viktor Ivanovich Stepanov (1924—1988) is no longer with us. He has left such a bright trace that it seems our acquaintance has happened only yesterday. For many of us, Viktor Ivanovich was and remains a Teacher, even beyond mineralogy. So what is the significance of his activities?

Viktor Ivanovich did not leave behind a long list of scientific publications. Assemblage of a mineralogical collection in the course of half a century has been the task of his lifetime.

The collection, now kept at the Fersman Mineralogical Museum of the Russian Academy of Sciences, rivals in its completeness, scientific and social significance with large national collections of modern Mineralogical Museums. In the extent of research and documentation, its exhibits exceed many of them.

The dedicated work of assembling this collection allowed Viktor Ivanovich to acquire tremendous mineralogical knowledge, resulting in some most interesting observations which are published in his works, but mostly written in detailed explanatory labels accompanying the mineral specimens. In working with collection's systematisation, principles of its organization, storaging, methods of specimen preparation and other museum issues, Stepanov became the most qualified museum specialist, mineralogy has ever known, both in our country and perhaps even abroad. He has discovered efficient approaches of working with mineralogical collections and created his own School, whose pupils have applied his methods in many museums across Russia. His assemblage methods have had significant impact on some high profile private mineralogical collections.

The assembly of this particular collection, its development and, on occasion, struggle for its preservation are a truly long-term feat. Viktor Ivanovich Stepanov was without any exaggeration a devotee of his craft.

History of collection

Personal collection, 1935–1963. As for many others in those years, Viktor Ivanovich's mineralogical passion began in reading Fersman's "*Popular Mineralogy*". According to his own ironic comments, after shutting the book he rushed to the cemetery where Volynian labradorite could be found among the grave stone debris. He even recalled an exact date and hour: 7 pm on 25 August 1935 (Evseev, 1998; 2014). Since then, he started his personal collection, although more serious and purposeful collecting commenced only in 1938. In 1941, Stepanov entered the Sverdlovsk Mining Institute[1]. Soon he was evacuated and then signed up to the Red Army. Wounded at the frontlines, he left the hospital to continue his army service as a translator in Bulgaria until 1946 (Fig. 1). Even during his army days, Viktor Ivanovich managed to collect minerals. It is from finds of that time that the autunite and tornbernite from the outskirts of the Bukhovo Village of the Sofia Region and several specimens from the Rhodope deposits were later included into his main collection. In addition to his own collecting, he began to exchange specimens

[1] — More detailed biographical information can be found in article by I.E. Maximyuk in this issue of magazine.

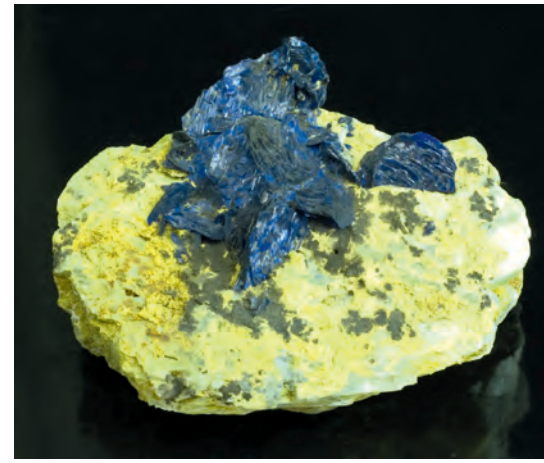
Fig. 1. Viktor I. Stepanov. Vraca, Bulgaria. October 20, 1944. From Stepanov family archive.

with the employees and post-graduate students of the Sofia University. He maintained and developed these links during his entire life. Soon after demobilisation from the army in 1946, Stepanov entered the Geology-Prospectical Faculty of the Moscow Geology-Prospectical Institute (MGRI), and in 1950, he transferred to the Geological Faculty of the Moscow State University, which he graduated in 1952. During his studies, Viktor Ivanovich continued active mineral collecting near Moscow, in Crimea (Fig. 2), and in geological expeditions. During this period, he found (for the first time for Moscow Region) delvauxite, takovite and other minerals. Later, the list of Moscow minerals substantially expanded (Feklichev, 1998).

Already during these years, Viktor Ivanovich not only assembled his own collection, but also granted mineral specimens to the largest Mineralogical Museums in Russia. For example, the first ones that he granted to the Mineralogical Museum of the Academy of Sciences are from Bulgaria. They were catalogued in the systematic collection in 1946, i.e., immediately after his demobilisation from the army. The specimens granted to the MGRI Museum (now Vernadskiy State Geological Museum) are dated approximately by the same year. Viktor Ivanovich continued to donate to various Museums practically throughout his entire life. It is worth mentioning, for example, that the collection of the main fund of the Fersman Mineralogical Museum received more than 1500 of its specimens from Stepanov, while the MGRI Museum — about 800. These exhibits are a separate part of his legacy and are not considered a part of his main collection.

After graduation, Viktor Ivanovich worked as a mineralogist in Central Kazakhstan (Fig. 3). Here, he acquaintainted himself with many unique mineralogical objects: Kara-Oba, Akchatau, Eastern Kounrad, and visited many others. He made many interesting observations and perfected his art of mineral sampling and preparation. Stepanov's archive has tremendous information on Central Kazakhstan deposits. His collection grew quickly and soon he faced the inevitable problem of its documentation and systematisation. In 1956, while still continuing to work in Kazakhstan, Stepanov became an employee of the Department of Mineralogy at the Institute

Fig. 2. Niter rosette. Bakla Mt, near Bodrak village, Bakhchisarai district, Crimea. 5 cm. FMM #ST1334, found by V.I. Stepanov. Photo: M.M. Moiseev.
Fig. 3. Azurite. Kairakty, Central Kazakhstan. 6 cm. Found by V.I. Stepanov, 1953. FMM # ST2010. Photo: M.M. Moiseev.



for Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry (IGEM) of the Academy of Sciences.

IMGRE Museum, 1964–1985. In the end of 1963, K.A. Vlasov, the founder and director of the Institute for Mineralogy, Geochemistry and Crystallochemistry of Rare Elements (IMGRE) of the Academy of Sciences, invited Stepanov to work for this institute with a special purpose of assembling its mineralogical collection. 1964 commences a new and most productive stage in the development of the Stepanov Mineralogical Collection. His personal collection served as a foundation for the IMGRE collection and was officially assigned a status of IMGRE Museum.

The transfer to IMGRE was very favourable for Viktor Ivanovich. The young employees of the newly established institute worked practically with all the most cutting edge mineralogical prospects of the USSR. This allowed Stepanov to travel to these prospects and obtain the relevant material. The analytical laboratories of the institute had supreme specialists. Administration of the institute encouraged his activity, and the majority of employees supported his work. Viktor Ivanovich had at his disposal a semi-basement floor in the building near the main edifice of IMGRE on the Sadovnicheskaya Embankment along with several other semi-basement and basement rooms nearby for his collection. He had one assistant (two at best times) and most importantly he had the freedom to fulfil the tremendous task of his daily voluntary hard work, interrupted only by Sunday cross-country skiing.

It is difficult to avoid nostalgic memories of this basement, which was visited by most curious employees from different institutes, students, pupils, and mineral collectors and stone lovers, who came far beyond Moscow. It is amazing that Viktor Ivanovich had time for everyone. He was demonstrating his collection, commenting on some specifics or on the history of findings of some minerals. He disclosed his methods, asking many questions himself, critically evaluating research or collected material. Often, he scolded his visitors, but even this scolding took such an ironic twist that it never ever had the smallest degree of anger. To those who protested against the criticism he often used to say: *"I only tell you off, because I think you can become somebody, once I understand that you are hopeless I stop wasting my time on this"*. Viktor Ivanovich did not hold back his praises, if he did like something, and it was always a great honour to earn his compliments. He was always willing to consider newly delivered specimens for mineral assessment, enjoyed gifts and ironically encouraged his visitors to come with "a stone in their bosom". The visitors were usually willing to abide. Visiting and talking to Viktor Ivanovich, with his in-depth expertise and undying enthusiasm, was always inspiring. In A.G. Zhabin's words (Zhabin, 1992), *"Viktor Ivanich was an incarnation of a Teacher, a conscience trigger, a critic and an advisor. People would always come to see him"*. It is fascinating that his unofficial approach to people remained unaltered, whether he was talking to a school pupil or to a high level academician.

Fig. 4. Getchellite. Khaidarkan, Kirghizia. 24 cm. V.I. Stepanov donation, 1982. FMM # 81823. Photo: M.M. Moiseev.

As a result, the IMGRE collection, never initially intended for public display, has acquired an exhibitory function and had quite a following, thanks to Viktor Ivanovich.

It is difficult to estimate the scale of Stepanov's collection when he joined IMGRE, but it is evident that its core collection, both in quality and scientific value, was assembled at this time. It is also during this time that Stepanov undertook the most productive field trips to the Central Asian deposits of Khaidarkan (Fig. 4), Tuya-Muyun, Chauvai, Dzhizhikrut, as well as the Moscow region (Fig. 5), Kola Peninsula, Caucasus and Crimea. Viktor Ivanovich's particular interest in cave mineralogy developed then too, result-

Fig. 5. V.I. Stepanov, collecting minerals. Podolsk, July 1975. From Stepanov family archive.

ing in a separate collection dedicated to it (Fig. 6). Key experiments and collecting methodology, to be discussed below, were developed during this period.

In 1984, A.A. Godovikov, the then recently appointed director of the Fersman Mineralogical Museum, has invited Stepanov to transfer to the Museum. The IMGRE management should be paid tribute for recognising the needs of the collection and approving Stepanov's transfer with his entire IMGRE Museum assemblage.

Already in 1984, Viktor Ivanovich was practically working at the Fersman Mineralogical Museum, being actively involved in the preparations for the International Geological Congress in the summer of the same year. His formal transfer to becoming a curator of collections and scientific inventory of the Museum's funds was documented in 1986. The collection's move took several years and was completed in 1987 (Fig. 7). Viktor Ivanovich was already seriously ill by this time. Sadly his work at the Museum was only brief. He passed away in August 1988.

So what did the Museum acquire in 1987? The main part was the most systematised and partially documented *Collection A*, consisting of ~8500 specimens. More than 10000 specimens made up the *Collection B*. The significant portion of the latter is labelled, but not catalogued. About 5000 duplicate items were kept in the collection (Nikiforov, Shkurskiy, 1988), dedicated to the processes of cave mineralisation. This collection has not been catalogued either, with only partial detailed documentation available.

Numerous materials were moved from the basement rooms of Stepanov's former collection, where they were assembled in trays and boxes. Their number can be estimated only approximately (~15000). Only a small portion of these materials is labelled, mainly by people who collected it. It is these materials that Stepanov chose items from for his Collections A and B. Nevertheless Viktor Ivanovich kept coming back to these materials, which he considered worked out. The scale of this part of the collection turned out to be significant and remains work in progress to this day.

When the collection first joined the Fersman Mineralogical Museum, a decision, we now consider erroneous, was taken, cataloguing specimens in the same order as the Museum's other new acquisitions. About 600 specimens from Collection A were recorded this way. It is only later that a decision to catalogue Collection A as a separate memorial collection of the Museum's main fund was taken.

Key statistical characteristics of Collection A

When comparing the Stepanov Collection with those of Russia's three largest Museums based on two most important quantitative characteristics (Table 1), it is evident that despite the smaller overall number of Stepanov's mineral specimens, the number of mineral species is closely matching. About one hundred of Stepanov's mineral species was not to be found in the collections of the other three Museums mentioned in Table 1. Another 60 titles in Collection A refer to mineralogical composites as well as specimens as yet unrecognised by the Commission on New Minerals, Nomenclature and Classification (CNMNC IMA). About 30 specimens were included in the collection as potentially new mineral specimens, with some having already been recognised as such.

Collection A specimen classification is shown in Table 2. The classification largely adheres to that of a typical museum collection, indicating a highly representative nature of Collection A and its general correlation to mineral abundance in nature.

The geographic provenance of the majority of the specimens (i.e., around 75%: 6327

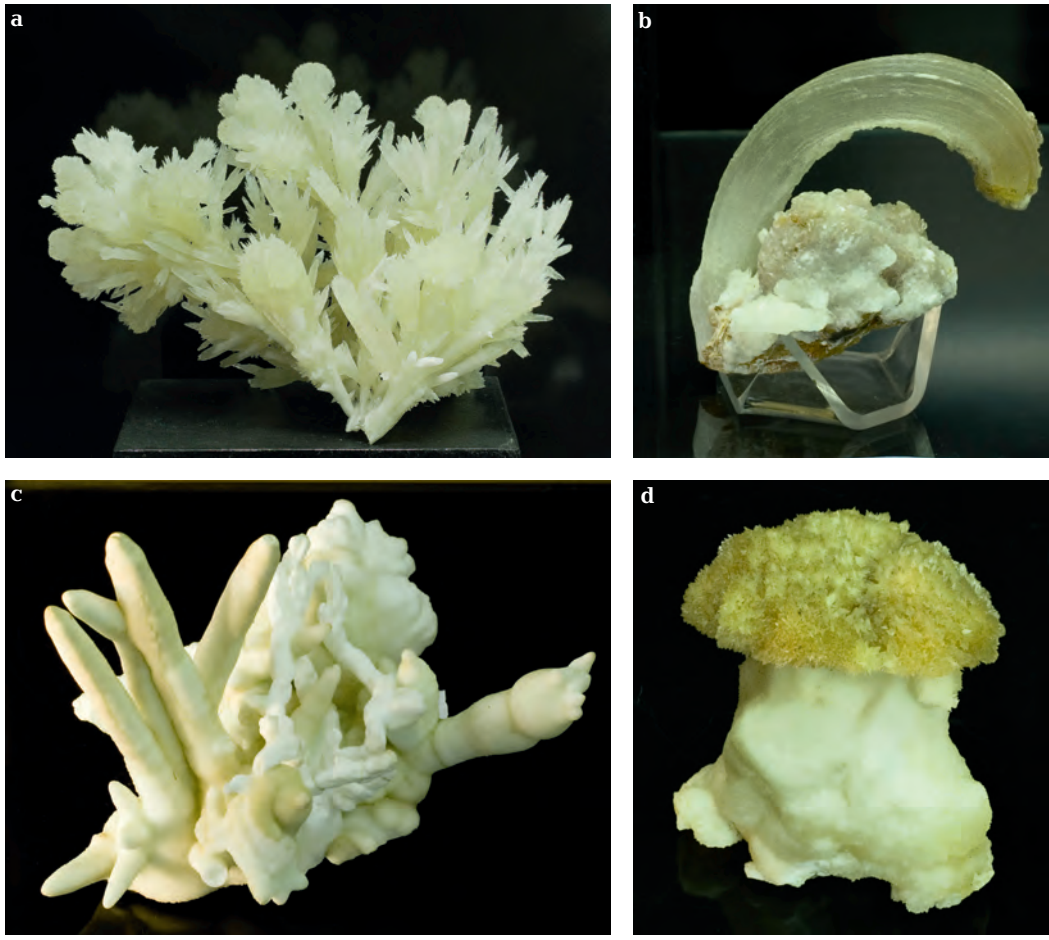


Fig. 6. Mineral aggregates of Khaidarkan caves, Kirghizia: (a) calcite, 20 cm; (b) gypsum (antolite), 8 cm; (c) calcite (helectite), 14 cm; (d) calcite (mushroom), 15 cm. V.I. Stepanov collection. Photo: M.M. Moiseev.

Fig. 7. V.I. Stepanov in the A.E. Fersman Mineralogical Museum together with workers of Acquisition Section, 21 May 1987. 1st row (from left to right): B.B. Shkursky, V.I. Stepanov, T.I. Matrosov, Yu.S. Kobyashev; 2nd row: D.A. Romanov, D.V. Abramov. Photo: A.A. Evseev.

Table 1. **The number of display items and mineral species in the Russian mineralogical collections as of May 1987, according to Stepanov (1989) and Stepanov *et al.* (1989)**

	Total specimens	Total mineral species
Fersman Mineralogical Museum, Moscow	125000	1968
Museum of Plekhanov Mining Institute, St.-Petersburg	34000	1795
Mineralogical Museum, Moscow Geology-Prospectical Institute (now in collection of Vernadskiy State Geological Museum)	59000	1100
The Stepanov Collection (IMGRE Museum)	8500 Collection A 15000 Collection B	1297

specimens) is indeed from the territory of the former USSR. These are distributed across the former republics as follows: Russia — 4227, Kazakhstan — 874, Kyrgyzstan — 373, Ukraine — 331, Tajikistan — 257, Uzbekistan — 121, Georgia — 117, Azerbaijan — 103, Turkmenistan — 78, Armenia — 43, Moldova — 2, Belarus — 1.

The abundance of foreign specimens in this collection is amazing for the time (1731 specimens from 70 countries; Table 3). It is evident that rumours of Stepanov's work have reached far and wide beyond the Iron Curtain. This is probably linked to his correspondence and personal acquaintances with foreign collectors and researchers. Moreover, specimens were brought to him as gifts by fellow Soviet geologists who had travelled abroad.

We should note also that more than 300 specimens from Collection A remain unknown in provenance and location.

1350 specimens from Collection A were collected personally by Viktor Ivanovich. It is definite that 616 specimens were obtained by exchange with both national and foreign collectors and Museums. The majority of other specimens (around 6500) are donations of various nature from at least 400 researchers, collectors and stone enthusiasts. The following have contributed the most to the collection by donating 50 and more specimens: Yu.S. Kobyashev (327), E.I. Semenov (159), V.Yu. Volgin (153), A.P. Khomyakov (89), L.S. Borodin (88), B.Z. Kantor (85), A.A. Godovikov (82), A.G. Zhabin (75), V.V. Bukanov (70), R.V. Gaines (67), A.A. Evseev (66), N.N. Pertsev (51).

Stepanov's key approaches, tactics and methods of collection, systematisation and documentation are characterised below.

Assembling the collection

Personal collecting. Viktor Ivanovich was an expert of mineral specimen collecting. He gained invaluable experience of approaching a future display item without disrupting it. He was able to intuitively identify a cornerstone, which once extracted helped dismantle a seemingly unapproachable section. The range of his tools was diverse, some of which he improved himself. This can be read about in more detail in Boris Kantor's publications (Kantor, 1982; 1988). Stepanov was tireless when it came to collecting. Even pouring rain could not put him off his work as he would put his raincoat on and rejoice in that the specimens would not need rinsing. It seems that only darkness could stop him from collecting minerals. He would always aim to get as much material as he could get and carry away, starting to prepare specimens on site (as ruined specimens could be replaced there and then, if necessary). He processed all the collected materials later (*"Do not put the best specimens separately from the others, or you would lose them"*, he would say and many would regret not heeding to his advice afterwards).

A whole separate category amongst Stepanov's personally collected specimens is the finds from dumps and, literally, bins of research institutions, whose researchers disposed of their collections (frequently with labels and analytical data) when they lost their interest after papers publications (Fig. 8, 9). In many of such cases, Stepanov would take it upon himself to take care of preserving the original research. His continuous explanatory work yielded its results, prompting such institutions as IMGRE to treat working material with more responsibility.

Revision of collections of researchers and collectors, agitation for donating of specimens to the collection. Viktor Ivanovich would systematically survey new materials of his IMGRE colleagues and staff of other Museums and institutes. He was all get-up-and-go and willing to visit collectors at their homes, even when the said collector was a mere school pupil. While observing collections he would make enquiries and interesting remarks, often revealing details about collections that the collectors would never have suspected about. Often he would automatically reach out for some paper as he spoke and write down specimen labels for the col-

Table 2. **Collection A content by the mineral species, represented by five or more specimens**

1.	Calcite	295	55.	Pyrochlore	26	109.	Gibbsite	16	163.	Gagarinite	11
2.	Quartz	210	56.	Rutile	26	110.	Pyrope	16	164.	Hedenbergite	11
3.	Sphalerite	148	57.	Phenakite	26	111.	Rhodonite	16	165.	Helvine	11
4.	Barite	109	58.	Astrophyllite	25	112.	Berthierite	15	166.	Lazulite	11
5.	Pyrite	109	59.	Gold	25	113.	Wadeite	15	167.	Leucophane	11
6.	Fluorite	96	60.	Copper	25	114.	Hubnerite	15	168.	Löllingite	11
7.	Celestite	91	61.	Mellite	25	115.	Cuprite	15	169.	Lomonosovite	11
8.	Apatite-(CaF)	89	62.	Pectolite	24	116.	Livingstonite	15	170.	Ludwigite	11
9.	Cinnabar	69	63.	Witherite	23	117.	Loparite	15	171.	Monticellite	11
10.	Muscovite	69	64.	Gypsum	23	118.	Magnesite	15	172.	Murmanite	11
11.	Zircon	69	65.	Opal	23	119.	Margarite	15	173.	Pyromorphite	11
12.	Natrolite	68	66.	Spinel	23	120.	Pollucite	15	174.	Ussingite	11
13.	Sulphur	58	67.	Augite	22	121.	Prosopite	15	175.	Huanghoite-(Ce)	11
14.	Beryl	55	68.	Bastnaesite	22	122.	Rinkite	15	176.	Elpidite	11
15.	Malachite	54	69.	Grossular	22	123.	Talc	15	177.	Bavenite	10
16.	Molybdenite	53	70.	Datolite	22	124.	Anglesite	14	178.	Betechtinite	10
17.	Antimonite	52	71.	Cobaltite	22	125.	Antigorite	14	179.	Brookite	10
18.	Diopside	52	72.	Orthoclase	22	126.	Danburite	14	180.	Wavellite	10
19.	Galena	51	73.	Polylithionite	22	127.	Dravite	14	181.	Variscite	10
20.	Dolomite	50	74.	Cyanite	21	128.	Ilvaite	14	182.	Villiaumite	10
21.	Aragonite	49	75.	Creedite	21	129.	Labuntsovite	14	183.	Viluite	10
22.	Chalcopyrite	46	76.	Mesolite	21	130.	Lovozerite	14	184.	Galkhaite	10
23.	Siderite	44	77.	Metacinnabar	21	131.	Manganneptunite	14	185.	Hemimorphite	10
24.	Clinochlore	41	78.	Silver	21	132.	Realgar	14	186.	Getchellite	10
25.	Titanite	41	79.	Smithsonite	21	133.	Serandite	14	187.	Canasite	10
26.	Topaz	39	80.	Stilbite	21	134.	Scheelite	14	188.	Kermesite	10
27.	Eudialyte	38	81.	Thomsonite	21	135.	Aeschynite-Ce	14	189.	Xenotime	10
28.	Arsenopyrite	37	82.	Wollastonite	20	136.	Alunite	13	190.	Cookeite	10
29.	Lorenzenite	34	83.	Hematite	20	137.	Biotite	13	191.	Laitakarite	10
30.	Elbaite	34	84.	Corundum	20	138.	Brucite	13	192.	Axinite-(Mn)	10
31.	Azurite	33	85.	Lamprophyllite	20	139.	Vinogradovite	13	193.	Manganite	10
32.	Nepheline	33	86.	Monazite	20	140.	Wurtzite	13	194.	Meionite	10
33.	Prehnite	33	87.	Phlogopite	20	141.	Clintonite	13	195.	Metavivianite	10
34.	Strontianite	33	88.	Bertrandite	19	142.	Nenadkevichite	13	196.	Mordenite	10
35.	Anhydrite	32	89.	Bornite	19	143.	Rhabdophan	13	197.	Parisite	10
36.	Bismuth	32	90.	Britholite	19	144.	Staurolite	13	198.	Powellite	10
37.	Goethite	32	91.	Vesuvianite	19	145.	Stellerite	13	199.	Antimony	10
38.	Heulandite	31	92.	Cancrinite	19	146.	Tennantite	13	200.	Fayalite	10
39.	Magnetite	31	93.	Rhodochrosite	19	147.	Thomsenolite	13	201.	Axinite-(Fe)	10
40.	Chrysoberyl	31	94.	Anatase	18	148.	Fluorapophyllite-(K)	13	202.	Chrysocolla	10
41.	Albite	30	95.	Cordierite	18	149.	Chalcocite	13	203.	Schörl	10
42.	Andradite	30	96.	Cerussite	18	150.	Zinnwaldite	13	204.	Enigmatite	10
43.	Cassiterite	30	97.	Andalusite	17	151.	Tsumoite	13	205.	Enstatite	10
44.	Almandine	29	98.	Bismutite	17	152.	Burbankite	12	206.	Anapaite	9
45.	Epidote	29	99.	Gearksutite	17	153.	Turquoise	12	207.	Willemite	9
46.	Analcime	28	100.	Gersdorffite	17	154.	Vanadinite	12	208.	Wodginite	9
47.	Cryolite	28	101.	Joseite A	17	155.	Columbite	12	209.	Vauquelinite	9
48.	Perovskite	28	102.	Catapleite	17	156.	Laumontite	12	210.	Gadolinite-(Y)	9
49.	Orpiment	27	103.	Pyrrhotite	17	157.	Arsenic	12	211.	Halloysite	9
50.	Graphite	27	104.	Synchisite-Y	17	158.	Olivine	12	212.	Hydroboracite	9
51.	Sodalite	27	105.	Charoite	17	159.	Epididymite	12	213.	Hydroxyapophyllite-(K)	9
52.	Ilmenite	26	106.	Chabasite	17	160.	Jarosite	12	214.	Gyrolite	9
53.	Lepidolite	26	107.	Atacamite	16	161.	Adamite	11	215.	Gudmundite	9
54.	Microcline	26	108.	Beaverite	16	162.	Wulfenite	11	216.	Digenite	9

Table 2. **(Continuation)**

217. Clinoptilolite	9	270. Hydrozincite	7	323. Hauyne	6	376. Delafossite	5
218. Cosalite	9	271. Gmelinite	7	324. Geocronite	6	377. Dumortierite	5
219. Leucosphenite	9	272. Griffithite	7	325. Hercynite	6	378. Hiortdahlite	5
220. Salammoniac	9	273. Davidite-(La)	7	326. Hureaulite	6	379. Kaliborite	5
221. Allanite	9	274. Delvauxite	7	327. Descloizite	6	380. Crandallite	5
222. Petalite	9	275. Delhayelite	7	328. Djerfisherite	6	381. Cryolithionite	5
223. Pimelite	9	276. Jadeite	7	329. Kaolinite	6	382. Cryptomelane	5
224. Pyrolusite	9	277. Calomel	7	330. Clinohumite	6	383. Crystobalite	5
225. Ralstonite	9	278. Clinozoisite	7	331. Kobellite	6	384. Cuprotungstite	5
226. Sylvanite	9	279. Colemanite	7	332. Crocoite	6	385. Linarite	5
227. Tellurobismuthite	9	280. Coronadite	7	333. Leucite	6	386. Marialite	5
228. Terskite	9	281. Xonotlite	7	334. Libethenite	6	387. Mooihoekite	5
229. Uvarovite	9	282. Cubanite	7	335. Lizardite	6	388. Neptunite	5
230. Chloritoid	9	283. Lavenite	7	336. Mountainite	6	389. Penkvilksite	5
231. Chondrodite	9	284. Marcasite	7	337. Melinophane	6	390. Pyroxmangite	5
232. Chkalovite	9	285. Metastibnite	7	338. Mimetite	6	391. Pirophanite	5
233. Eglestonite	9	286. Mitridatite	7	339. Nagyagite	6	392. Plancheite	5
234. Batisite	8	287. Nacrite	7	340. Nadorite	6	393. Rectorite	5
235. Beudantite	8	288. Narsarsukite	7	341. Natrojarosite	6	394. Rosasite	5
236. Betafite	8	289. Neotokite	7	342. Nickeline	6	395. Roselite	5
237. Bindheimite	8	290. Oligoclase	7	343. Nordite	6	396. Rockbridgeite	5
238. Brushite	8	291. Pinnoite	7	344. Pachnolite	6	397. Mercury	5
239. Bustamite	8	292. Pyroaurite	7	345. Pilsenite	6	398. Sazhinite-(Ce)	5
240. Diaspore	8	293. Pumpellyite	7	346. Pyrophyllite	6	399. Sapphirine	5
241. Idrialite	8	294. Purpurite	7	347. Proustite	6	400. Cervantite	5
242. Ilmenorutile	8	295. Piemontite	7	348. Raite	6	401. Skutterudite	5
243. Ingodite	8	296. Rancieite	7	349. Saponite	6	402. Spurrite	5
244. Covellite	8	297. Seydozerite	7	350. Semseyite	6	403. Apatite-(SrOH)	5
245. Kornerupine	8	298. Senarmontite	7	351. Stannite	6	404. Suanite	5
246. Labradorite	8	299. Scolecite	7	352. Tainiolite	6	405. Thalénite	5
247. Manganotantalite	8	300. Scorodite	7	353. Gonnardite	6	406. Talnakhite	5
248. Miserite	8	301. Spessartine	7	354. Ullmannite	6	407. Tirolite	5
249. Microlite	8	302. Szaibélyite	7	355. Umangite	6	408. Tikhonenkovite	5
250. Millerite	8	303. Stibiotantalite	7	356. Whewellite	6	409. Todorokite	5
251. Paragonite	8	304. Stilpnomelane	7	357. Ferrierite	6	410. Triplite	5
252. Petzite	8	305. Taranakite	7	358. Forsterite	6	411. Tungstite	5
253. Sellaite	8	306. Thorite	7	359. Franckeite	6	412. Tungusite	5
254. Sillimanite	8	307. Fedorite	7	360. Chiolite	6	413. Tundrite	5
255. Titanclinohumite	8	308. Fersmanite	7	361. Chrysotile	6	414. Ulexite	5
256. Zoisite	8	309. Fluellite	7	362. Chromite	6	415. Fergusonite	5
257. Chamosite	8	310. Zirkelite	7	363. Euxenite-(Y)	6	416. Volborthite	5
258. Schorlomite	8	311. Ekanite	7	364. Enargite	6	417. Freibergite	5
259. Epistolite	8	312. Acanthite	6	365. Erionite	6	418. Fluorophlogopite	5
260. Altaite	7	313. Aktashite	6	366. Yuksporite	6	419. Huntite	5
261. Amblygonite	7	314. Ankerite	6	367. Baddeleyite	5	420. Apatite-(CaCl)	5
262. Anorthite	7	315. Aurichalcite	6	368. Belovite	5	421. Cyanotrichite	5
263. Bayldonite	7	316. Barytolamprophyllite	6	369. Bismoclite	5	422. Zinkenite	5
264. Birnessite	7	317. Berillite	6	370. Braunite	5	423. Churchite	5
265. Boulangerite	7	318. Betalomonosovite	6	371. Vivianite	5	424. Shcherbakovite	5
266. Bournonite	7	319. Wakabayashilite	6	372. Bismutotantalite	5	425. Euclase	5
267. Weberite	7	320. Valentinite	6	373. Harmotome	5	426. Ehlite	5
268. Vuonnemite	7	321. Galenobismutite	6	374. Hessite	5		
269. Halite	7	322. Gahnite	6	375. Danalite	5		

Table 3. **Distribution of specimens beyond the former USSR in Collection A by number of items**

1.	USA	139	19.	Brazil	26	37.	Zaire	8	55.	Ireland	2
2.	Germany	136	20.	Norway	26	38.	Chile	7	56.	Iceland	2
3.	Bulgaria	123	21.	Slovakia	25	39.	Peru	6	57.	Nepal	2
4.	Hungary	112	22.	Austria	24	40.	Turkey	6	58.	North Korea	2
5.	China	110	23.	Sweden	22	41.	Bolivia	5	59.	Belgium	1
6.	Denmark	100	24.	Great Britain	22	42.	Switzerland	5	60.	Burma	1
7.	Czech Republic	91	25.	France	19	43.	Argentina	4	61.	Gabon	1
8.	India	62	26.	Madagascar	16	44.	Pakistan	4	62.	Zambia	1
9.	Mongolia	61	27.	Namibia	16	45.	Uganda	4	63.	Iran	1
10.	Canada	55	28.	Guinea	15	46.	Tanzania	4	64.	Kenya	1
11.	Morocco	54	29.	Cuba	14	47.	South Africa	4	65.	Malawi	1
12.	Japan	51	30.	Mozambique	13	48.	Vietnam	3	66.	Malaya	1
13.	Mexico	47	31.	Finland	13	49.	Greece	3	67.	Sudan	1
14.	Romania	45	32.	Afghanistan	11	50.	Zimbabwe	3	68.	Taiwan	1
15.	Italy	44	33.	Yugoslavia	11	51.	Columbia	3	69.	Tunisia	1
16.	Poland	40	34.	Spain	9	52.	Macedonia	3	70.	Chad	1
17.	Algeria	34	35.	Serbia	9	53.	Somalia	3	71.	Antarctica	1
18.	Congo	28	36.	Australia	8	54.	Sri Lanka	3	72.	Indian Ocean	1

lector. This not only prompted people to give away specimens that interested him, but also made them pursue Stepanov in the future to demonstrate their collections, while many also visited him in return, bringing minerals for consultation and donation in anticipation of his evaluation and took pride, if their donations were considered worthy of inclusion in his collection. Although when talking to collectors, Viktor Ivanovich would confiscate lumps of ore that he liked and offer replacement from duplicates of his own specimens. These transactions can be hardly seen as exchanges (which he was an expert in), not only in virtue of disparity of the specimens involved, but also in intentions of both parties. It would be more accurate to see these incoming specimens as donations. A typical example is the donation to Stepanov of the best part of Moscow Regional State Pedagogical Institute's collection, assembled by a whole group of students.

In return the institute received specimens for educational sessions. Viktor Ivanovich generally held collectors in high esteem, treating their encounters with great importance and helping them however he could, as for him collectors were "the soil on which Museums grow". This stood out amidst the infamous narrow-minded policy of some state geological institutions at the time which advocated keeping collectors out of Museums.

Exchange. When it came to purposeful exchange with Soviet collectors, specimen value rather than monetary value was at stake. Often the equivalence was not preliminarily established or traced down, especially

Fig. 8. Molybdenite (crystals up to 4 cm). Emerald Mines, Middle Urals, Russia. Found by V.I. Stepanov in waste dumps of Sverdlovsk Mining Institute, 1941. FMM #ST8138. Specimen Labels (a) left by V.I. Stepanov and (b) right – Fersman Mineralogical Museum. Photo: M.M. Moiseev.

Fig. 9. Indite. Abundant black grains in "wood tin", cassiterite. Jalinda mineral occurrence, Primorskii krai. 3.5x2 cm. G. Komarova's collection, IGEM, 1976. FMM #ST595. The label belongs to V.I. Stepanov's (left side is face, right side is reverse side). Photo: M.M. Moiseev.

in dealings with constant partners. Foreign collectors usually preferred to evaluate specimens by their market value abroad. Viktor Ivanovich was equally prepared for such transactions and was well equipped in the knowledge of foreign markets. Rare, but beneficial exchanges would take place with the very few Soviet mineral dealers. Collector Igor Bogutsky, for instance, who traded minerals in Ptichiy Flea Market in Moscow, was keen to exchange one or several valuable minerals for a multitude of less valuable once or even leftovers from specimen preparation.

Purchased items are virtually absent in Viktor Ivanovich's collection (as they were not a part of the institute's budget), except for when he used his own salary to acquire a specimen.

Preparation

Specimen moulding was a standard of preparing minerals for collections at the end of the 19th — beginning of the 20th century. Even geological field guides would recommend specimens of notable size. By the middle of the 20th century, this method had virtually disappeared in the USSR and was reinvented by Stepanov. Apart from moulding and mechanical preparation Viktor Ivanovich experimented a lot with acids and developed a series of his own methods of mineral specimen preparation. He took particular joy in watching a collector's reaction to a once discharged stone, which with some preparation had become a remarkable specimen that could make a worthy contribution to any collection. As far as we know, Stepanov was the only museum employee and collector in the USSR to extensively apply specimen preparation, and those who used later were taught by him. Interestingly, there were some in the museum community who directly opposed any mineral preparation. The policy "to preserve everything in its original state" was often taken so far that specimens were sometimes put into Museum collections with moss and even dirt.

Diagnostics and the study of minerals

Many people who have encountered Viktor Ivanovich were most impressed by his ability to visually diagnose minerals. It is this quality that is brought up to the forefront of many memoirs and is pointed out as his key achievement, which in our opinion is not exactly accurate. This wonderful ability (Viktor Ivanovich was undoubtedly the most able and precise diagnostician) was a consequence of his in-depth knowledge of mineralogy, extensive and continuous observations, remarkable memory and persistence in working with the collection itself.

This ability allowed him to not miss any interesting and new material while working in the field or with collections and identify the material that was most worthy of further studies. He was well aware of the limitations of visual diagnostics and would always use other instrumental methods as a backup. Studied specimens were given preference when it came to assembling his collection. Viktor Ivanovich knew mineral analysis methods well and was constantly in touch with many analysts (chemists, X-ray analysis specialists and others), knew optical methods himself and had a good command of typical analytical mistakes.

More than 30 specimens are identified in the collection as "mineral X". This was how Stepanov labelled minerals, whose diagnostics led him to conclude that they could belong to new mineral species (comments to this effect are made on the label). For some of these, like khaidarkanite, his suspicions have already been confirmed. Part of these specimens is still being studied, others yet await further studying. The proportion of studied specimens in Stepanov's collection is the highest compared to Soviet Museum and private collections and it would seem, compared to foreign collections too. Moreover the potential of his collection to yield new mineral data is immense.

Systematisation of collection

Circulation of material. Incoming specimens underwent multiple filtration. The most interesting ones were selected out of the mass of collected material. From here specimens were selected for Collection A based on typology, intraspecies diversity, degree of research scrutiny and aesthetics, resulting in a systematic collection. The remaining material in the first filtration formed Collection B. Materials that did not fit either of these two categories were sometimes referred to as Collection C by Stepanov. These were the multiple duplicates and specimens considered to be of low quality in the process of filtration. After multiple investigations, they still were not dumped, even though they occupied the most space, boxed or stacked up in several basement rooms.

Stepanov would frequently come back to part C, from time to time selecting new entrants for collection A and B, as notions of mineralogical value changed over time and new information regarding them and their provenance emerged. According to Viktor Ivanovich himself, the mineral specimens that remained after filtration from collection B to collection A were more characteristic of mineral species variations, typical for their provenance. The selection logic of Collection B came to closely resemble the deposit collections of the Fersman Mineralogical Museum of the Russian Academy of Sciences. Specimen circulation also occurred in the opposite direction A → B → C as new collections and data came in.

Defining a specimen's place within collection. In compiling his collection, Viktor Ivanovich had a precise idea of why a particular specimen was selected, what specifics of its mineral species or its origins it reflects and what its role and place in the collection should be. Amongst other things he developed *a qualitative scale* for specimens in order to formalise these notions (Stepanov, 2001). Here, a natural specimen was to be evaluated separately based on three categories of rarity, research scrutiny and aesthetics. Every category was ranked by one to ten scale. In terms of rarity, 10 was assigned to mineral species represented by one of a kind specimen. Mineral species holotype was identified as 10 in research scrutiny scale. Ten points in the more subjective aesthetic scale relied on such criteria as a spectacular, well formed and intact crystal druse. Other scale points were also identified and explained in detail[2]. This approach (of identifying three numbers) made specimen evaluation significantly easier for museum staff. For Viktor Ivanovich himself however evaluation was rather intuitive. Stepanov paid most attention to systematisation of Collection A. Its mineral species were typically distributed based on the universal chemico-structural classification (although based on the storage conditions, he frequently discussed the idea of arranging them in alphabetic order). Unlike many Museum collections the order was not geographically determined within a species, but was defined by its diversity. Mineral specimens that characterised the morphological diversity of a species (Stepanov assigned immense significance to morphology as an indicator of formation conditions) were displayed first, then followed the specimens that characterised the various mineral associations of this species. This order made storage easier when new material arrived or when old material was reworked and the usefulness of additions had to be detected.

Collection documentation

Viktor Ivanovich attributed great importance to collection documentation (or, in Museum terms, scientific inventory). This made his collection one of the best documented collection of our time. Stepanov's key means of documentation was *a scientific label*. The label was not inscribed with a catalogue number, name, geographic provenance and source (all typical for Museum documentation) but also with a brief (or at times extensive) concise description of the specimen, with remarks regarding its quality and significance, time of collecting, collector, nature of acquisition, data regarding any analytical information for the specimen (and at times analysis results), the necessary conditions of storage and a series of other facts.

In other words, the label was inscribed with as much information as such piece of paper could permit (Fig. 9). To increase the label's capacity and to cut down the documentation time, Stepanov developed an advanced system of shortcut symbols. A table of these symbols was compiled. A label's capacity significantly increased, so that a stored specimen could provide efficiently obtainable data, which was often equivalent to that of a scientific article.

In fact a label became a quintessence of multi-faceted approach to a mineralogical

[2] – The scale is presented in full in I.E. Maximyuk's article, published in this issue

specimen, revealing its individual peculiarities, scientific value and link to historical events, if any such was present. This was an innovative approach for Mineralogical Museum practice worldwide.

Stepanov's other means of documentation was a catalogue, so detailed that it too exceeded other Museum collections of the time, but was less scrupulous than his labels (some of Collection A specimens were not even included). Evidently, Viktor Ivanovich had no time to cover the full scope of Museum documentation work. Nevertheless, the existing catalogue is quite enough to understand how such a catalogue is to be kept according to Stepanov. Namely, it should at least consist of the data from the labels. To get some idea of the influence of his work on one of the key Mineralogical Museums in the country, one ought to compare Stepanov's own label and a typical label of the Mineralogical Museum of the Academy of Sciences at the time with a label of the same Museum after Viktor Ivanovich had worked there (Fig. 10); as well as to compare the pages of the Museum catalogue before (Fig. 11a) and after (Fig. 11b) Stepanov joined.

Another peculiar feature of Stepanov's collection is the lists (an idiosyncratic equivalent of topographic descriptions, typical for Museums), which were each placed in an individual storage tray. These lists identified the total number of specimens in the tray for each mineral species and the number of specimens that characterise a particular morphological type, specific varieties, pseudomorphs, mineral associations, deposits and such like (Fig. 12) These equally innovative means of documentations made it easier to evaluate the collection in terms of its mineral species representativeness and gaps. Each tray that started the next large taxon was supplied with a list of mineral species of this taxon and/or its sub-division, including the location of the species' storage.

All together, this form of documentation worked as a form of database which could be used while working with the collection.

Display work

During its time as the IMGRE Museum, the collection had no permanent display. Stepanov organised separate thematic exhibitions in the institute's foyer and other venues. But even during his short stay at the Fersman Mineralogical Museum, Viktor Ivanovich had the time to prove that he was a master of his trade. In 1984, he was the key force in the Museum's preparation for the International Geological Congress alongside the Museum's then director Alexander Godovikov, creating and re-creating displays following long-term renovations. He was the author (and the chief deliverer of display items) for the permanent *"Cave Mineralogy"* exhibition, which, its scientific value aside, became an aesthetic asset for the Museum's exhibition hall (Fig. 13). The *"Forms of Mineral Occurrence"*, co-created with A. Godovikov, was one of a kind exhibition, which demonstrated the systematics of individual and aggregate minerals based on the nature of their morphology and formation or transformation (Forms..., 2003). A *"Diversity of Mineral Species"* exhibition, based on Collection A's organisation and bearing a large part of its specimens, was created already after Viktor Ivanovich had passed away.

Speaking of Viktor Ivanovich's specimens at the Mineralogical Museum exhibitions, their quality can be evaluated according to the following criteria: the correlation between the specimens displayed to the overall total donated by Stepanov's collection is the highest amongst all other Museum donations.

Fig. 10. Labels of the Fersman Mineralogical museum (a) until 1984 and (b) after 1984.

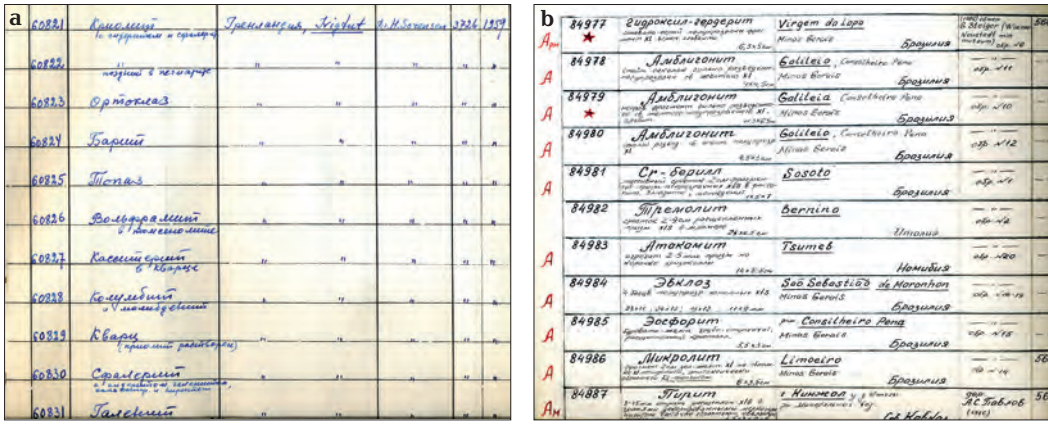


Fig. 11. The pages of museum catalogue (a) before V.I. Stepanov worked and (b) after his work in the Fersman Mineralogical Museum.

The social significance of the Stepanov Collection

Once when asked what was he considered most important in his collection, Viktor Ivanovich replied that it was its "social significance". The answer seemed surprising at the time, but turned out to be well justified.

This collection was assembled in the course of half a century (1938—1985). It was then that geological research, surveying and development of most mineral deposits (which could be accessed with relative ease) in the USSR flourished. The country which was set to make itself independent of any resources imports, requested work in ore research and extraction of virtually all chemical elements as well as nonmetalliferous mineral resources.

At the same time the country witnessed a sudden drop of interest in assemblage and research of mineralogical collections. Universities and research institutes stopped buying mineral collections, formerly an inalienable part of education even for non-geologi-

Fig. 12. Topological inventory of calcite from V.I. Stepanov collection.

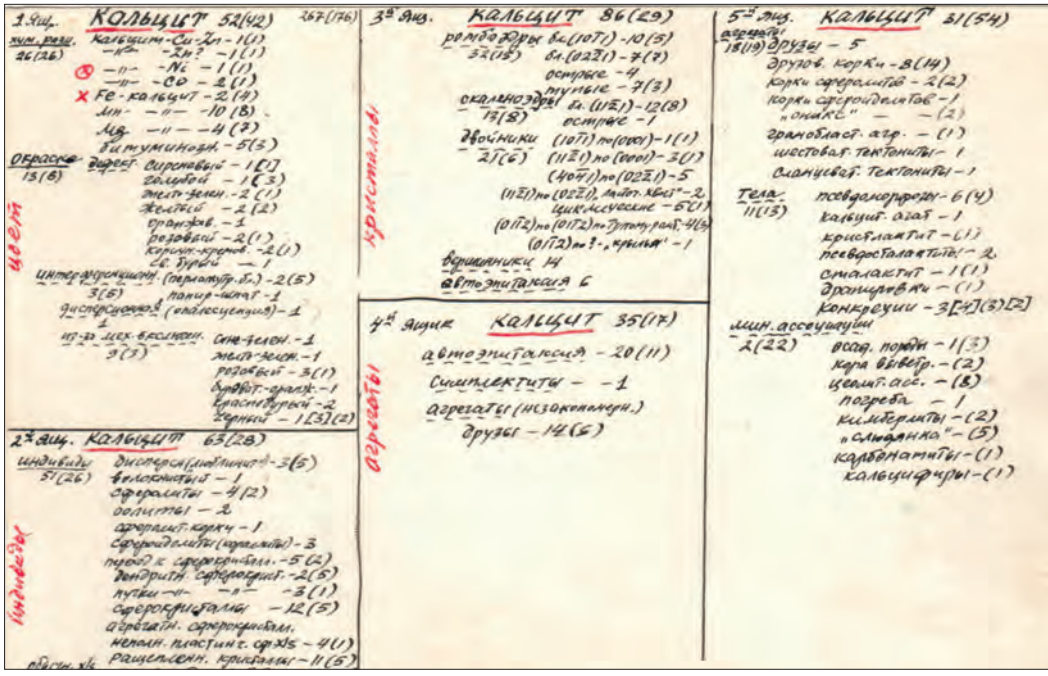


Fig. 13. "Mineralogy of Caves" exposition in Fersman Mineralogical Museum. Photo: M.M. Moiseev.

cal universities. Mineralogy was no longer taught in schools. The number of amateur collectors rapidly decreased (to virtually zero, in some years). There was no interest in mineralogical specimens as a subject of collecting, even commercially. Mineralogical Museum work also decreased. Staff of scientific research institutes was largely unmotivated to preserve the already studied material. It is difficult to imagine now, the extent of spectacular mineral specimens and fascinating study material that ended up in the dumps instead of Museums and collections, just because there was no interested in collecting them. Meanwhile to obtain a specimen at the time, it was very often when all one had to do is merely bow down and pick it up.

A collection put together at such a time, which not only bears samples from deposits no longer accessible, but also contains a substantial volume of data regarding them is undoubtedly of great scientific, social and historical significance.

Equally important is that Viktor Ivanovich's personality, his collection and his ideas have all exercised a great influence on Museum work in the field of mineralogy and on the emergence of new mineral collectors. A very fair remark was made by I.V. Pekov (in his verbal presentation during the meeting at the Fersman Mineralogical Museum's, dedicated to the 90th jubilee of Stepanov's birth, January 2014) that much of what we, as Stepanov's followers today, see as obvious *a priori* givens for Mineralogical Museum, and collections work had to be first formulated and invented by him.

Viktor Ivanovich Stepanov virtually single-handedly created a collection, which is outstanding in many ways as well as developed an elegant and logical notion of museum work in the field of mineralogy at a time when it seems circumstances were least favourable. The experience that made him the most qualified and as yet unparalleled expert of mineralogical museum work is both an example, a reproach and an action plan for us, mineralogists and museum staff.

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