

Data processing: The data obtained in the field when doing sampling as well as the analysis results are further processed by the mathematical statistics method. The processing of these data in ČSSR is performed on computers. On the basis of these processed data anomalies are defined and are drawn into the hydrochemical map.

Densifying: When the anomalous fluor values in water are obtained and the anomalies are defined, the densifying of the net is performed. The samples are taken at the distance of 50 m and the works are done in the map scale 1 : 10 000.

FLUORITE SONDE

The water samples taken at hydrochemical prospecting are analysed in the laboratory by fluoride sonde on pH from which, further, the fluor content in water in mg/lit. is defined.

Fluorite sonde is, in fact, fluoride electrode. It is in its bottom made of fluoride lanthanum crystals (LaF_3). Before beginning the operation this electrode is to be put into the solution of pF_6 in order to activate it. It should be in this solution 1 hour. After that and on the basis of the solution - standard of pF_3 , pF_4 , pF_5 and pF_6 the calibration curve is performed. The pF values are registered on the abscissa and on the ordinate the millivolts from the indicator of the apparatus.

The water should be neutral when doing exploration. Depending on the values pH, pH citrate or acetate are added to the water. The water is homogenized. Homogenization is being done during the whole process of the analysis. Then two electrodes are put into the sample:

1. fluoride electrode and
2. calomel electrode.

When the indicator on the apparatus stand still, the millivolts

are read. From the curve made on the basis of the read millivolts, the value pF is found, and the fluor content in $mg/lit.$ is defined from the tables. A large number of samples can be analysed in one day by this method. This method has an obvious priority over the other methods owing to its great efficiency and economy.

APPLICATION OF STATISTICAL MATHEMATICS

The taken data and obtained results of the analyses by fluorite sonde, or in some other way, are processed by the method of statistical mathematics in order to determine anomalous values and anomalies separately for each field, the type of material, etc. On account of this, it is necessary, when doing research by hydrochemical method and calculation and obtaining the necessary data on the computers, to prepare the following data:

1. the number of the sample
2. the number of the map - coded
3. the locality in the map - coded
4. the material - coded
5. the material variability - coded
6. The terrain morphology - coded
7. the place of the sampling - coded
8. the fluor content in $mg/lit.$
9. the temperature in $^{\circ}C$
10. the factor pH
11. the anomaly-result after the calculation on the computer

The computer gives the coefficient of variation for the normal logarithmic conditions. The calculation and definitions of the values and the determination of anomalies for each field, material, etc. are done.

After obtaining these results, anomalous values of the fluor

content in the water, the drawing of the anomalies is performed in the hydrochemical maps.

In the places of the anomalies, after the net densifying by hydrochemical method or slick method, further research is done, if it is necessary, by metallometric method in order to compare and to check up the obtained results. After that long-hole drilling is done or trenches are made aiming at discovery and establishing the deposit. When the deposit is found, classical, mining-geological prospecting works are performed: level entries, shafts, lateral roads, crosscuts, etc. The deposit is outlined. The deposit, researched in this way, is given to exploitation..

A large number of anomalies and fluorite deposits on the skirt board of Czech massif are discovered by this method.,The fluorite deposit "Jilové" and the fluorite-barite deposit of new vein "Moldava" are among the above mentioned deposits.

Hydrochemical method renders good results with prospecting, ~~except~~ except with fluorite and indirectly barite, and also with exploration of sulphide deposits. In this case, by application of hydrochemical method the exploration works are adjusted for such deposits. Two identical samples are taken from each location. One sample is analysed by semi-quantitative spectrum analysis for: lead, zinc, copper, arsenic and etc., and the other sample is analysed by various methods for: fluorite (by fluorite sonde), pH, chlorine, SO₄. After the obtaining the anomalies a detailed research is performed. Generally, such research works are combined with metallometric method as well.

METALLOMETRIC METHOD

After finishing exploration in the regional scale by the slick method of prospecting and hydrochemical method, the further research is continued by metallometric method, if it is necessary, or the net densifying is performed by these methods in

the places of anomalies.

Metallometry is done in the map in scale of 1:10 000.

The exploration by metallometric method is performed on the net 50 x 50 m simultaneously with densifying of the net by slick method or hydrochemical method, or independently of the application of these methods in the places of anomalies.

Sampling: The samples are taken from drills. Drilling is made in the defined profiles vertically to the vein direction, if it is known, or to the assumed direction of the veins at a distance of 50 m and when doing detailed prospecting at 20 m. It is drilled down to the fundamental strata i.e. till the compact rock mass. Three horizons always occur at drilling.

1. horizon is humus (horizon A)
2. horizon is claysh, loose under the humus (horizon B)
3. horizon is a rock in disintegration (horizon C).

The samples are taken from the horizons B and C (2nd and 3rd). Two samples are taken from the each horizon. The smaller one for chemical analysis, and the bigger one (10 to 15 kg) first for sifting then for slicking and finally for mineralogical analysis. The first small sample is representative for both horizons.

Results obtained by metallometric method in one field do not necessarily represent the anomaly in the other fields. Whether the content of a mineral in one field is anomalous depends on many factors: petrographic structure, geological structure of the terrain, etc.

If a mineral of anomalous content occur, it means there must be a deposit there. In the places of anomalies the trenches are dug vertically to the assumed direction of the ore vein strike, or if a blind deposit is in question then drilling is made. When the deposit is found, the further research works are continued

by classical mining-geological prospecting works (level entries, shafts, etc.).

THE SAMPLE ANALYSIS

In the course of my training stay in ČSSR, after the made schedule, I became familiar in the laboratories of the enterprise "Geoindustria" with the further treatments, after taking samples according to the described prospecting methods, with methods and the way of analysing of those samples: chemical, semi-quantative and quantative spectrum analyses, mineralogical analyses, etc., whose results are further used in determination of anomalies and in geological interpretation.

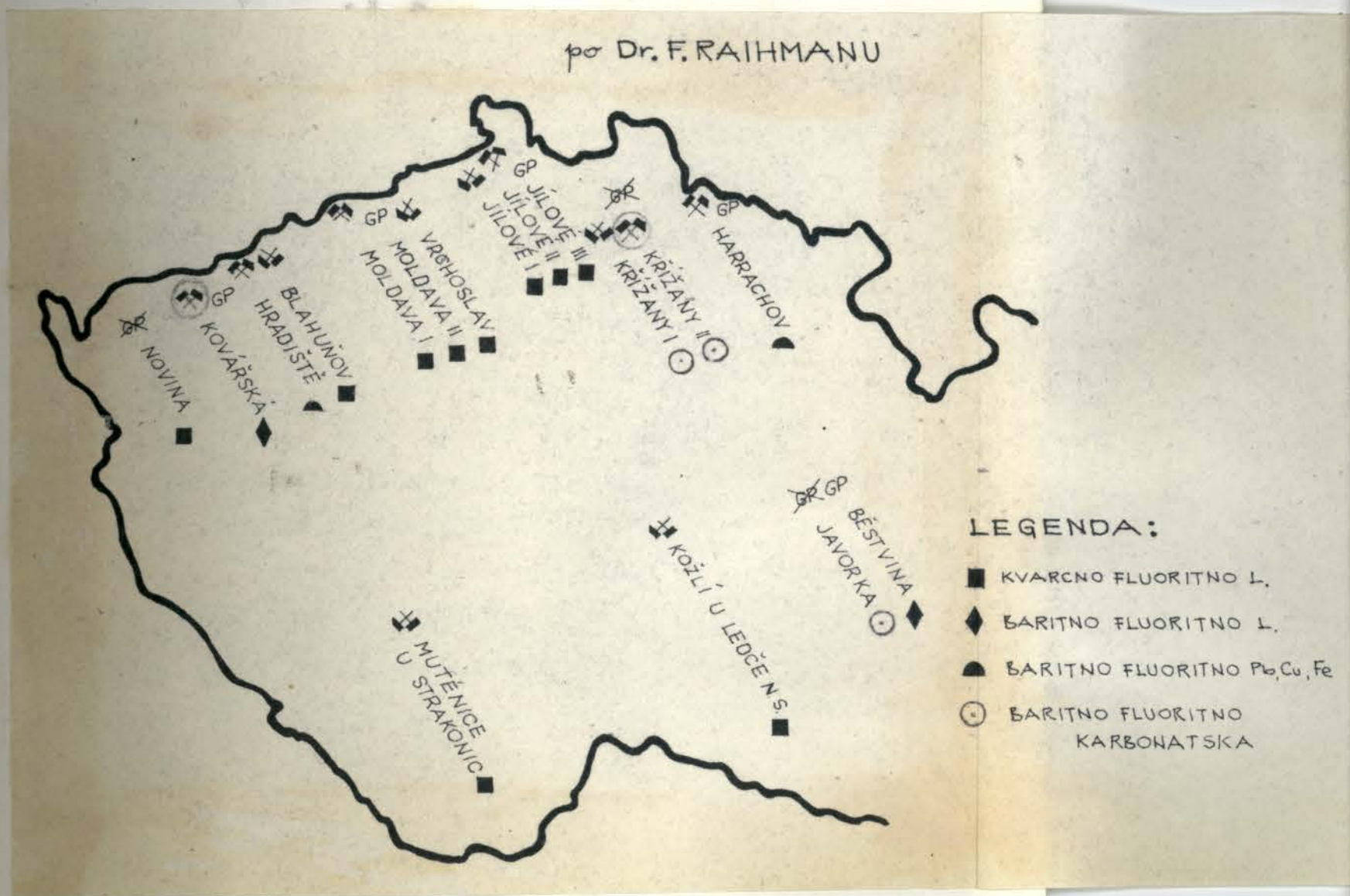
Analysing is performed by the most contemporary and most perfect apparatus and instruments aiming at obtaining as exact results as possible. For example, the spectrum analyses are performed on:

- a) atomic-fire absorbing spectrum photometer and
- b) X-ray fluorescent diffractonal sequent cristall spectrometer.

With the results obtained in this way the further processing of the data and interpretations take place.

THE FLUORITE AND BARITE DEPOSITS

In order to become fully acquainted with the results of the explorations by the described methods I visited and got to know in detail almost all the barite and fluorite deposits in ČSSR regardless whether they are discovered by these methods or previously in the classical way. (Picture 6.)



PICTURE 6

THE FLUORITE AND BARITE DEPOSITS IN ČSSR

The deposit "Javorka" - Běstvína

The deposit "Javorka" is the youngest fluorite-barite mining district. It has been recently discovered by the modern methods of prospecting. The prospecting was done by slick method and after the deposit was discovered by mining works. It was opened by level entry and further explorations are continued by lateral roads.

The terrain geology: The terrain is formed of gneiss. The ore bodies are connected with tectonic zone of Laabian line.

The deposit geology: The deposit is represented with fluorite veins with barite and barite of metasomatic type in gneiss. These veins have lens appearance. They decline at the angle of 40° - 60° .

Genesis: The mineralisations are hydrothermal. Metasomatic deposits were formed in hydrothermally changed silified lens of marble in gneiss.

The principal minerals: in the deposit are: fluorite, barite and accompanying minerals are: quartz, clay minerals, sphalerite and galenite. The accessory minerals are: calcite, pyrite, halcopyrite, wulfenite, limonite and pyromorphite.

The deposit "MOLDAVA" near Teplice

The prospecting on the deposit "Moldava" began in 1953 by classical methods. Later it was continued at the known and indicated localities. In 1958 under the supervision of Dr. Chrt hydrochemical prospecting on fluorite was performed, and in 1972 the study for exploration of fluorite deposits in ČSSR was finished. A few anomalies around Moldava were discovered by hydrochemical method.

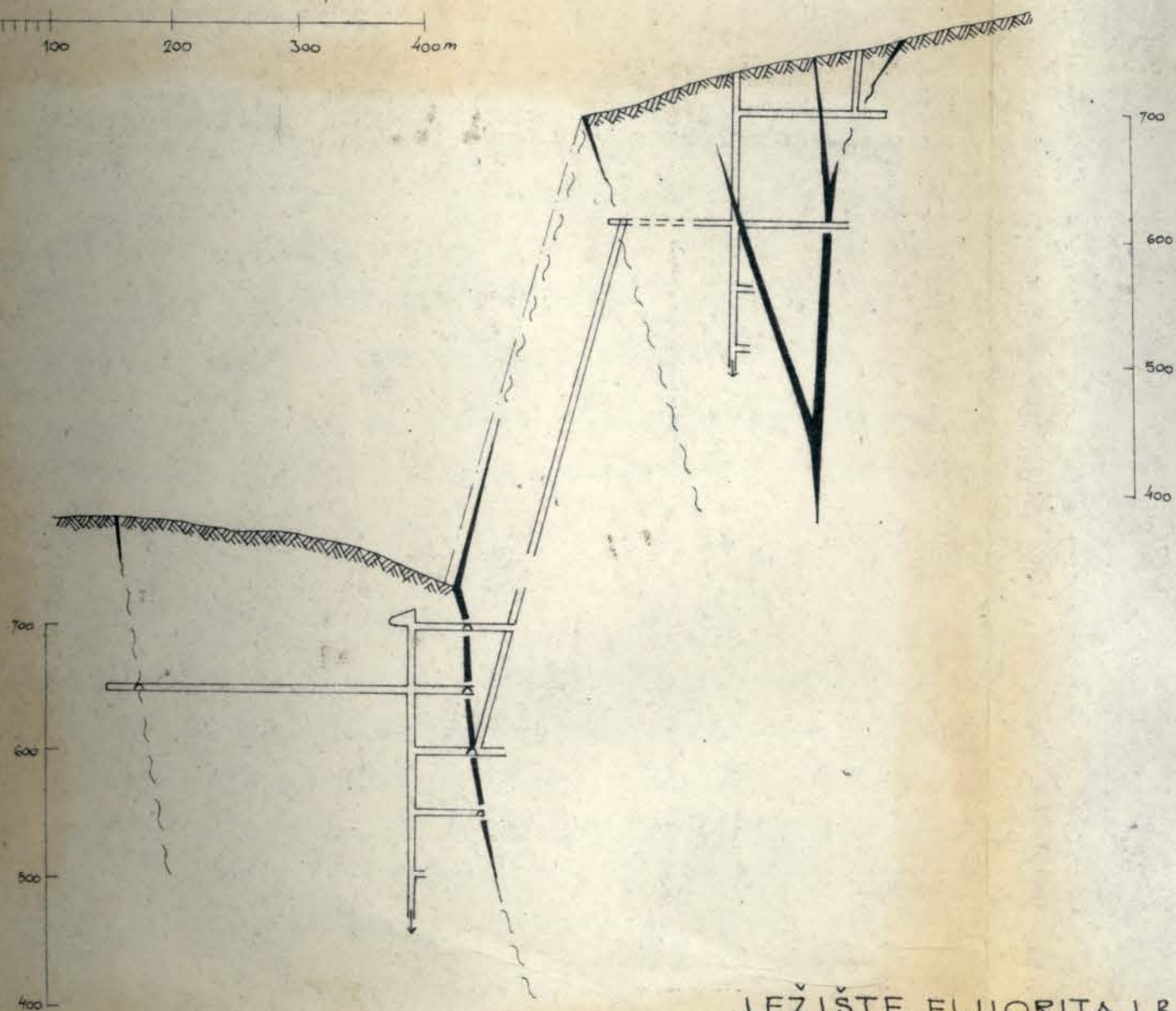
The terrain geology: This terrain is formed primarily of paragneiss in the west, orthogneiss which are in the cores, in the

east mica schist too. Further to the east there are Teplic quartz porphyrites. Crystallinum of the Moldava region is intersected by veins of quartz porphyre and granite porphyre. Mineralisation of fluorite, barite and hematite veins is connected with two faults. At the crossing of these two faults mineralisation of fluorite and barite occurred and along the fault the veins of milonite and hematite occur.

The deposit geology: "Moldava" is the deposit of the vein type. The two veins "Jozef" and "Papoušek" ("parrot") are discovered. The veins are vertical or almost vertical (picture 7) connected with milonite fault zone.

Genesis: Mineralisations are of hydrothermal way of origin. The zonality of mineral occurrences is clearly observable: white quartz, barite, fluorite in the depth, then again hematite quartz.

The principal minerals: in the deposit are: fluorite and barite, and the accompanying minerals are: quartz, hematite and clay minerals.



LEŽIŠTE FLUORITA I BARITA „MOLDAVA“
POPREČNI PROFIL

PICTURE 7
THE DEPOSIT „MOLDAVA“

The deposit "KOVÁRSKA" near Chomutovo

This deposit is still in the phase of prospecting. After performed exploration by hydrochemical method, the prospecting works are being continued by deep drilling.

The terrain geology: The ore bearing regions are formed of gneiss series tectonically disturbed.

The deposit geology: The deposit is represented with vein system of barite and barite-fluorite veins inserted in the gneiss series. The veins have aphofise branches. Their thickness is from 1 cm to 2 m. The veins are of rose barite at the top and going down into the depth fluorite prevails.

Genesis: The deposit is of hydrothermal type.

The principal minerals in the deposit are: barite and fluorite, The accessory minerals are: galenite, sphalerite and iron oxides, the accompanying mineral is Quartz.

The deposit "JÍLOVÉ" near Děčín

The prospecting of this region has begun with the working out of the "Map of parts". Simultaneously, the exploration with slick method of barite and hydrochemical method of fluorite has been performed. In the places of anomalies the prospecting works are continued by deep drilling and mining works (level entries, deep headings). The deposit is being prospected.

The terrain geology: This region is formed of biolitic-muscovite gneiss. They are covered by cretaceous-cenomanian sandstones of marine or fresh-water type. Cenomanian is overlaid by lower Turonian represented with kaolinite and clay sandstones, then middle Turonian forming the southern and northeastern part of Vysokí Snežník with similar lithological structure. Upper Turonian forms the southern part of this terrain. These sandstones are intersected by olivine basalt in the forms of pillars.

The basalts are of Tertiary age. The mineralisation bearers are clastic rigid sandstones.

The deposit geology: The ore bodies are of vein type. They are vertical veins of 65° - 90° with the exception of a slope of 50° . The veins are in the rigid quartz sandstones and disappear in kaoline and clay sandstones. The mineralisation is characterized by previous silification of sandstones, by filling of pores and fissures and by opalisation as well. Opalisation is somewhat younger than silification and it occurs to greater extent. Mineralisation is connected with mechanical-lithological conditions, with clastic sandstone maps. There is no mineralisation in clay and kaoline sandstones.

Genesis of this deposit is not quite clear, therefore there are a number of hypotheses about the way of mineralisation. There are opinions that the mineralisation is connected with post-effusion activity or that it occurred by the activity of descending vadose water or by regeneration of old hercynian deposits. There are three types of the ore veins. The first ones were formed by mineralisation of open fissures made by tectonic without later changes. Fluorite occurring in them has a stratified texture. The second type was formed in open fissures by disturbed tectonic in the course of mineralisation, and the third type is tectonically fractured where fluorite forms breccias.

The principal mineral is fluorite. The deposits are monomineral. The fluorite is of white or slightly bluish color, but greenish fluorite occurs as well. The accompanying minerals are quartz and clay minerals, and the accessory minerals are: opal, illite, monmorionite, gëitite, etc.

The deposit "VRCHOSLAV" near Teplic

The prospecting of this deposit were done by classical mining-

geological works, mostly by lateral roads along the vein. The deposit was exploited till 1969. Now it is closed for exploitation.

The terrain geology: The veins of granite porphyre and Preisselber micro granite break through quartz teplic porphyre. To the east of the quartz teplic porphyre there is a crystallinicum - orto gneiss which form a sharp contact among themselves.

The deposit geology: The deposit is of the vein type. The veins of quartz, hematite, fluorite and less barite are vertically 80° - 90° , and there are some steep ones of 45° . The longitude of the vein strike is about 2 km.

Genesis: The veins of quartz, white quartz, hematite, fluorite and barite occur as the result of magmatic differentiation of micro granite.

The principal mineral is fluorite, the accompanying minerals are: quartz, hematite and barite.

The deposit "HRADIŠTE" near Karlovy vary

Hematite was exploited here in the Middle Ages. After II World War the prospecting of barite began here, and at present there is fluorite prospecting. The explorations began by classical method and today also they are performed in that way - mining-geological works (shafts and lateral roads).

The terrain geology: The terrain is mostly formed of orto-gneiss. Para-gneiss and muscovite mica schist occur as well. Two fault systems were found: lateral tectonic and crosscut tectonic.

The deposit geology: 22 ore veins occur here. Some of them are being prospected, and some are in exploitation. In the eastern part of the deposit the veins with fluorite-barite mineralisation prevail, and in the western part the mineralisation of hematite and to lesser extent pyrite. The vein thickness ranges

from 1 m - 5 m. The veins decline at the angle of 60° - 90° , and they strike from 100m to 5 km.

Genesis: The ore veins are hydrothermal formations, formed at low temperatures, connected with acid magmatism - granitoid pluton, krušnogorski pluton.

The principal mineral is fluorite and the accompanying ones are: barite, quartz, pyrite, hematite, marcasite, siderite and limonite.

The deposit "KRIŽANY" near Liberec

This deposit is interesting owing to the fact that only in it carbonates occur. The deposit was discovered by emanometry in the course of uranium prospection. After that a level entry and a shaft were made and subsequently deep rilling was performed. Then the prospecting was continued by mining works.

The terrain geology: The terrain is formed of cretaceous - lower Turcinian sediments and metamorphosed phylites of yested crystallinum which are sharply bordered with Lužická poruha - dislocation. The deposit is situated in metamorphosed phylites near the dislocation of Lužická poruha.

The deposit geology: The veins of fluorite-quartz, siderite-dolomite-fluorite and barite-fluorite lie in the phylite at the angle of 45° . The depth of occurrence of the ore veins amounts to 150 m and they strike 300 - 500 m. The ore body thickness ranges from a few decimeters to 11 m.

Genesis: The ore bodies are epithermal-hydrothermal veins connected with tectonic lines and variscan orogenesis. In the oldest fluorite quartz veins fluorite is of green color and in carbonate veins it is violet, while in the youngest barite-fluorite veins it is of green color again.

The principal minerals are: fluorite, dolomite and barite, and the accompanying ones are: quartz, limonite and siderite.

Calcite, ancerite, hematite, malachite, azurite, rammelsbergite, chalcopryrite, chalcocite, pyrite, sphalerite, galenite and getite occur as well.

The deposit "HARACHOV" near Tanvald

The prospecting of this deposit has begun in the classical way. The ore veins have been explored by lateral roads along the direction of the ore body strike. The exploration is continued by deep drilling from the shaft and by mining works, shaft, level entry and lateral roads.

The terrain geology: This region belongs to Krkonoško-Jezerski pluton. It is formed of granite of Hercynian age forming pluton in the form of number eight. In the most narrow part of that form there is the deposit of barite and fluorite. The deposit is in the granite near the contact with metamorphosed silicified phylites.

The deposit geology: The deposit is of the vein type. Six large veins occur forming Harachovian system of veins which has a form of a fan or broom and they are widening towards the west, and join towards the south. All the veins have their names (Kremeni val, etc.). The veins are mostly vertical. They reach into the depth of about 500 m, and they strike about 2 km. Barite occupies several parts of the deposit. Its participation in the ore mass decreases with the depth, and in the deepest parts it occurs to a very small extent. Fluorite prevails in the deeper parts.

It is a very important fact to observe that barite occurs also in the depth of 450 to 500 m.

Genesis: The deposit is connected with younger tectonic lines. It is of Alpine age and of hydrothermal way of origin.

The principal minerals are: barite, fluorite and galenite, and

the accompanying ones are: Quartz and hematite. Pyrite, chalcopyrite, malachite, ceruzite, opal, jasper, sphalerite, covellite, anglesite and wulfenite.

Besides the mentioned deposits I became acquainted in detail with the deposits of cassiterite and wolframite "KRUPKA" and "CINOVEC" in the course of my stay in ČSSR. These deposits of tin and tungsten are very significant in the middle Europe.

IV. VIEWS ON THE USE OF THE TRAINING

The training which I carried out in ČSSR, after the schedule which people's enterprise "Geoindustria" - Prague made, was of great use for my further professional improvement and enabled me for application of modern methods in geological prospecting in my enterprise and in my country. To what extent my specialisation, my new knowledge will contribute to further development of my enterprise and the region depends on many factors, primarily on their acceptance of them and material possibilities for their application. Modern methods of prospecting, described in this report, have a great advantage over up to now used classical prospecting methods. This advantage is in their great efficiency, time-saving and safety. The application of these methods with us would be of great use by which the exploration of mineral raw materials would be carried out with more safety, more time-saving and with less expense. These methods would render a great economic advantages, especially in discovering of new deposits which consequently would benefit the further economic development and increase of the economic power of the enterprise and the country.

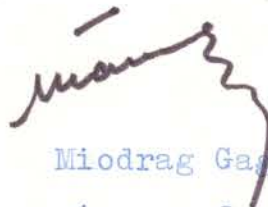
Having this in mind and taking into account the problems of barite exploration in the region of Velika Kladuša, slick prospecting of barite and other minerals of this region should be

performed as soon as possible. In the places of obtained anomalies further detailed prospecting work should be subsequently done by modern methods.

On the basis of the fact that barite also occurs in the deeper parts (to - 500 m) of the deposit, the exploration of the barite veins should be continued along the dip to the west of the shaft "6" by steep drillings because in deeper parts in that very place the barite vein bends in a knee-like form and forms a vertical dip (90°) from the steep position. This should be done as the barite vein nowhere naturally disappears.

In working out of metallogenetic maps in wider regional scale and aiming at discovery of new deposits also, the described slick method, hydrochemical method and metallometric method should be widely applied which would render an enormous economic benefit.

Finally, I feel obliged to express my gratitude to my colleagues from the "Geoindustria" Prague and its institutes at Jihlava, Teplice and Liberec for all they did for me and made it possible for me to get familiar with the modern methods in geological prospecting and in this way to widen my professional horizon.



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