



AGH



WGGiOŚ

Złoża surowców mineralnych Ukrainy Przyszłość dla Europy ?

Adam Piestrzyński

Jadwiga Pieczonka

Władysław Zygo



Złoża Surowców mineralnych ukrainy(after GSU)

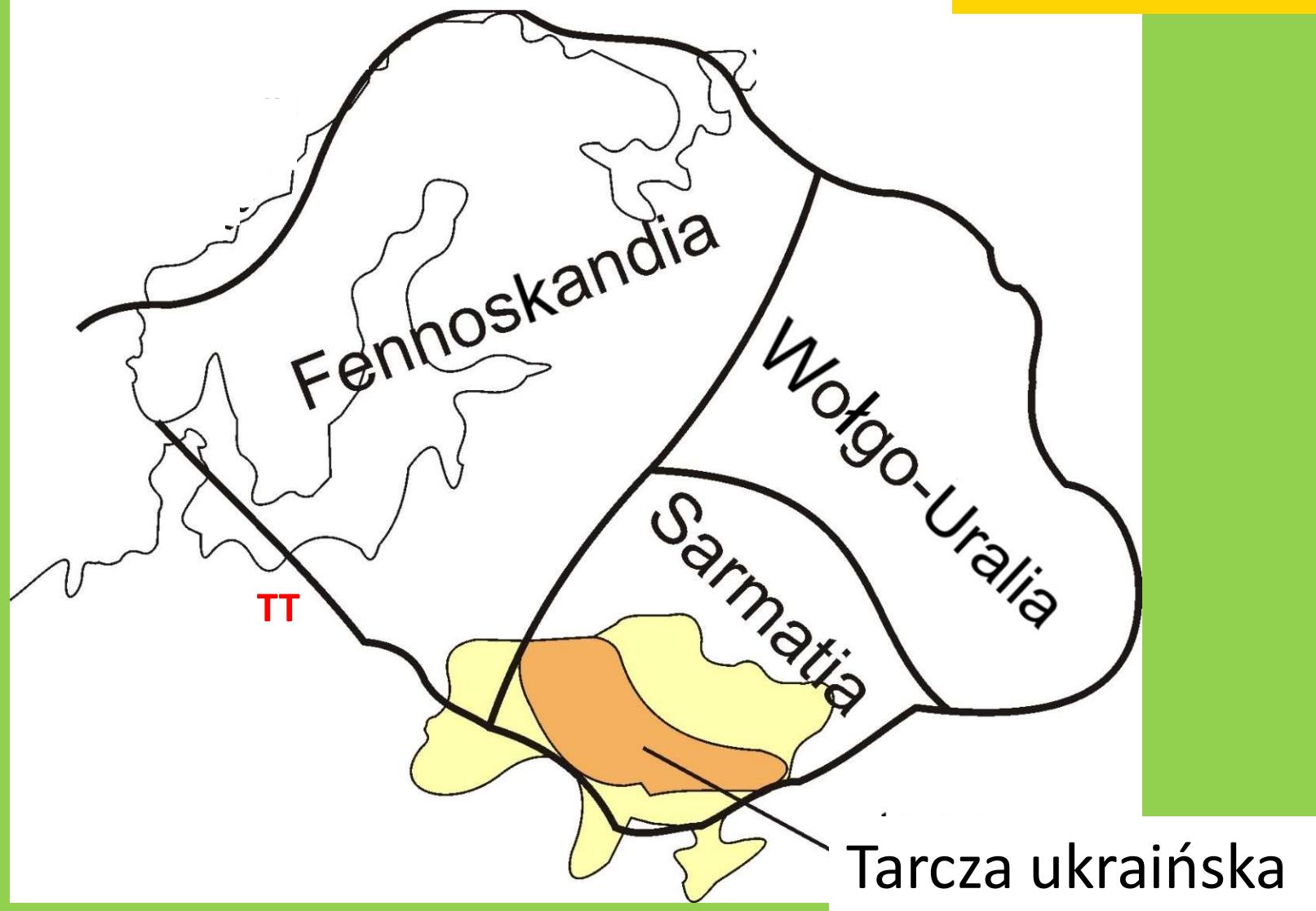
Surowce palne 2233

Surowce metaliczne 147

Surowce niemetaliczne 4676

Ukraina

Powierzchnia- 603.7 km²
Ludność- 44,13 miliona (2020)



Polska

Białoruś

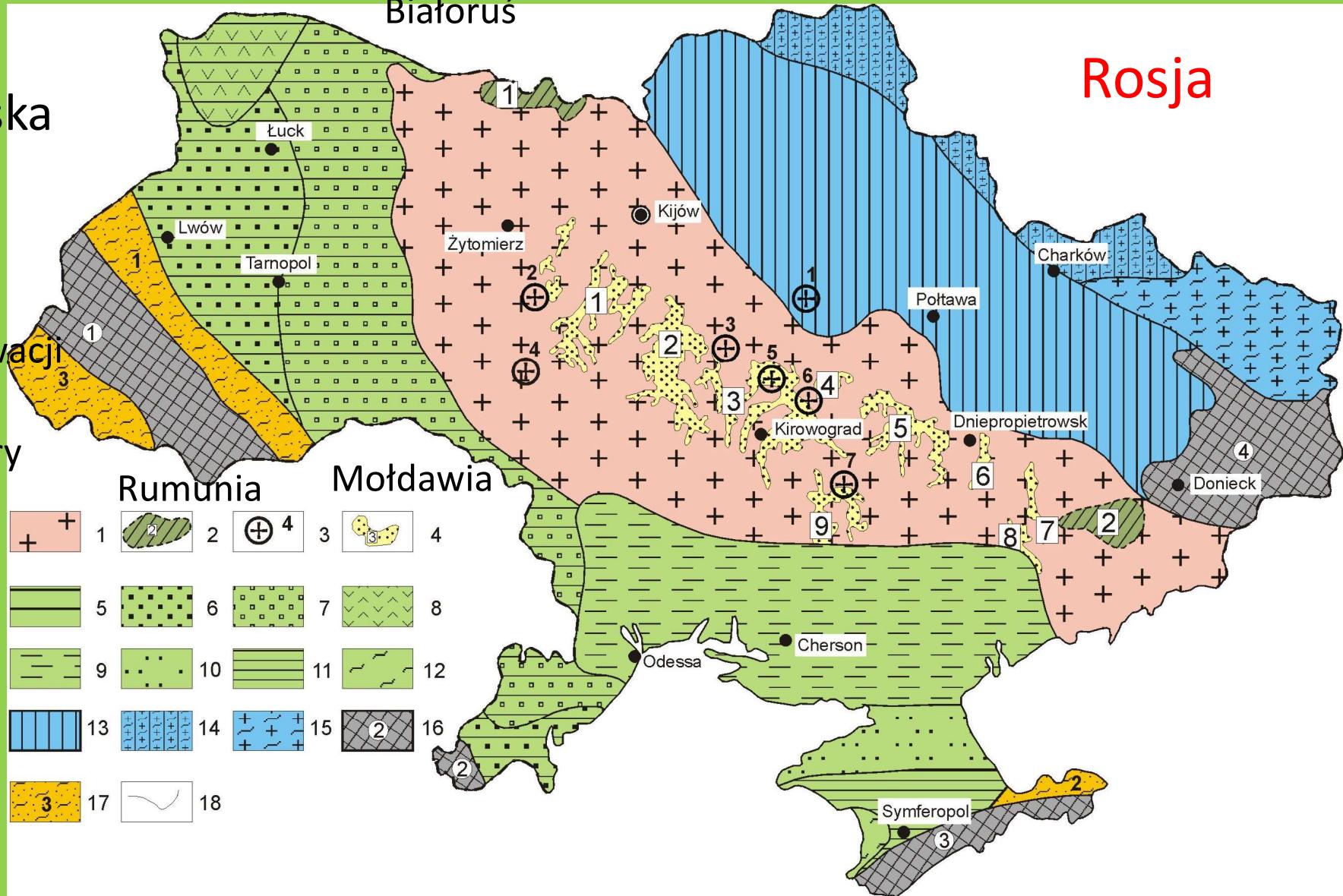
Rosja

R. Słowacji

Węgry

Rumunia

Mołdawia



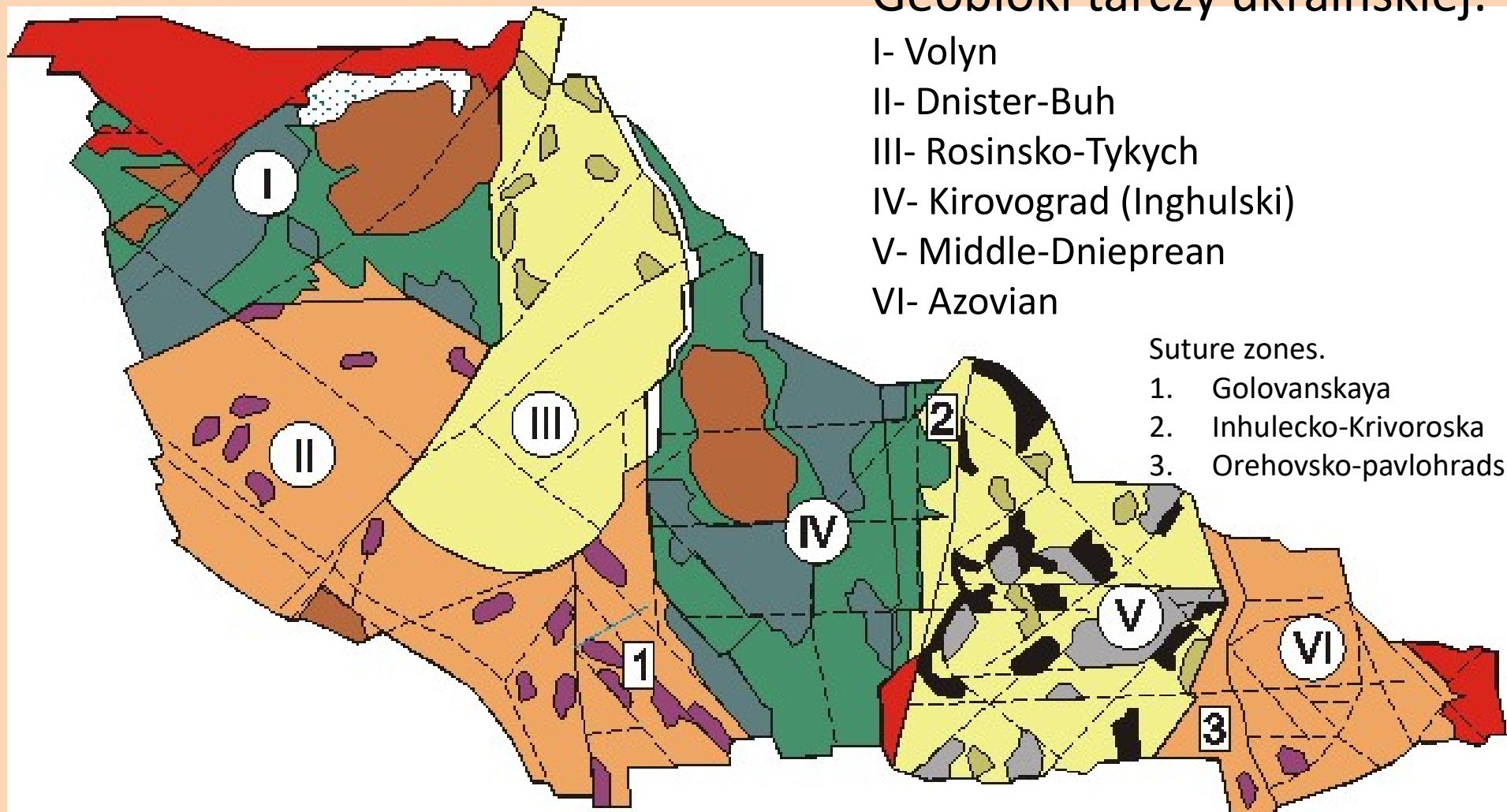
1- Tarcza ukraińska; 2- tektoniczno-erozyjne rozłamy, 3- impactyty 4- depresje, 5- płyta Vohlyn-Podole, 6- Paleozoik, 7- monoklina Vohlyn-Odessa, 8- Paleozoiczne elewacje, 9-monoklina S-Ukraińska, 10- deprfesja N-Krymu, 11- centralna elewacja krymska - kreda-paleogen, 12- cretaceous-paleogen alminian depression, 13- Mezozoiczna niecka dniepr-donieck, 14- NE krawędź niecki dniepro-donieckiego przykrywająca woroneską antyklinę, 15- południowy sklon woroneskiej antykliny, 16- jednostki fałdowe (1-Carpatian, 2- Dobruja, 3-Crimean, 4- Donbas), 17 depresje alpejskie (1-fore-Carpatian, 2-inhuo-cubanian, 3- transcarpathian)

Geobloki tarczy ukraińskiej:

- I- Volyn
- II- Dnister-Buh
- III- Rosinsko-Tykych
- IV- Kirovograd (Inghulski)
- V- Middle-Dnieprean
- VI- Azovian

Suture zones.

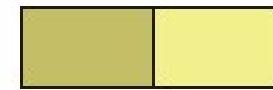
- 1. Golovanskaya
- 2. Inhulecko-Krivoroska
- 3. Orehovsko-pavlohradskaya



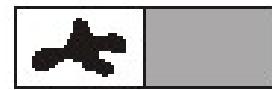
1-Pal.-Archian



2-Mezo-Archean



3-Neo- Archean



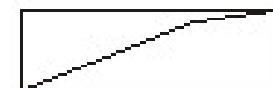
4- Pal-Proterozoic



5- Middle-Proterozoic



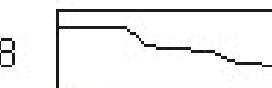
6



7

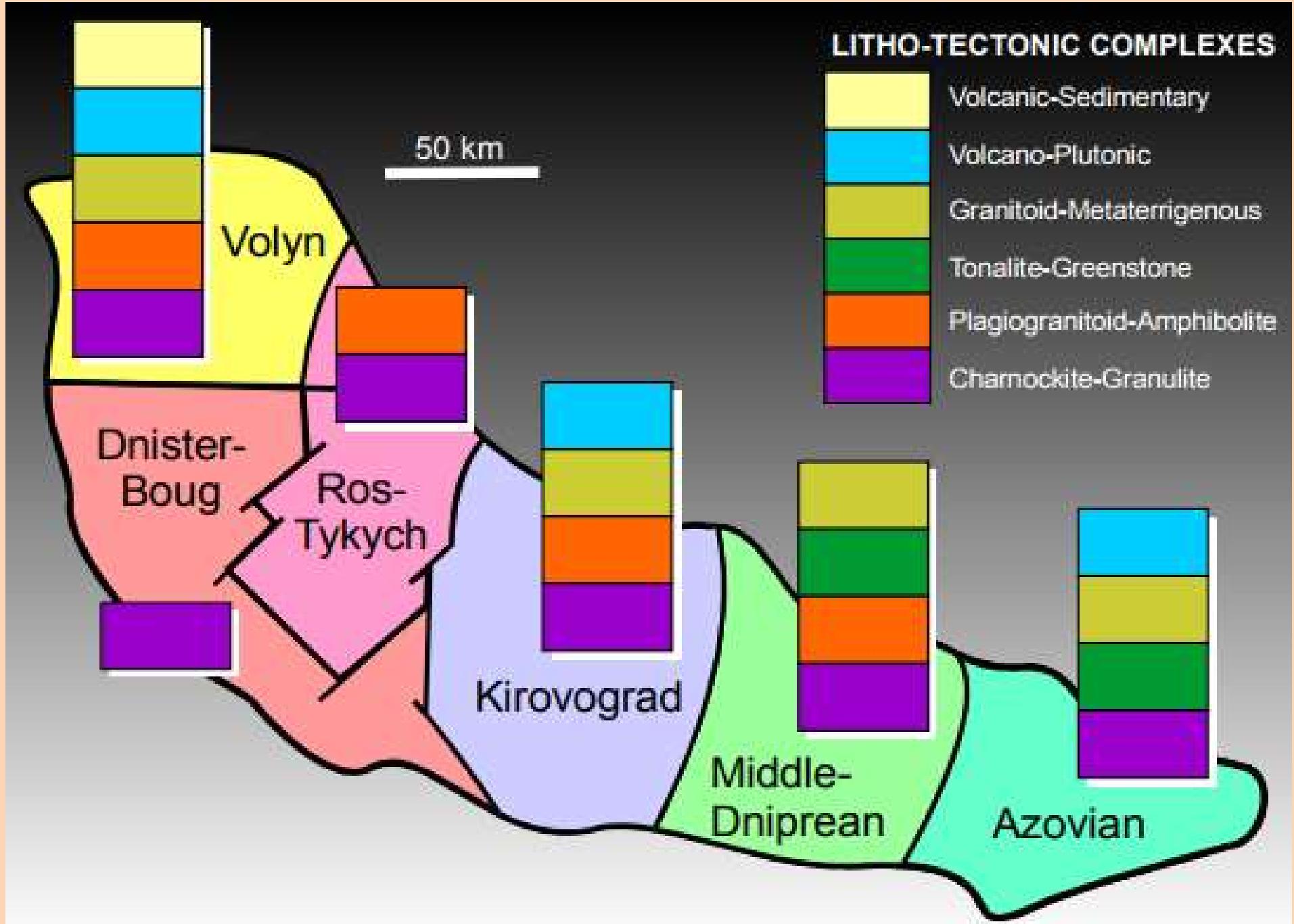


8



9

6- Neo-Proterozoic

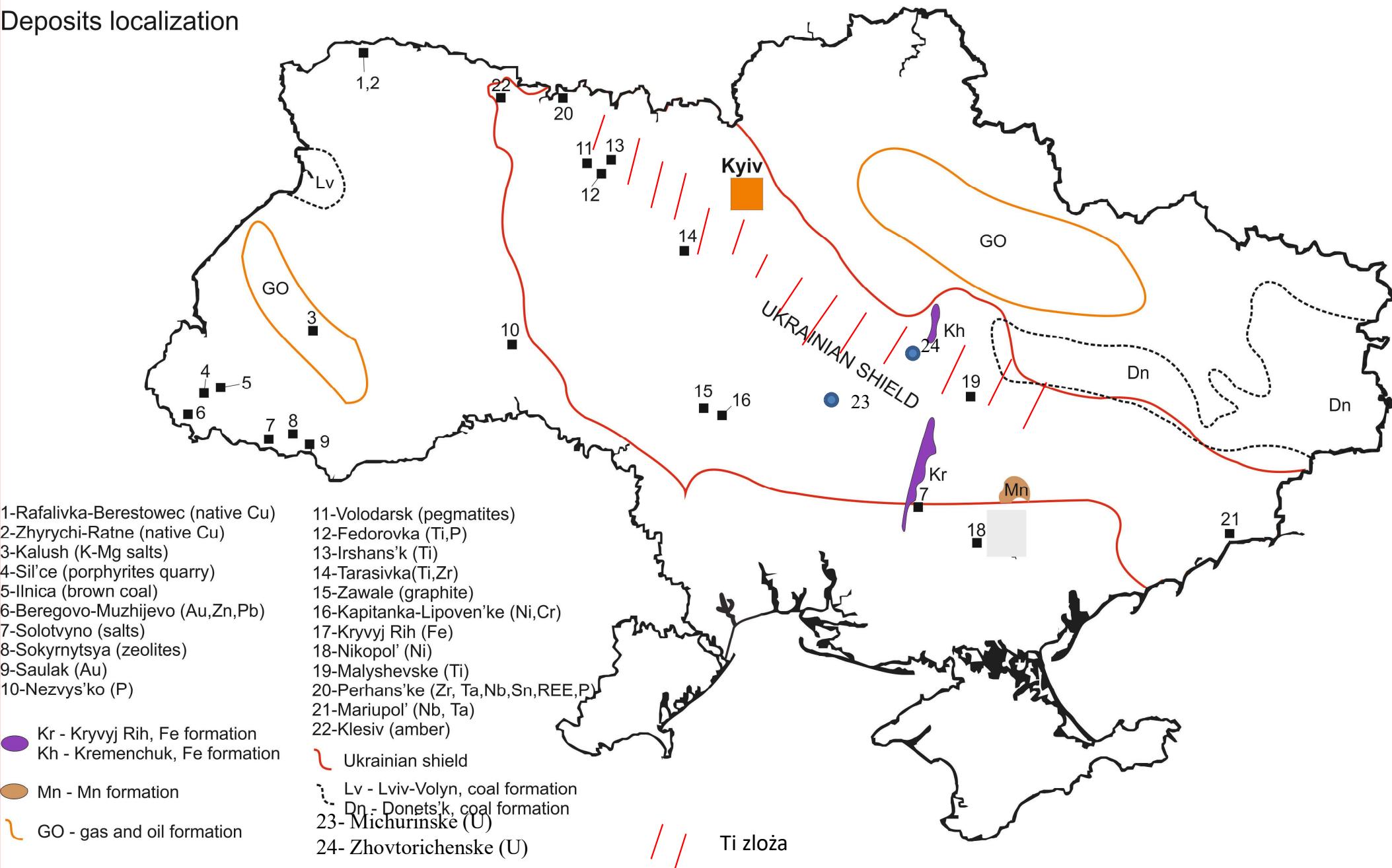


Mapa tarczy ukraińskiej (Boborov, 2016)

Złoża mineralne Ukrainy?

- Czarna metalurgia (złoża Fe, Cr, Mn, Ni)
- Złoża Ti
- Metale kolorowe (Cu, Zn, Pb,)
- Złoża metali krytycznych (Nb, Ta, Sc, Zr, PGM's, REE, Be)
- Złoża Au
- Złoża grafitu
- Złoża uranu

Deposits localization



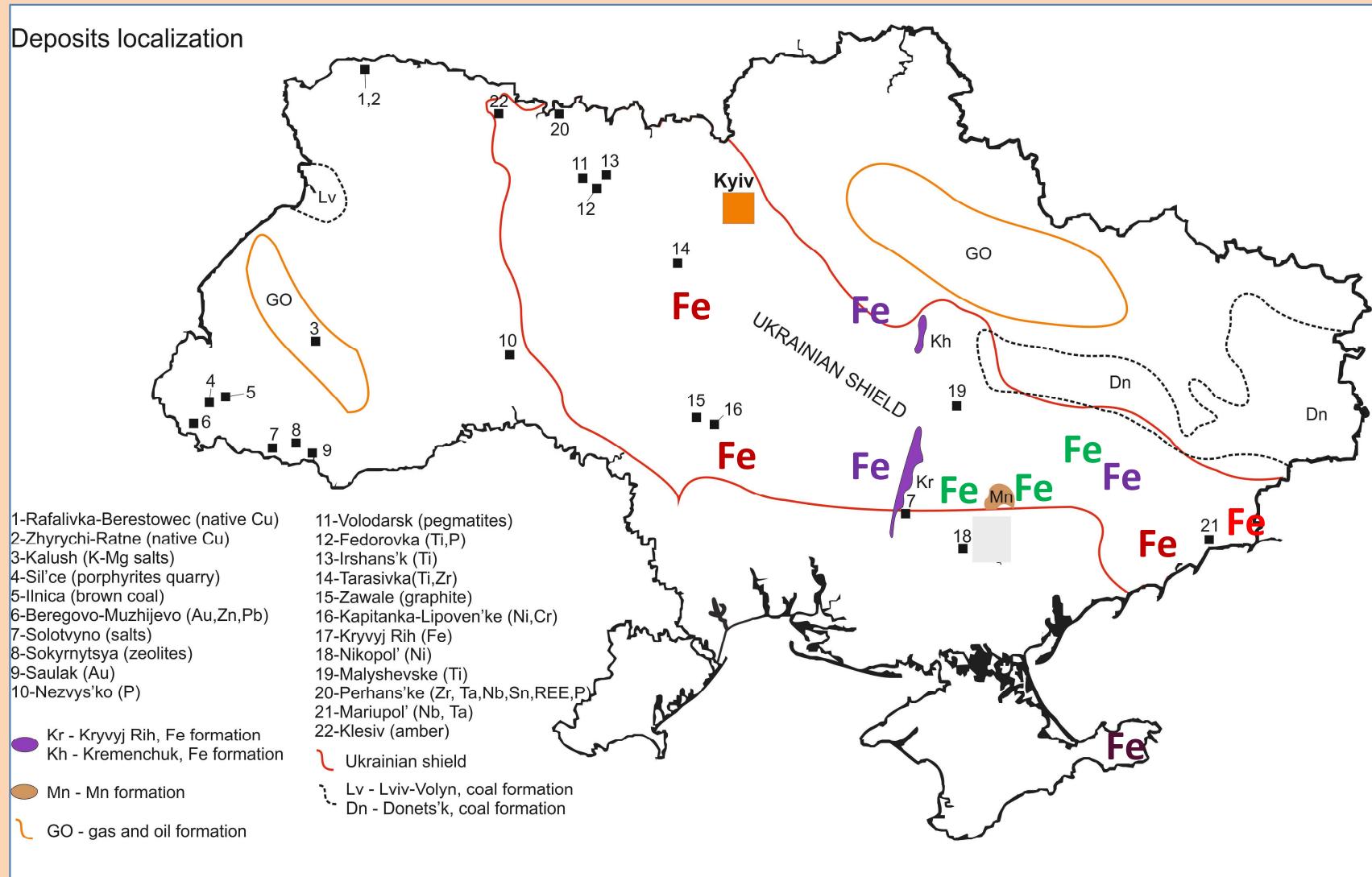
Fe (52 zloża, 24 czynne)

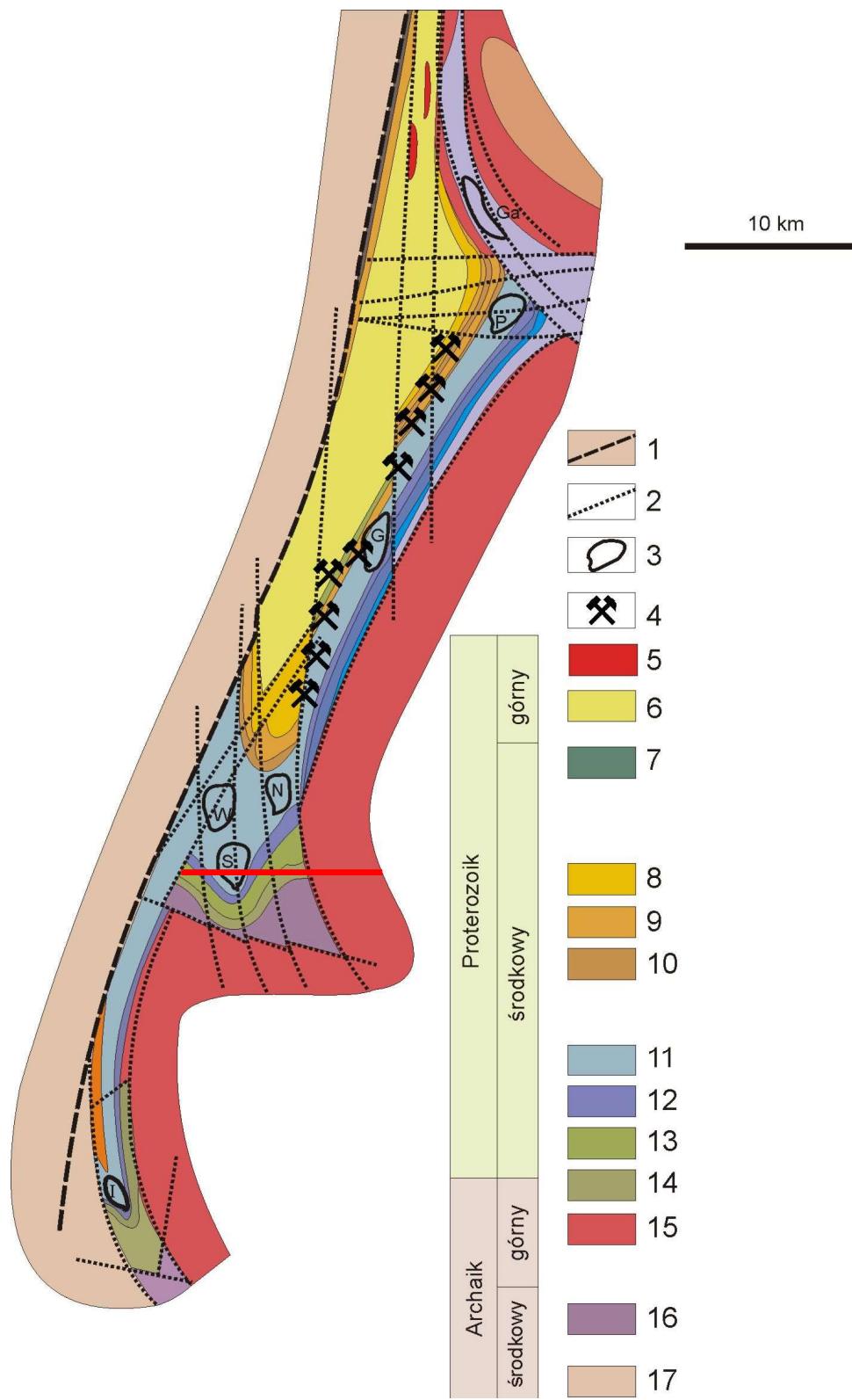
Archaik – green schists: Belozhierski (3.4 Gt/6 Gt), Pridnieprovskyi, Konskyi

Neo-Archaik: Odessa-Belocerkovskyi, Volodarskyi, West-Priazovskyi

Paleo Proterozoik: Krivyj Rih (21.8 Gt/ 19 Gt), Krementchuk (5.8 Gt/35 Gt), Huliepol

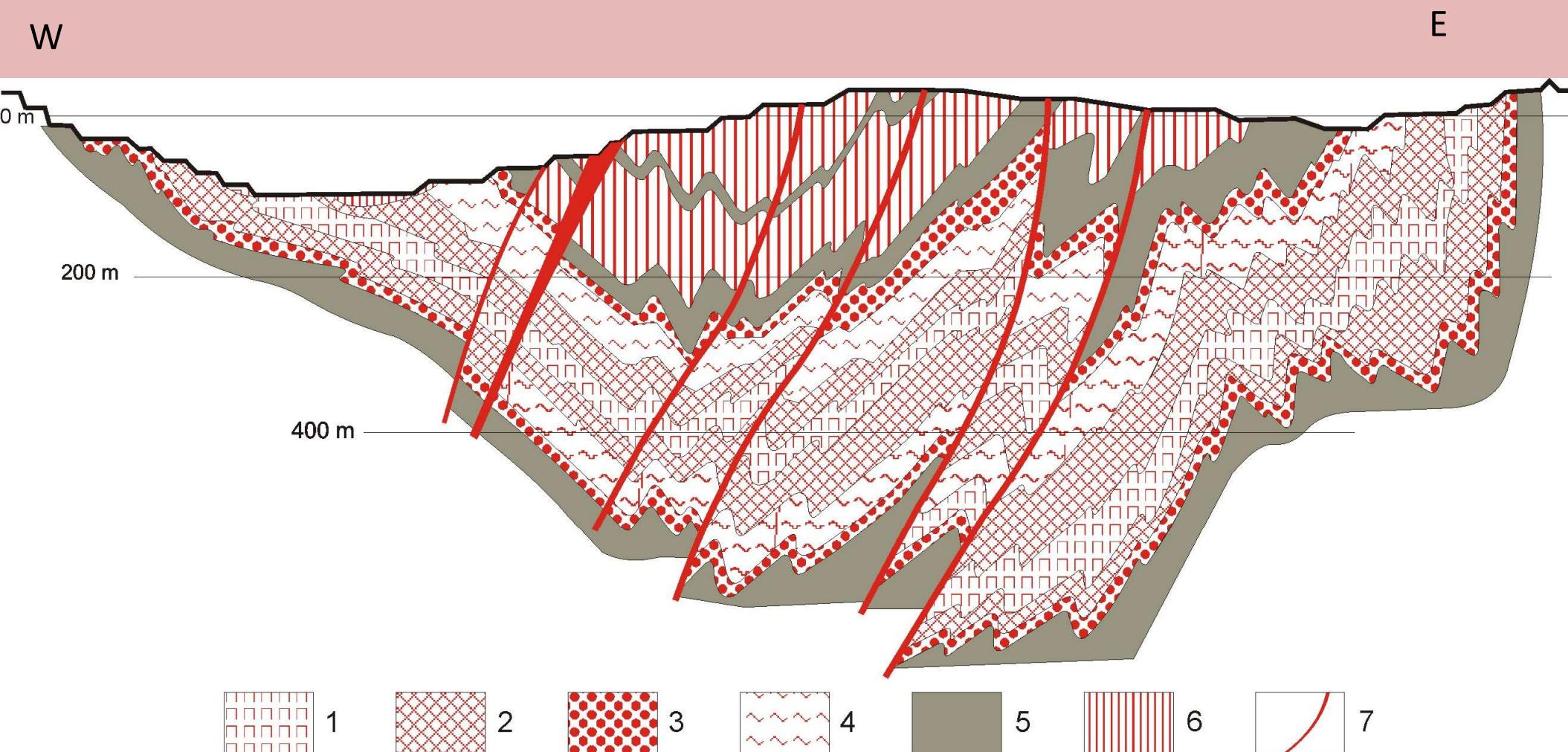
Górná Kreda: Kerch (1.1 Gt) (after Bobrov, 2005)





I- Inhuleckie
 S- Skelevatskie
 N-Novokryvorohskyie
 W-Valavkynskie
 G- Glevatskye
 P- Piervomayskiye
 Ga - Gannivskiye





1- ruda hematytowo-magnetytowa, 2- ruda magnetytowa 3- ruda magnetytowo-węglanowa, 4-kwarc-magnetytowo-węglanowa ruda, 5-horyzonty łupkowe, 6- utlenione Fe-kwarcyty, 7- uskoki



Yugok, 2010



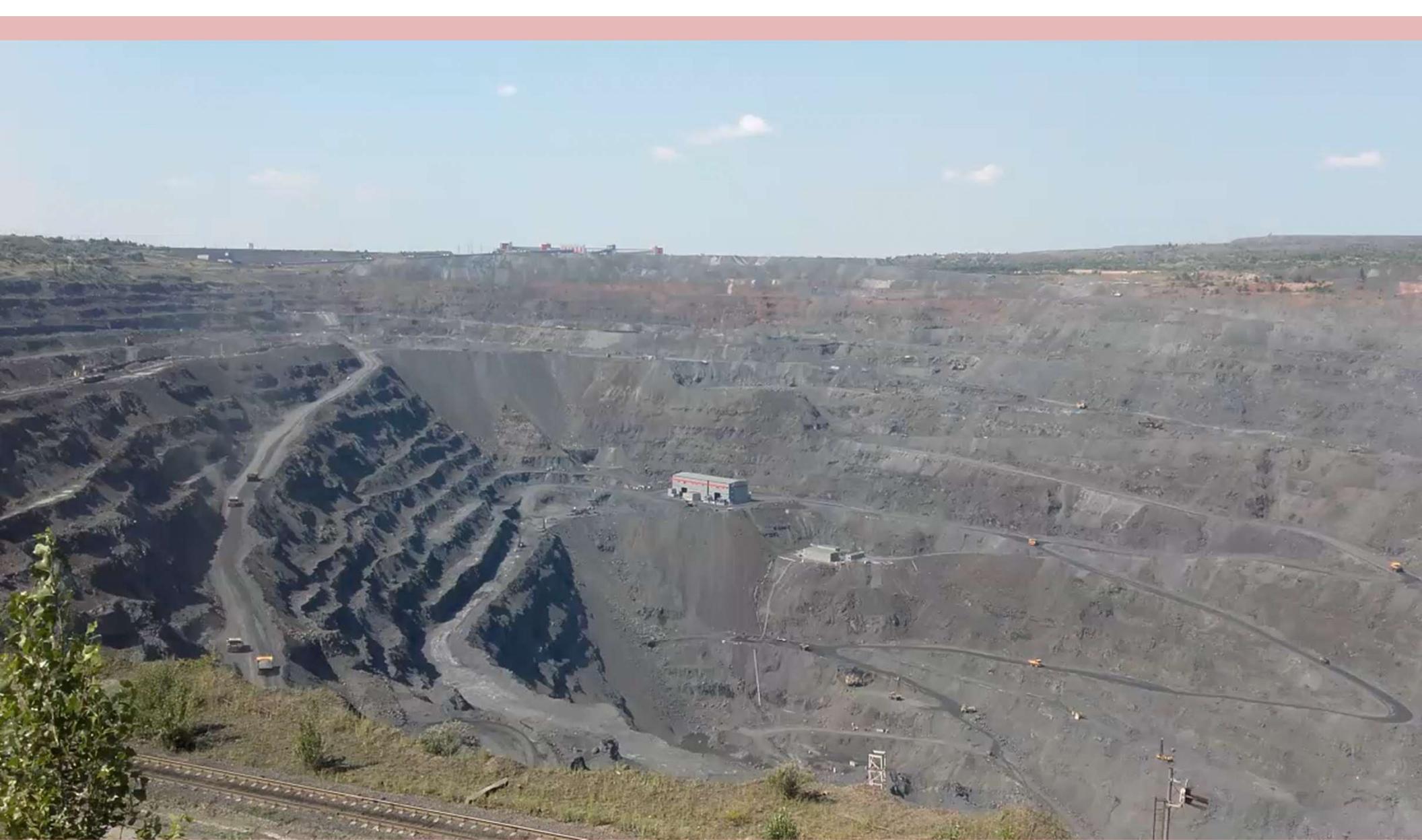
Yugok 2008



Yugok, 2010

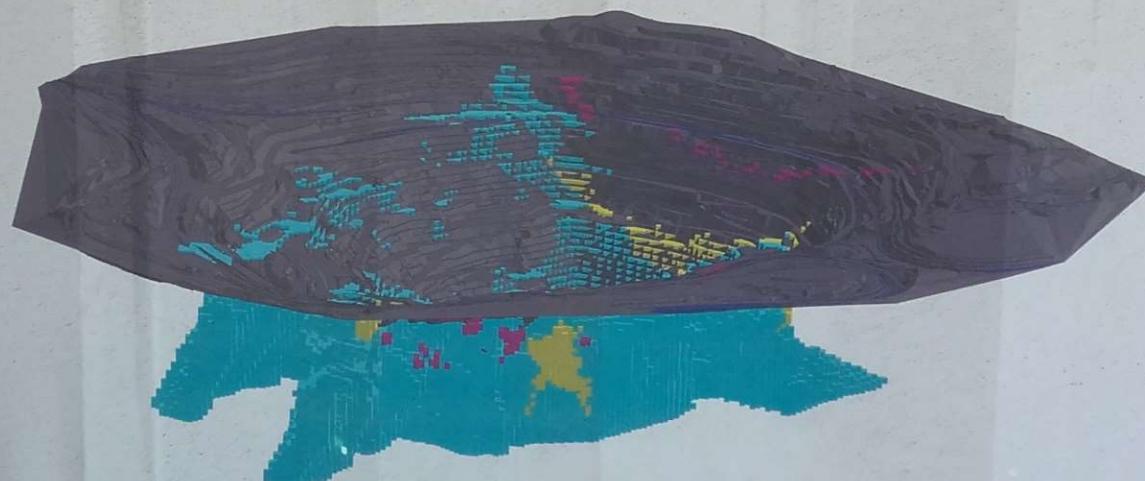


Yugok, 2013 r.



Piervomaysk, W. Zygo, 2010

- В 1961 году были начаты горно-капитальные работы по вскрыше рудного тела Первомайского карьера
- В 1962 году была отгружена первая тонна железной руды
- В 2012 году добыта **1 000 000 000 ТОНА РУДЫ**



Параметры	Проект	Факт
ГЛУБИНА КАРЬЕРА	750 м	485 м
ДЛИНА	3 500 м	3 200 м
ШИРИНА	3 000 м	2 600 м

Piervomaysk



**Wychodnie kwarcytów żelazistych,
Krasnaja Bałka, Krzywy Róg**

Miąższość [m]	horyzonty	Litologia
640	VII Fe horyzont	amphibole-chlorite-magnetite, ribeckite-magnetite, & hematite quartzites
350	VII łupkowy	magnetite-carbonate-amphibole & chlorite-amphibole schists + barren quartzites
350	VI Fe horyzont	magnetite-, silica-magnetite & carbonate-magnetite quartites
300	VI łupkowy	silica-chlorite and biotite-chlorite schists with magnetite
300	V Fe horyzont	ferruginous-mica-magnetite, magnetite, & carbonate-silica-magnetite quartzites
120	V łupkowy	chlorite-biotite, amphibole-chlorite schists with graphite
700	IV Fe horyzont	silica-carbonate-magnetite, carbonate-magnetite, silicate-magnetite quartzites
300	IV łupkowy	sericite-chlorite, sericite-biotite schists + barren quartzites
50	III Fe horyzont	magnetite-silic-quartzites
140	III łupkowy	graphite-chlorite-biotite schists + barren quartzites
150	II Fe horyzont	magnetite quartzites, Q-carbonate-magnetite
60	II łupkowy	biotite-chlorite-amphibole schists + barren quartzites
400	I Fe horyzont	magnetite quartzites, Q-magnetite, biotite-quartz
300	I łupkowy	amphibole-chlorite-biotite schists + barren quartzites

**VI^t –horyzont rudny
kwarcyt, Magnetyt,
egiryne
27.5 %Fe**



Fot. W. Zyg, 2010

V – horyzont łupkowy:
Kwarz, magnetyt,
cummingtonit
13 %Fe





BIF

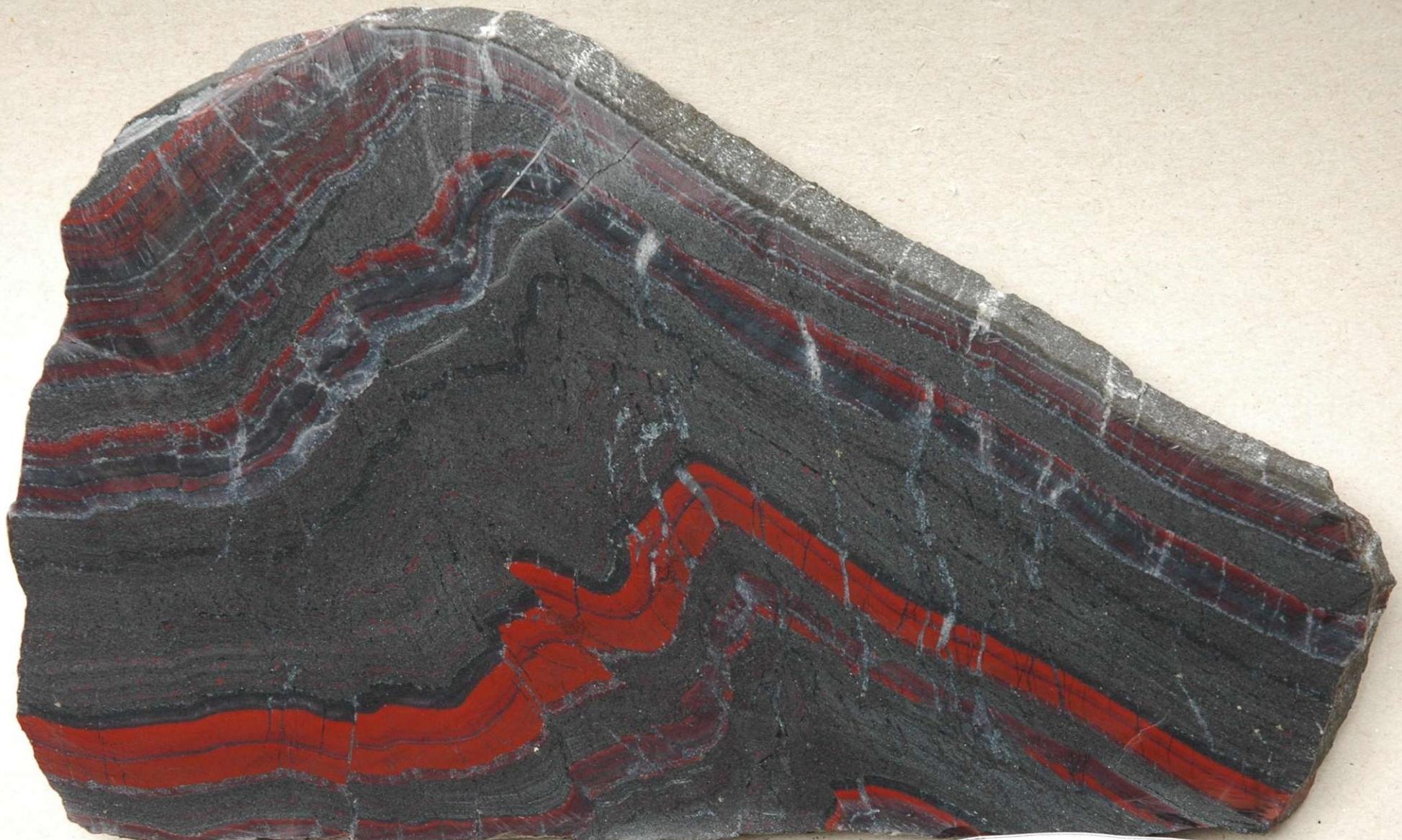
II horyzont rudny
Cummingtonit-
magnetyt







Ukraine , 2011



5cm



5cm



5cm



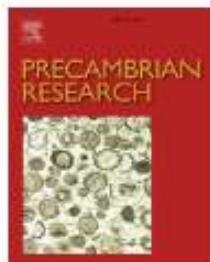
5cm



Contents lists available at ScienceDirect

Precambrian Research

journal homepage: www.elsevier.com/locate/precamres



Silver-gold and polymetallic mineralization in the banded iron formations deposit in Kryvyi Rih, Ukraine

Anatolyi Berezovsky^a, Jadwiga Pieczonka^{b,*}, Adam Piestrzynski^b

^a Kryvyi Rih National University, 11 Vitaliy Matusevych St, Kryvyi Rih 50027 Ukraine

^b AGH-University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection, Al. Mickiewicza 30, 30-059 Krakow, Poland

ARTICLE INFO

Keywords:
Au-Ag-Sb-Cu-Pb mineralization
First discovery
BIF
Kryvyi Rih

ABSTRACT

Since the beginning of iron mining in Kryvyi Rih in 1881, gold was a target of interest. Exploration for gold began in 1936. As a result, many gold occurrences were discovered. In this paper, regional geology of the gold mineralization and the iron deposit details are also described for better understanding of the position of hydrothermal mineral association. Gold - silver and polymetallic mineralization was found in the iron ore horizon in the Ingulets operating iron open pit. A new association of gold and Sb-bearing sulfosalts is described. Gold occurs in an association with arsenopyrite, pyrite, and pyrrhotite in quartz-arsenopyrite veins type mineralization discovered in the Ingulets quarry. Gold was found as minute inclusions in arsenopyrite and as inclusions in Ag-Sb-, Pb-Sb-, Ag-Pb-Sb- sulfosalts. Based on both ore microscope and EMP measurements, the following minerals have been identified: arsenopyrite, pyrite, pyrrhotite, tetrahedrite, freibergite, sphalerite, chalcopyrite, galena, stibnite, plagonite, zinkenite, fulopite, miargyrite, chalcostibite, andorite, and native Sb and electrum. It is the first discovery of Ag-Sb-Cu-Pb mineral association in the whole Kryvyi Rich structure. In this paper quantitative EMP measurements of all new minerals of the newly discovered association are presented. The baro-acoustic decrepitation analyses of the massive arsenopyrite and pyrite showed temperature formation ranging between 450 °C and 650 °C with an average of T = 585 °C. Based on mineralogical investigations, ore occurrences are considered as the product of high and middle temperature hydrothermal processes.

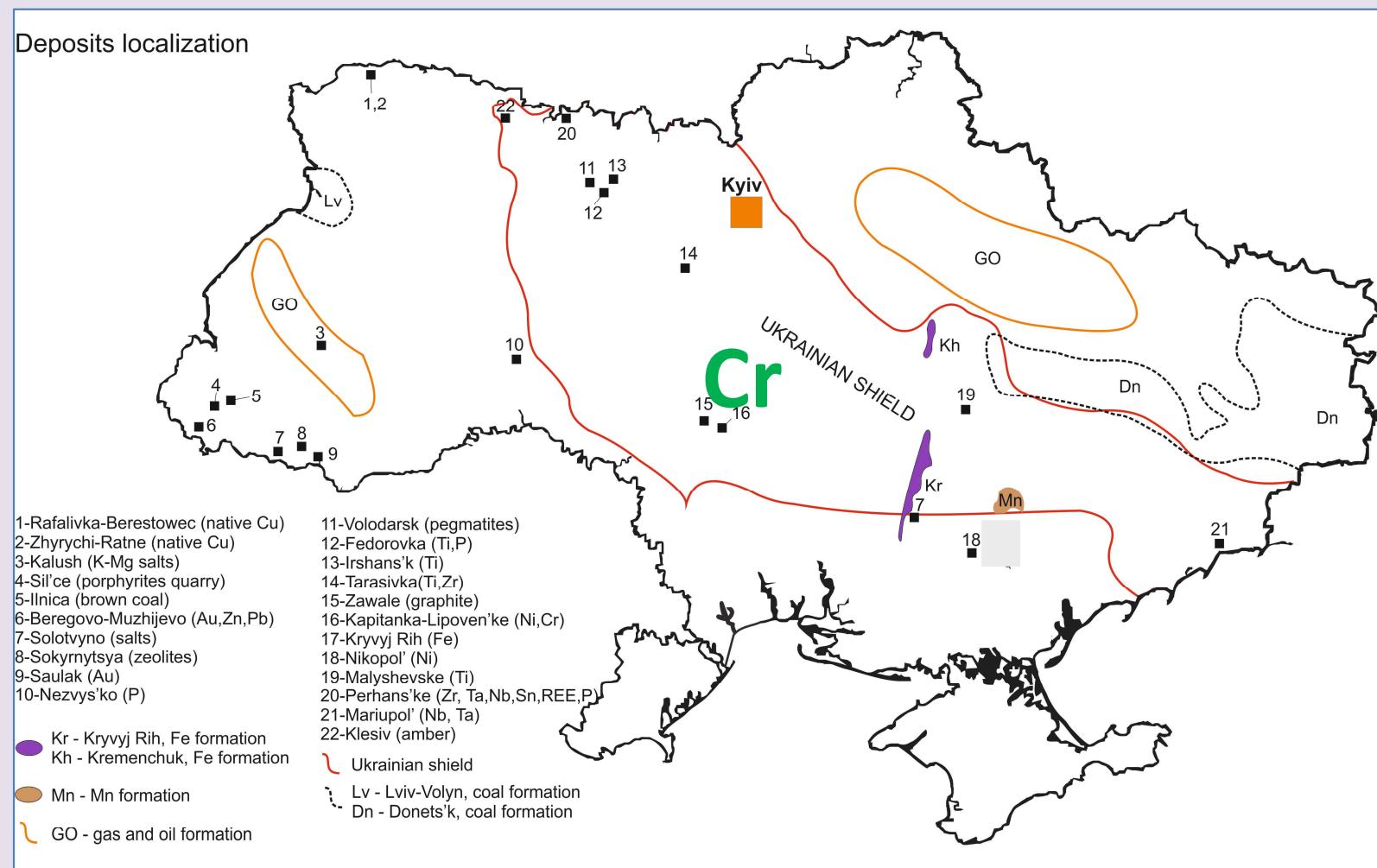
Złoża rud Cr

masyw Kapitanski: 7 złóż (P2 - progностyczne)

zasoby: 11-31.2 Mt @23,5%-29% (wg. Kulish & Kalinin, 2005)

P3: 15 złóż, 50-170 Mt (600m) @ 28% Cr₂O₃ Cr:Fe = 1.7-3.3

Wg. Volnovskyi, 1998





Lipovienki, 2010



Lipovienki, 2010



Lipovienki, 2015



cm

Złoże rud Mn

Ingulec-Bazavlok field
Western – Nikopol field
Eastern – Tokmackie
Zaporozie field (eastern and western part)

Reserves + resources A+B+C1+C2 = 2.426 Gt (after Kulish and Trietiakov, 2005)

Basen Nikopol:

Obszar: 250 x 100-150km

Głębokość zaledania rudy: 10 – 130m

Grubość pokładu: średnio 2.6 m (0-3.5m)

Stratigrafia: Dolny Oligocen



Nikopol, rudy Mn

Nikopol Manganese Basin and Location of Sampling
Scale: 1:1500



Legend

- oxide Mn ore
- carbonate Mn ore
- oxide-carbonate Mn ore

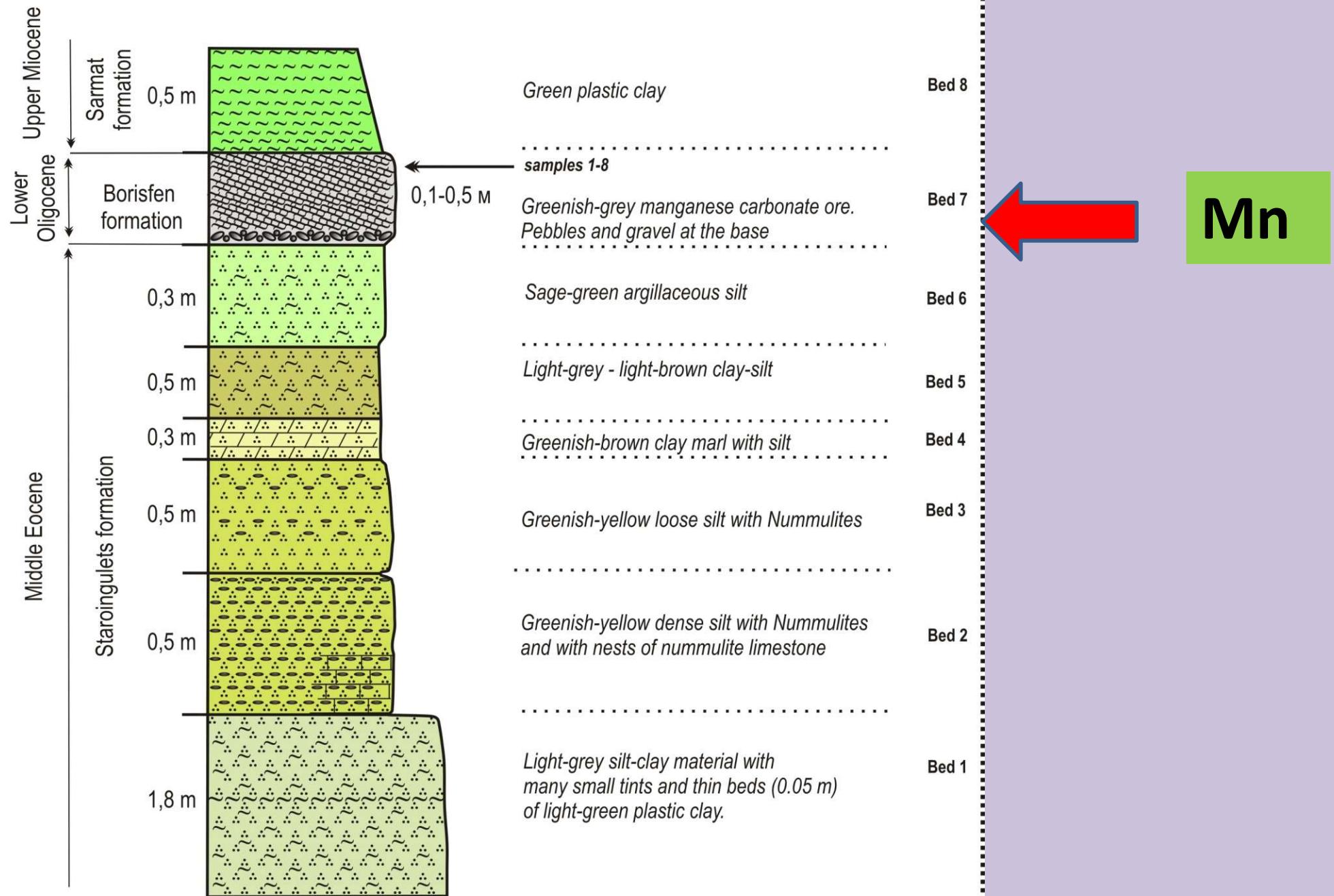


- Location of sampling:

- 1 - quarry of InGOK (samples № 1-8)
- 2 - quarry of Vizirka (samples № 20, 21)
- 3 - quarry of Ordzhonikidze (samples № 10, 11, 12)



The Geological Section Paleogene Deposits from North Part of Quarry
of Ingulets Mining and Processing Combine (InGOK), Krivoy Rog, Ukraine



Borisfen formation

Wizirka,
Ingulec, fot. 2011

Skład chemiczny rud Mn; odkrywka In-GOK

MnO_2 – 0 %

SiO_2 – 10,94

Al_2O_3 – 8,95

Fe_2O_3 – 1,91

MnO – 29,94

CaO – 14,95

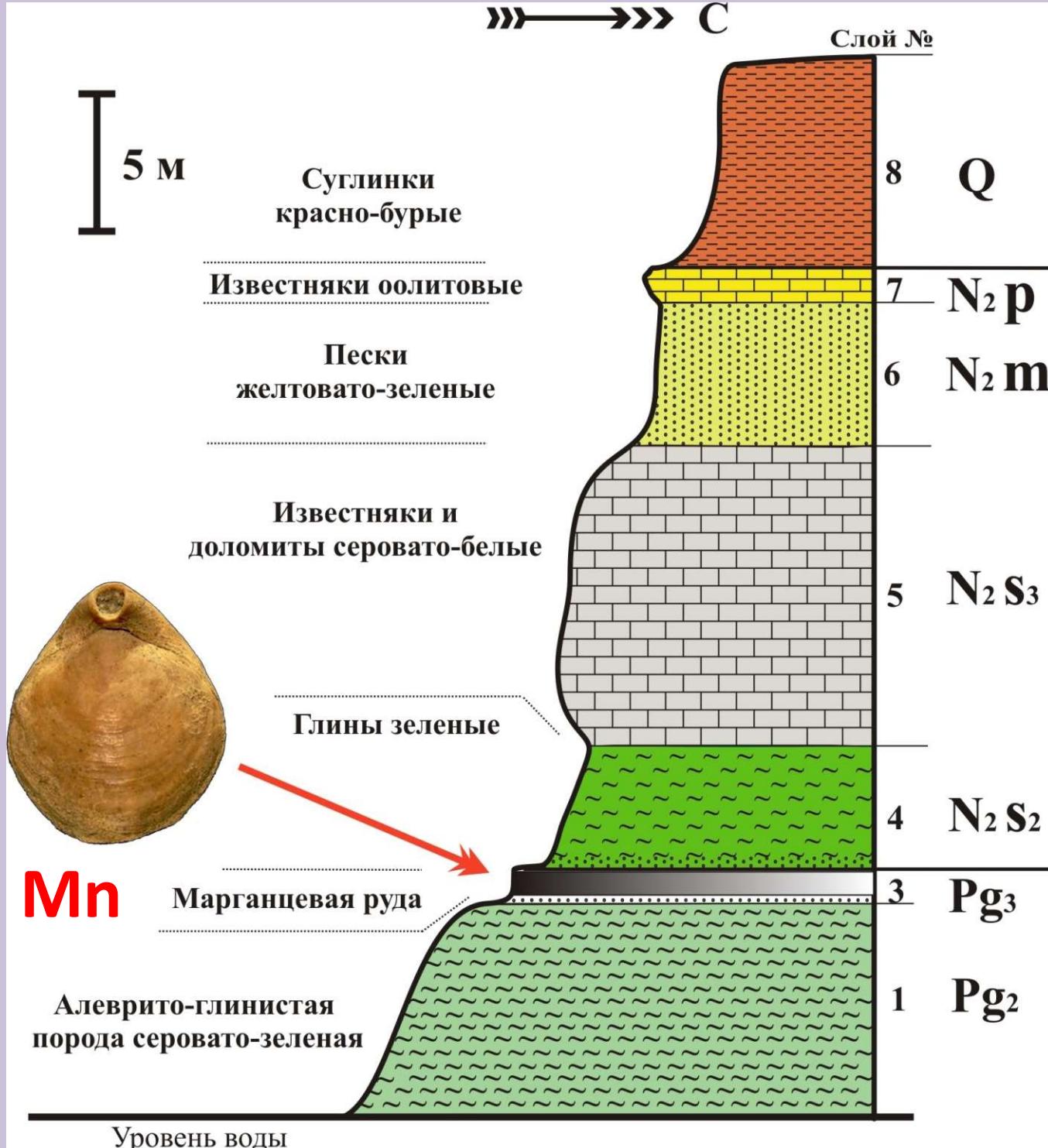
MgO – 3.22

BaO – 0.1

K_2O – 0.53

CO_2 – 27.94

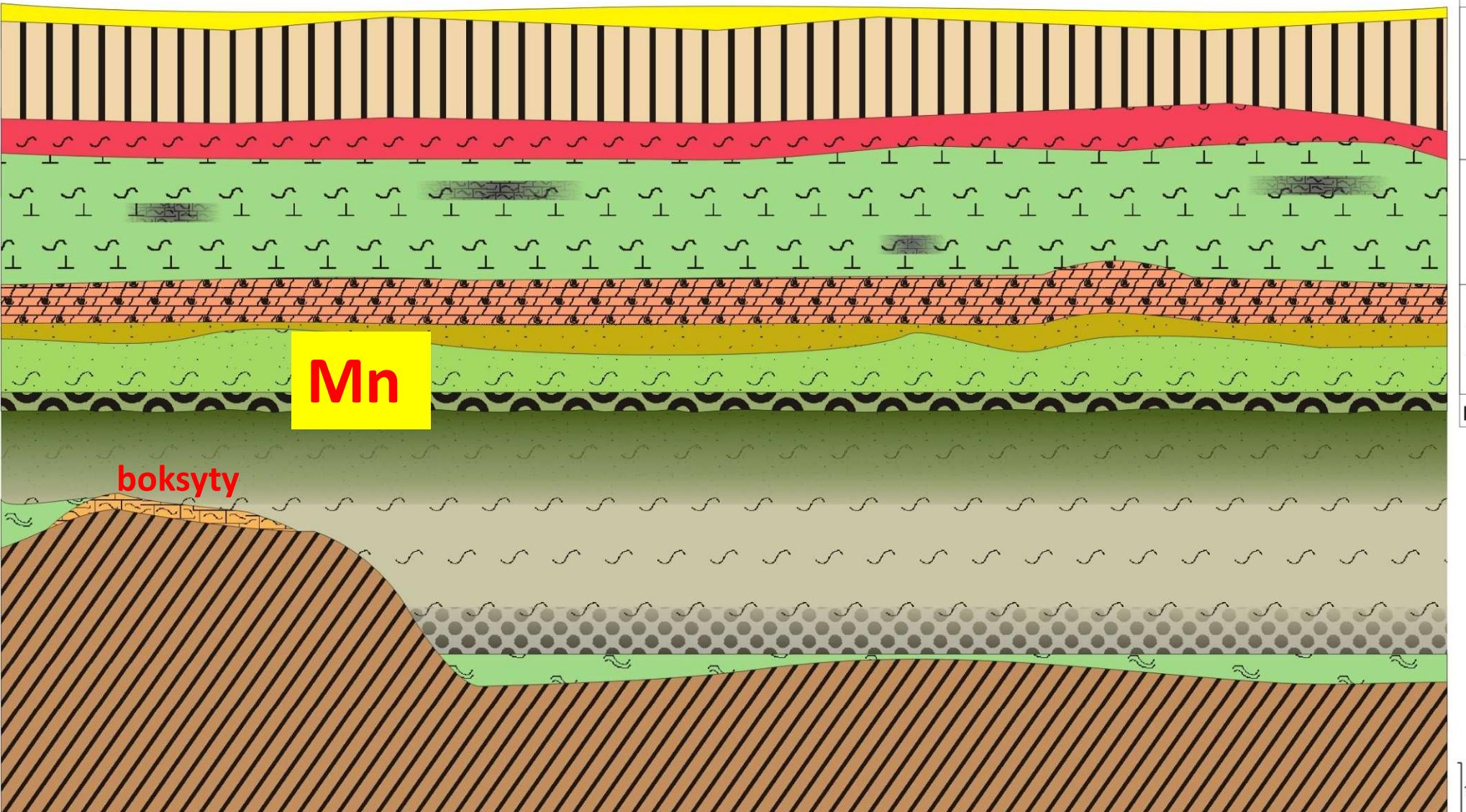




W

E

poziomy górnictwa



1 gleba	4 Iły zielone	7 Iły piaszczyste	10 Iły szare	13 kaolin
2 Iły brunatne	5 Wap. muszlowy	8 Mn	11 zlepieńce	14 boksyty
3 Iły czerwone	6 piaski	9 Glaukonit	12 Krystaliczny cokół	

Mineralogia:

Piroluzyt
Psylomelan
Manganit
Kryptomelan
Hydro-Kryptomelan
Todorkit
Manganokalcyt
Rodochrozyt
Ca-rodochrozyt
Mn-dolomit
Manganosyderyt
Minerały ilaste,
Glaukonit
seladonit



Rudy węglanowe

Ingulec

MnO₂ – 0 %

SiO₂ – 10,94

Al₂O₃ – 8,95

Fe₂O₃ – 1,91

MnO – 29,94

CaO – 14,95

MgO – 3.22

BaO – 0.1

K₂O – 0.53

CO₂ – 27.94

P2O5 – L.d.

rudy tlenkowe

Nikopol

27.4-44.8

35.7-40.0

1.5-4.86

2.17-4.44

4.3-7.3

1.06-3.86

L.d.

L.d.

L.d.

0.48-3.64

0.314-0.48

Tokmacki

15.46-49.6

13.52-58.1

2.4-5.27

5.08-12.06

2.09-15.0

1.01-12.39

L.d.

L.d.

L.d.

0.22-8.22

0.38-1.24





Odkrywka południowa, 2019



Schevchenkovska, fot. 2009



Schevchenkovska, fot. 2009



S-open pit, 2019



Odkrywka południowa, 2019

A close-up photograph of a dark, granular mineral surface, likely manganese ore. The material has a rough, irregular texture with various sized dark grey to black particles. Some lighter, yellowish-brown mineral inclusions are visible. The lighting creates highlights on the protruding particles.

Mn-ore

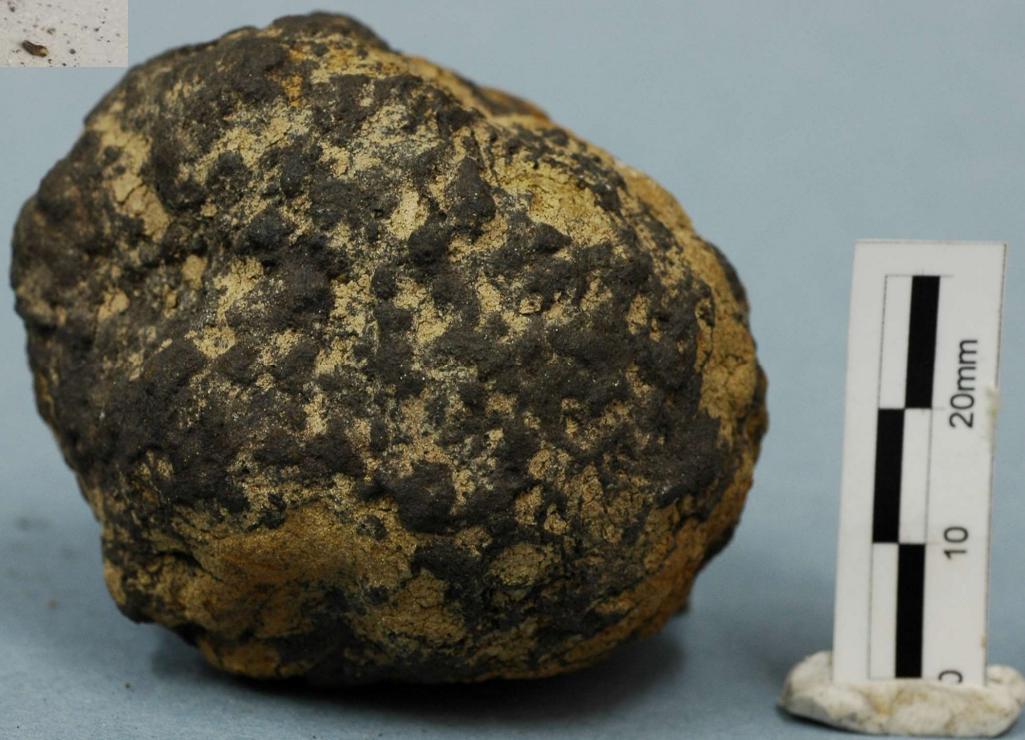
Schevtchenkovskaya, 2010



Odkrywka południowa, 2019



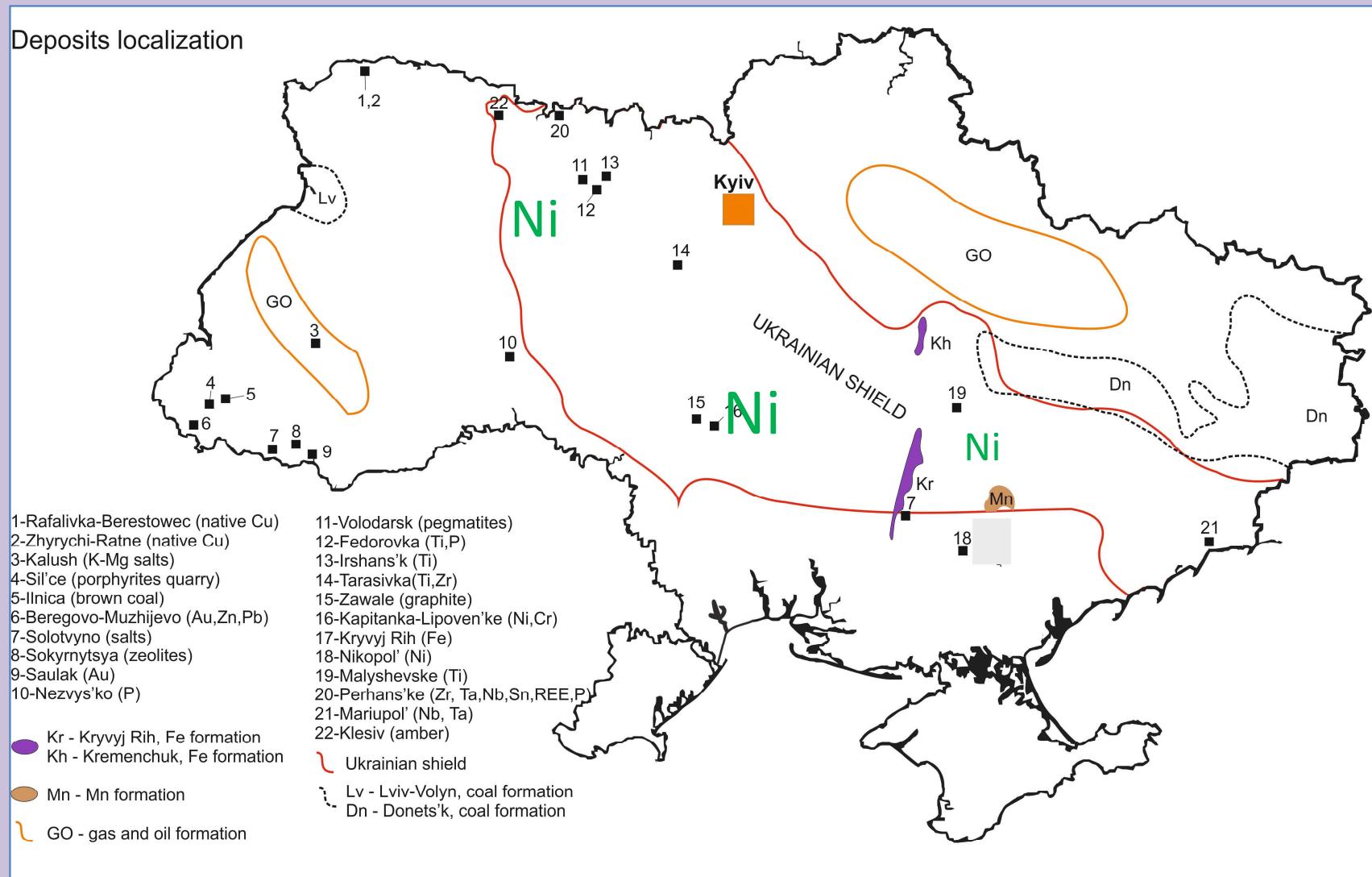
Odkrywka południowa, 2019



Złoże rud Ni

Pierwotne – Prutowskie

Wtórne (7 złoże) – 32 Mt @ 0.7-0.9 %Ni



A wide-angle photograph of a large, open-pit mine. The foreground shows the edge of a steep, brown, rocky cliff. Below the cliff, there is a large, turquoise-colored body of water, likely a tailings pond or a flooded quarry. In the background, there are more hills and mountains, some of which are covered in green vegetation and others in brown earth. The sky is blue with some white clouds.

Lipowienki

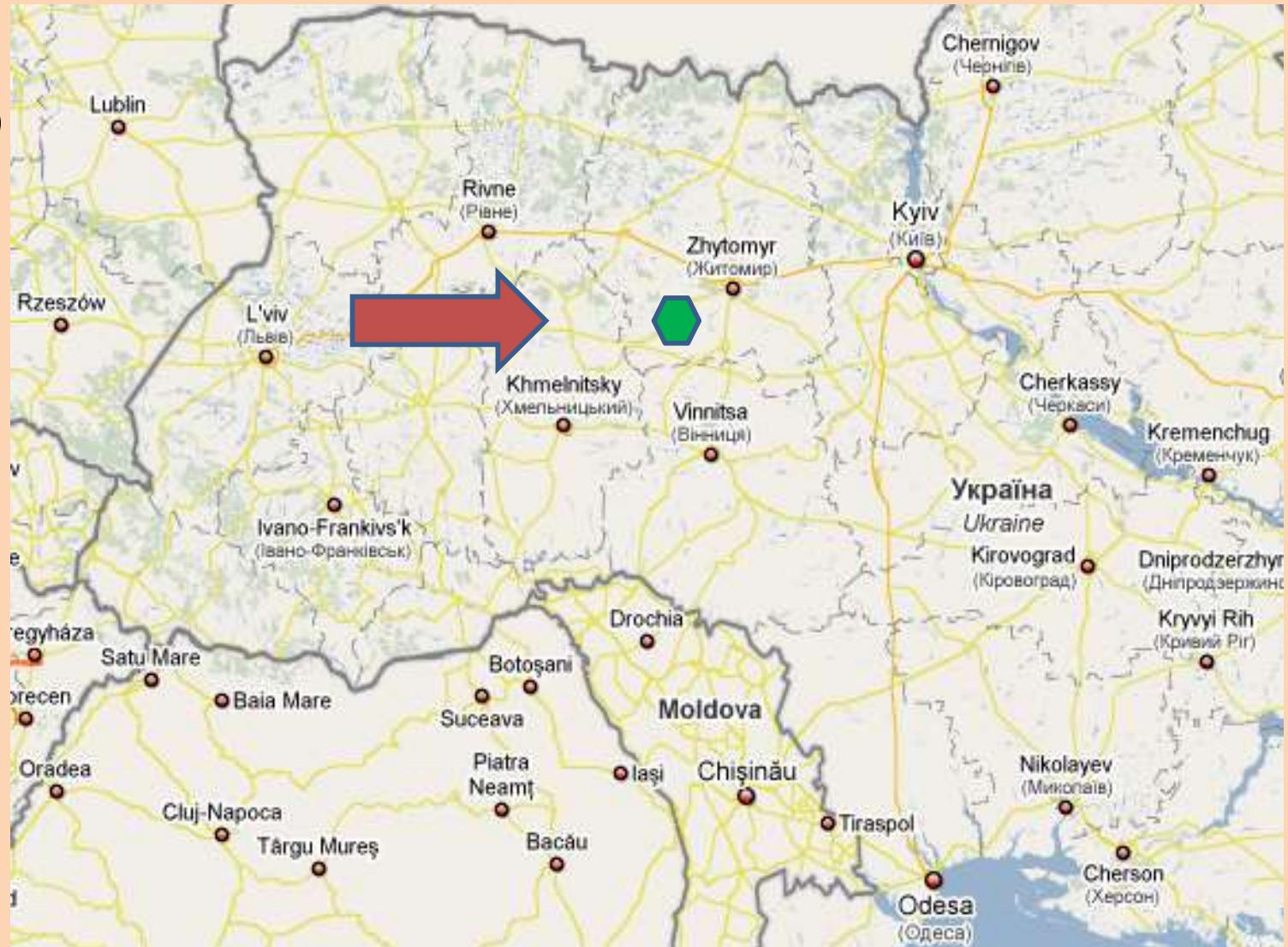




Złoże Prutowskie

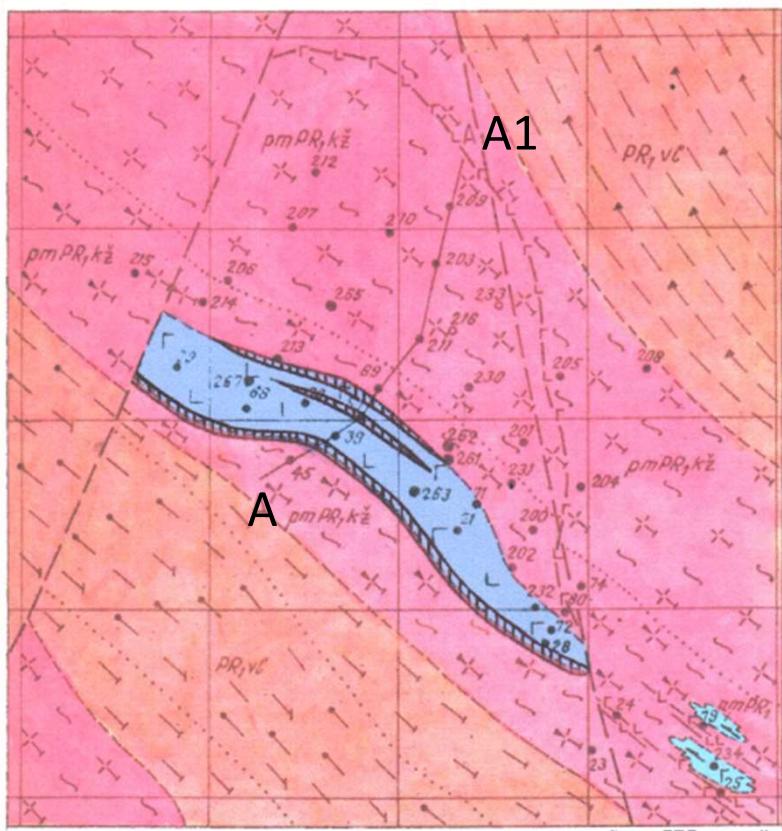
Ni, Co, Cu, Au, PGM's

Zasoby:
Ni eq. 250 000 C2+D

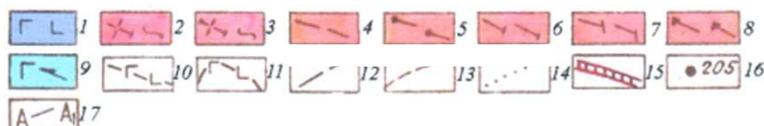


Geologia – masywu Bukinskiego

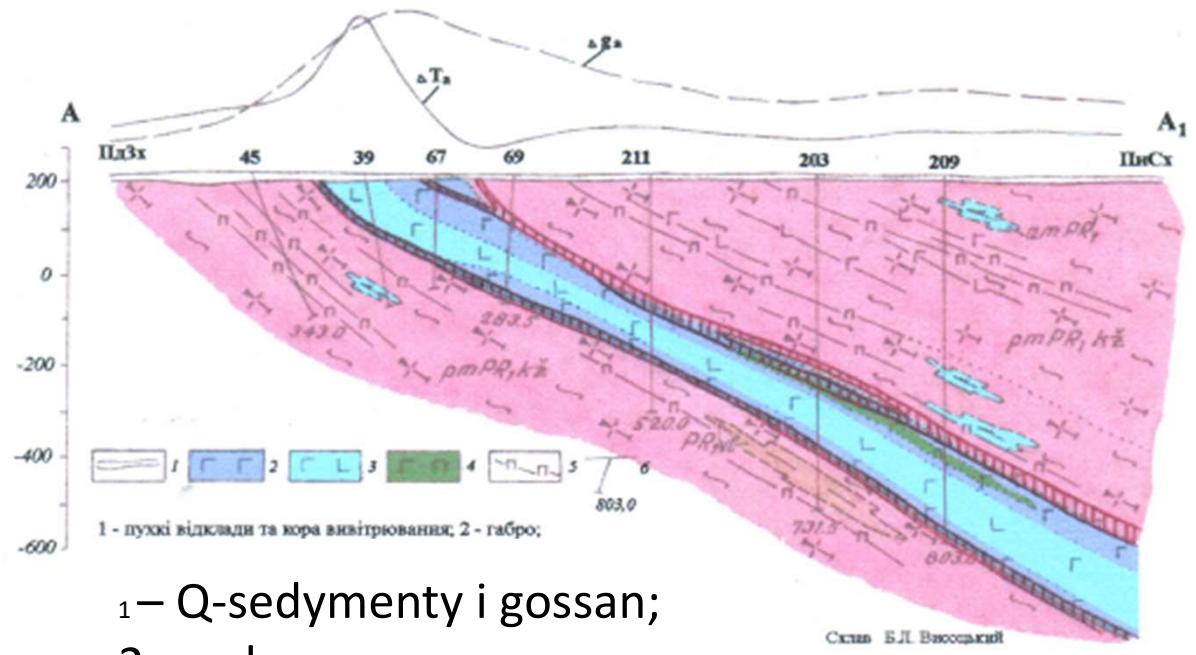
Złoże Prutowskie



gnejssy

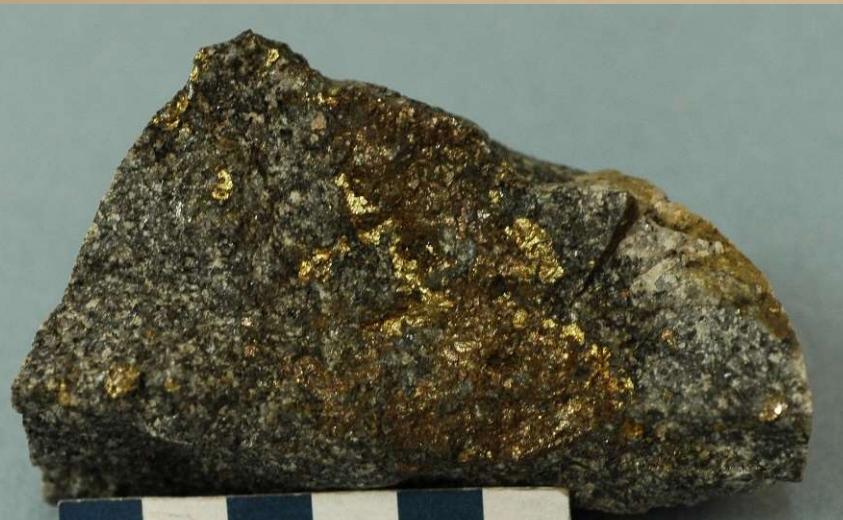


Geologiczno-geofizyczny przekrój wzduż linii A-A₁



- 1 – Q-sedimenty i gossan;
- 2 – gabro;
- 3 – gabro-doleryt;
- 4 – gabro-pegmatytowe;
- 5 – żyły pegmatytowe;
- 6 – otwory, no i głębokości

rdzenie



Charakterystyka mineralogiczna

Minerały główne:

Pentlandyt $(Fe\ Ni)_9S_8$

Co-pentlandyt

Pirotyn FeS

Chalkopirytyt $CuFeS_2$

Minerały współwystępujące:

Pirytyt

Kubanit

Violaryt

Tytanomagnetyt

Ilmenit

Chromit

Zawartości metali:

- **Ni in average: 0,58%** (max. 3,84%)
- **Cu in average: 0,26%** (max. 0,88%)
- **Co in average: 0,02%**

Au- do 0.5 g/t

Ag- 1.8 g/t

Pt do 0.25 g/t

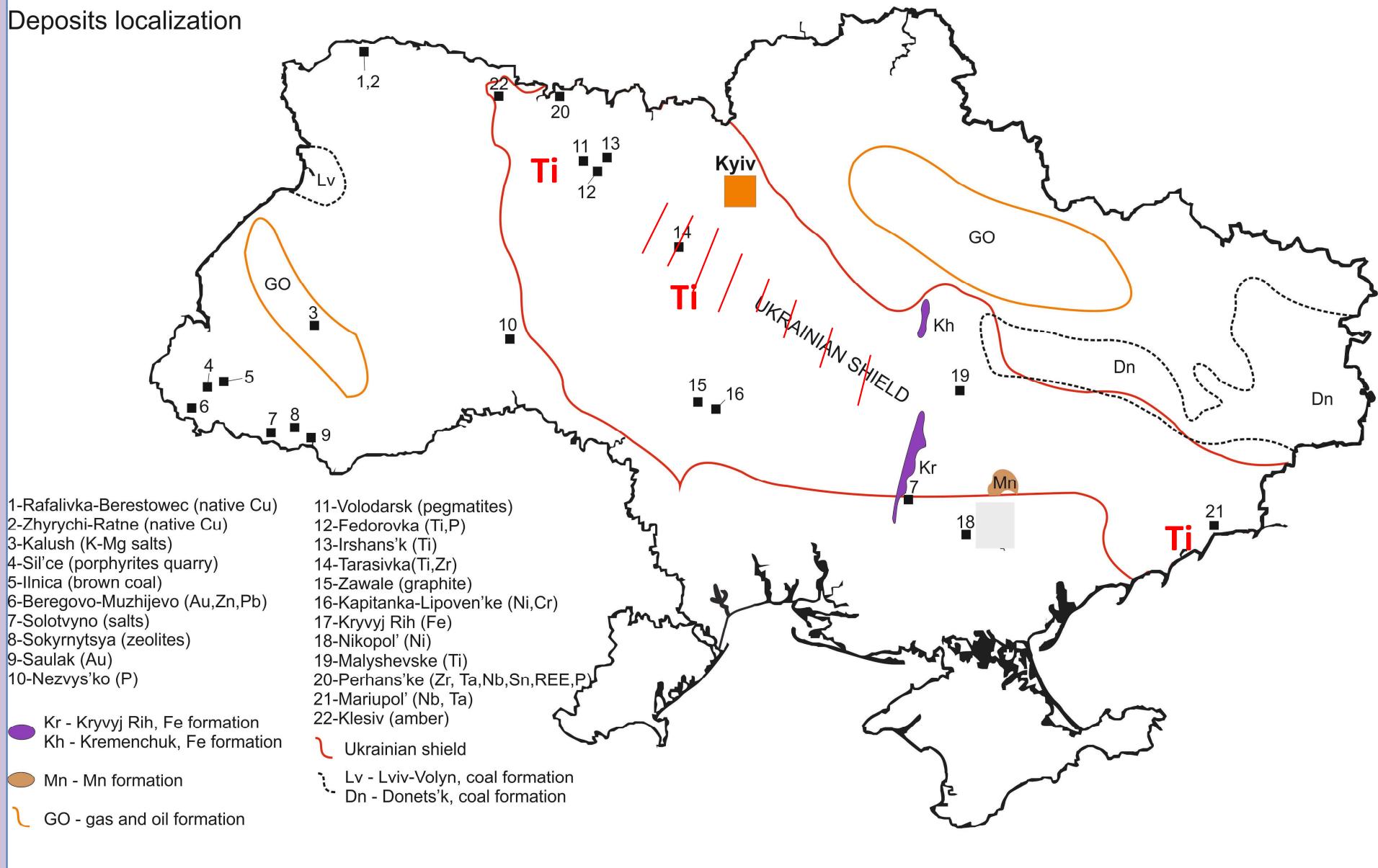
Pd do 0.35 g/t

Złoża rud Ti

Pierwotne – magmowe (3-4 złoża)

Wtórne – aluwialne, rezydualne (34 złoża)

Deposits localization



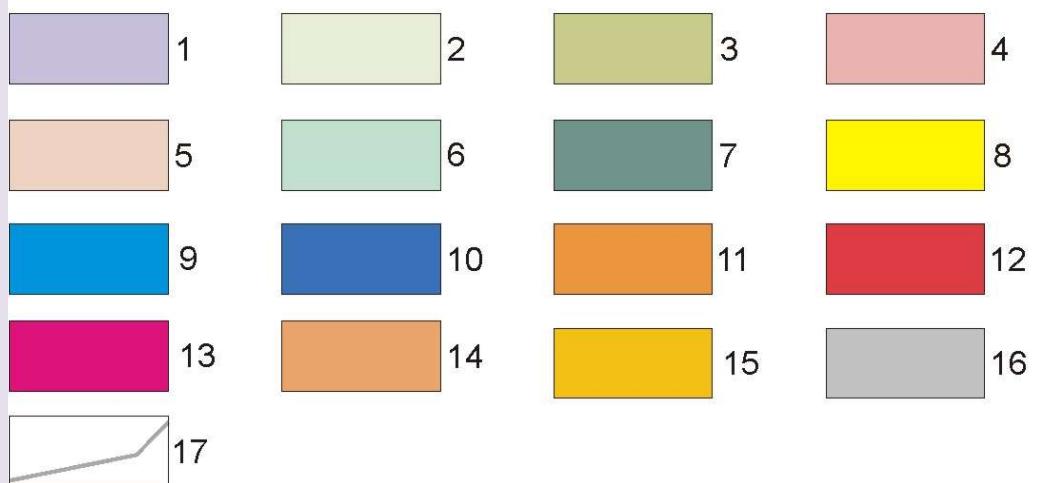
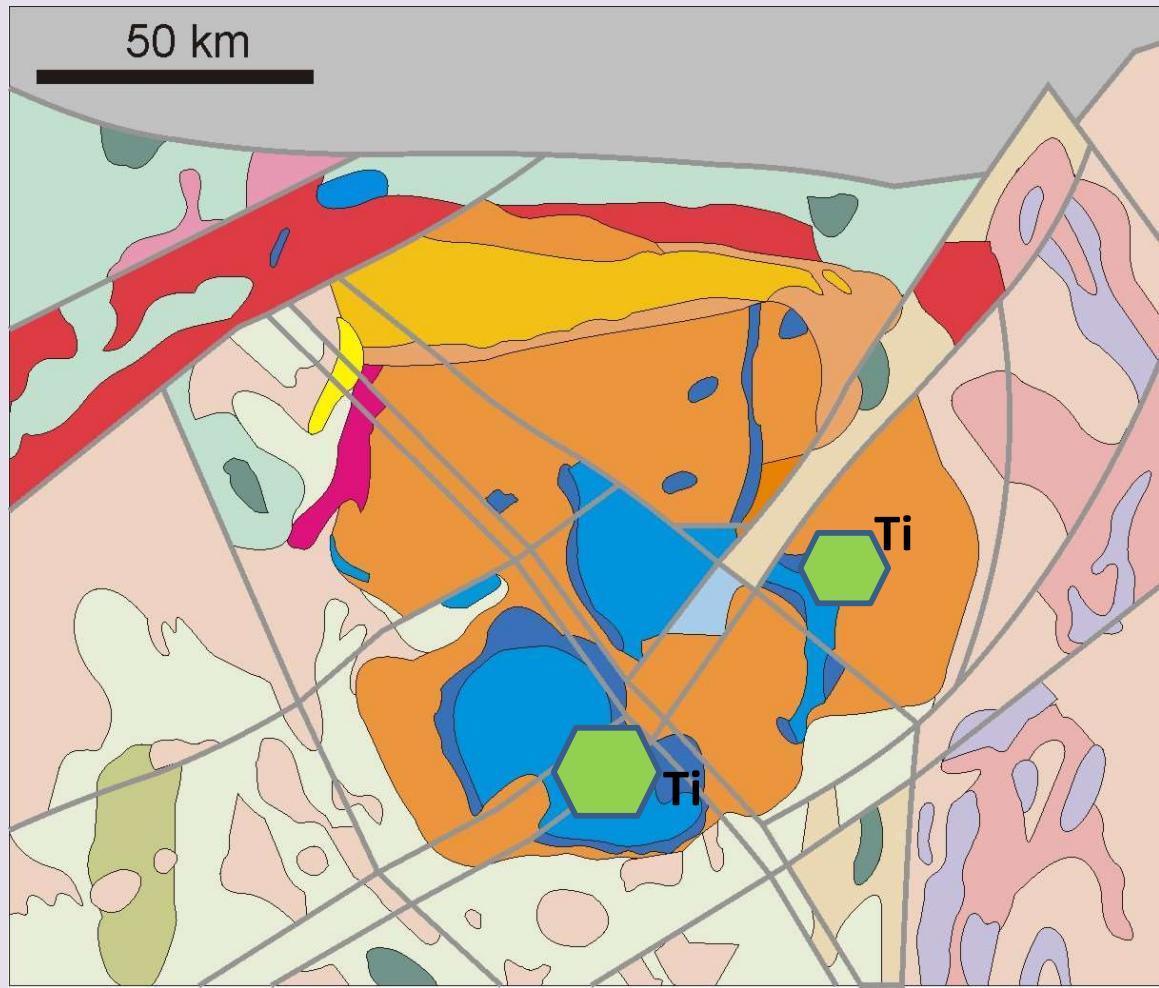
Według raportu GS na Ukrainie zidentyfikowano 78 złóż o różnym stopniu rozpoznania.

Jednak w rzeczywistości baza surowców mineralnych tytanu na Ukrainie jest reprezentowana przez około 40 złóż, w tym jedno unikatowe, 13 dużych i 10 średnich, pozostałe wymagają dalszego rozpoznania i oceny ekonomicznej.

Według niektórych szacunków Ukraina posiada do **900 mln ton łatwo dostępnych rud tytanu, co odpowiada 30% światowych odnotowanych zasobów.**

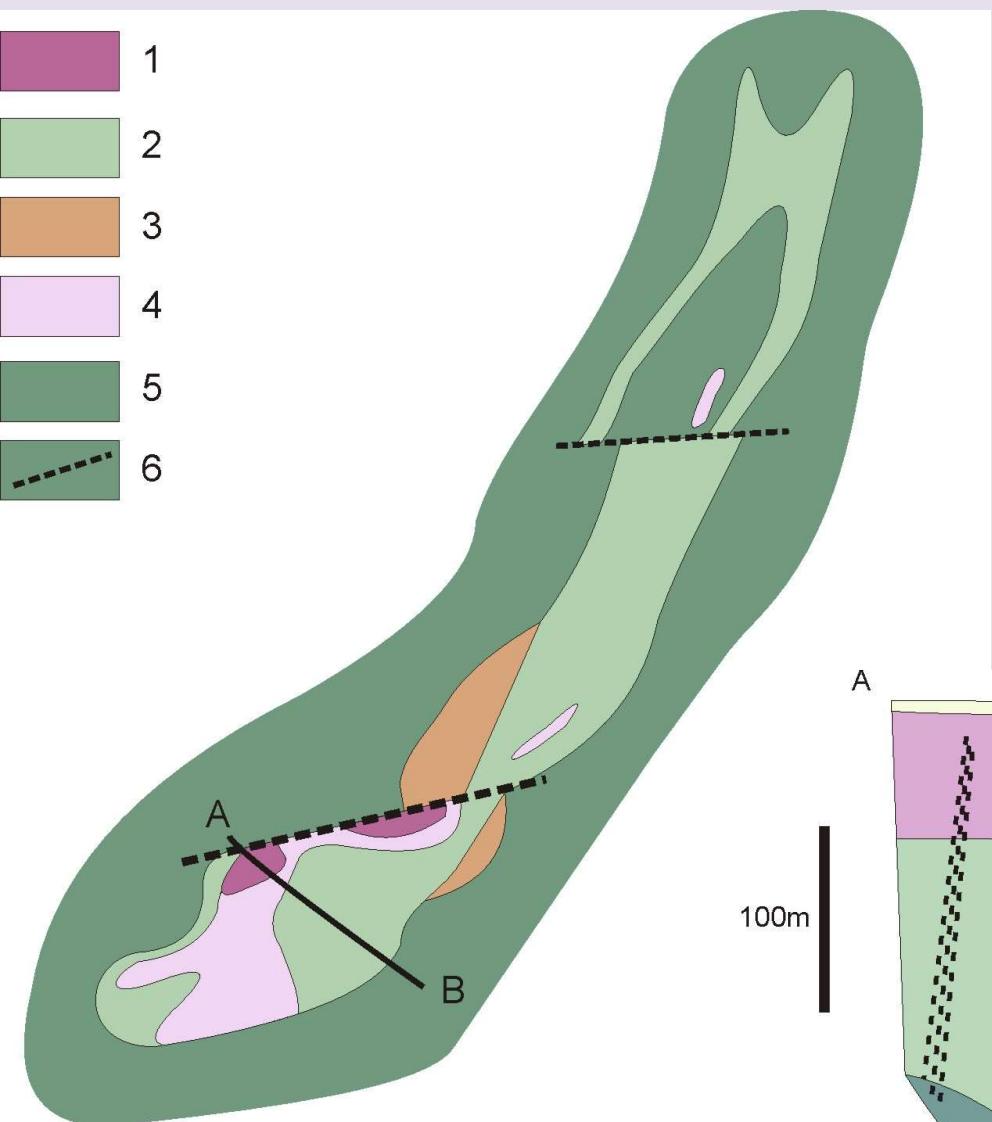
Korostenkyi pluton

50 km

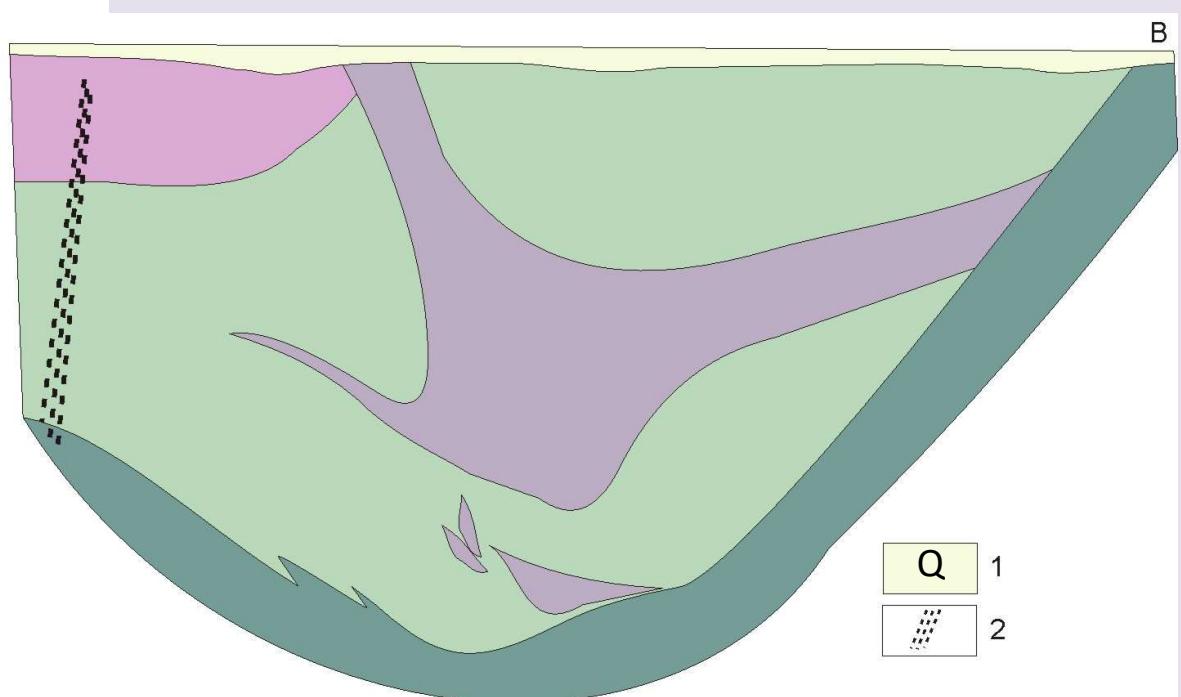


1. Metawulkanity (n-A)
2. metasedymenty (2.5-2.4 Ga)
3. Metavolkany (2.4 Ga)
4. Plagiogranity (2.1 Ga)
5. Anatectyczne granit. (2.06-2.02 Ga)
6. serie magmatyczno-wulk. (2.02-1.96 Ga)
7. intruzje po- fałdowe ((1.99-1.95)
8. Sedymenty bialocorovieckiego rowu (1.95-1.80 Ga)
9. Gabro-anortozyty (1.8-1.76 Ga)
10. Gabro-noryty, gabro (1.76-1.750)
11. Granity Rapakiwi (1.77 Ga)
12. Sub-alkaliczne granite (1.76-1.74)
13. Porfiroidy (1.74 Ga)
14. Wulkanity struktury Ovruch (1.74 Ga)
15. Q-piaskowce ovruckie (1.74-1.7 Ga)
16. Skały Phanerozoiczne rowu Prypeć
17. uskoki

Fedorivka Ti-apatyty

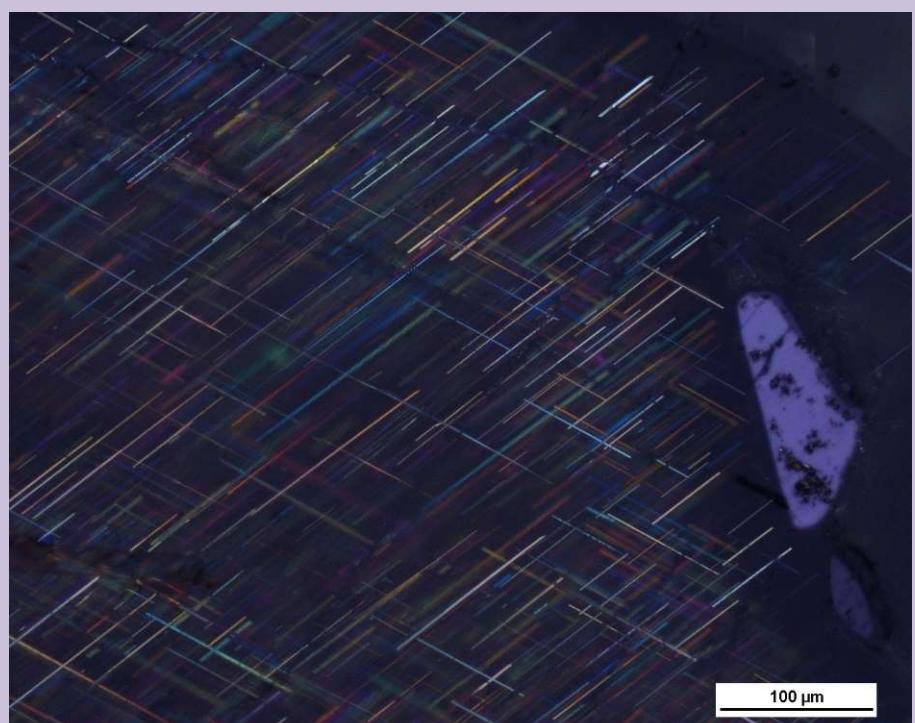
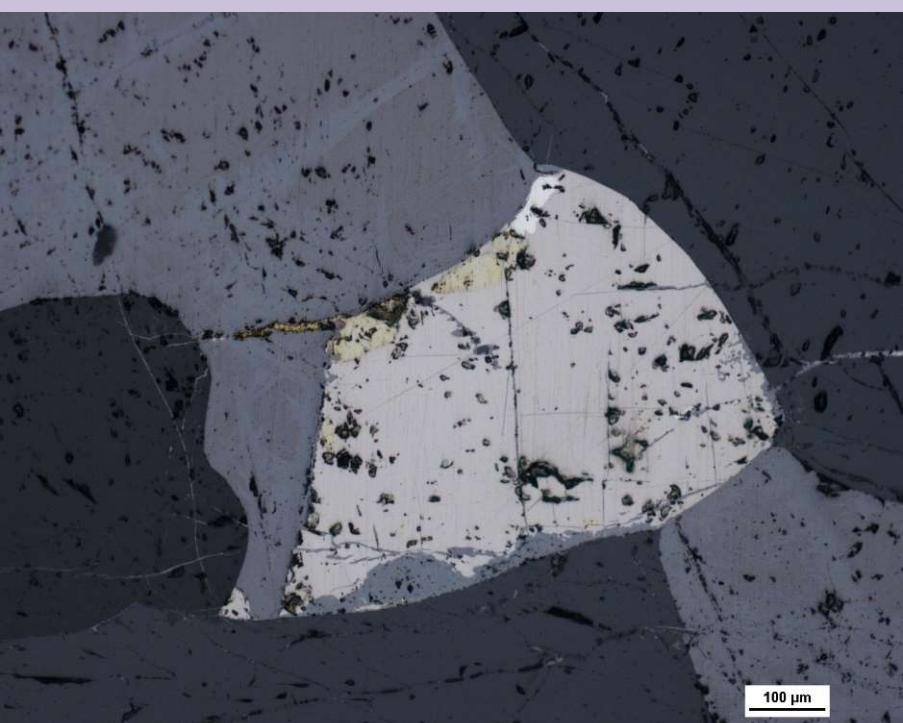
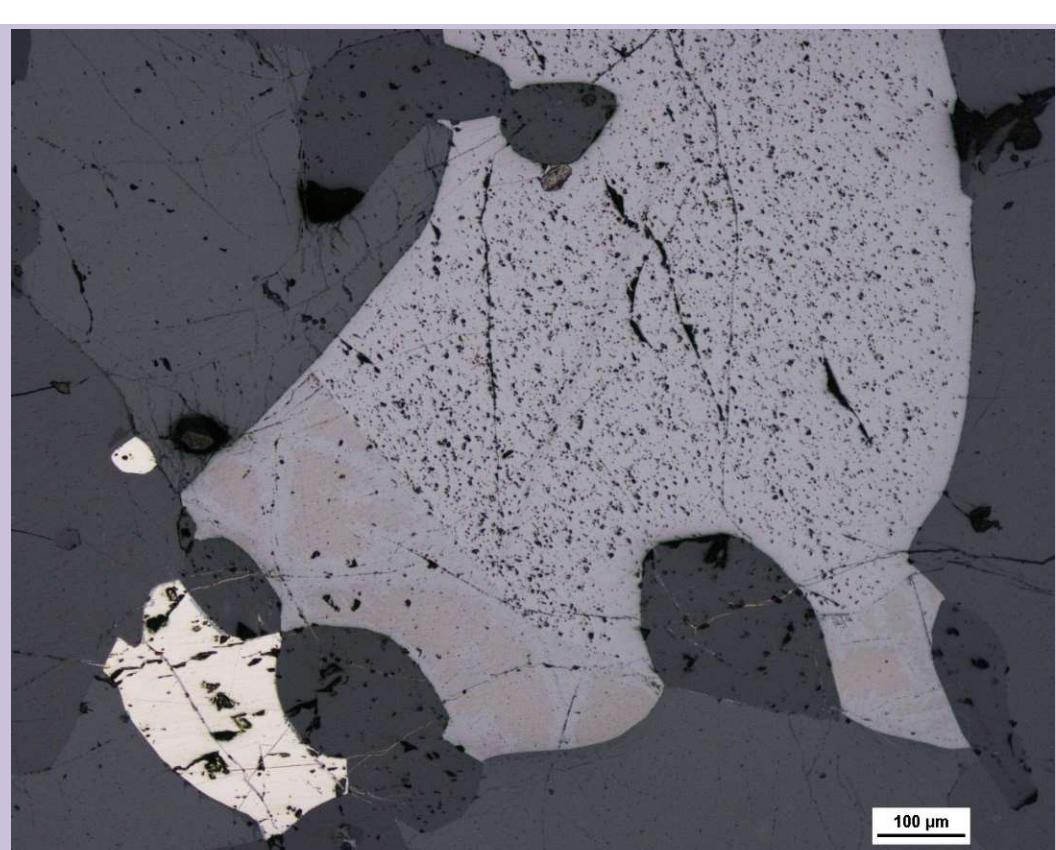
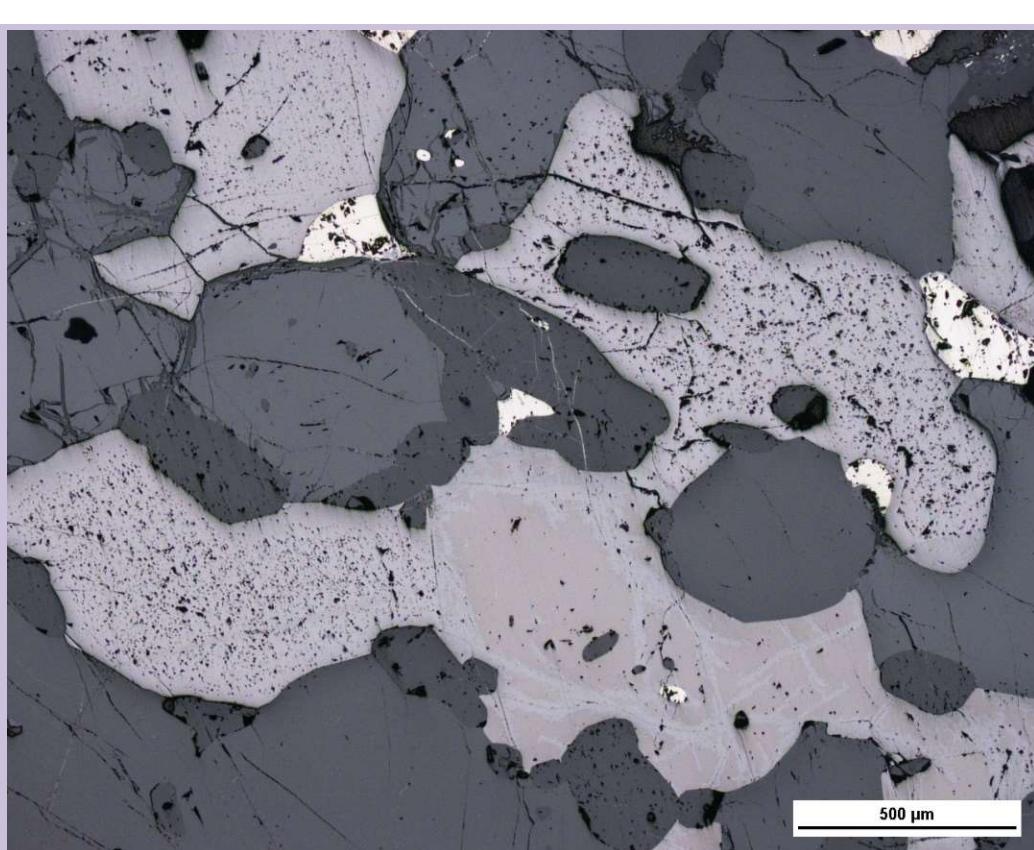


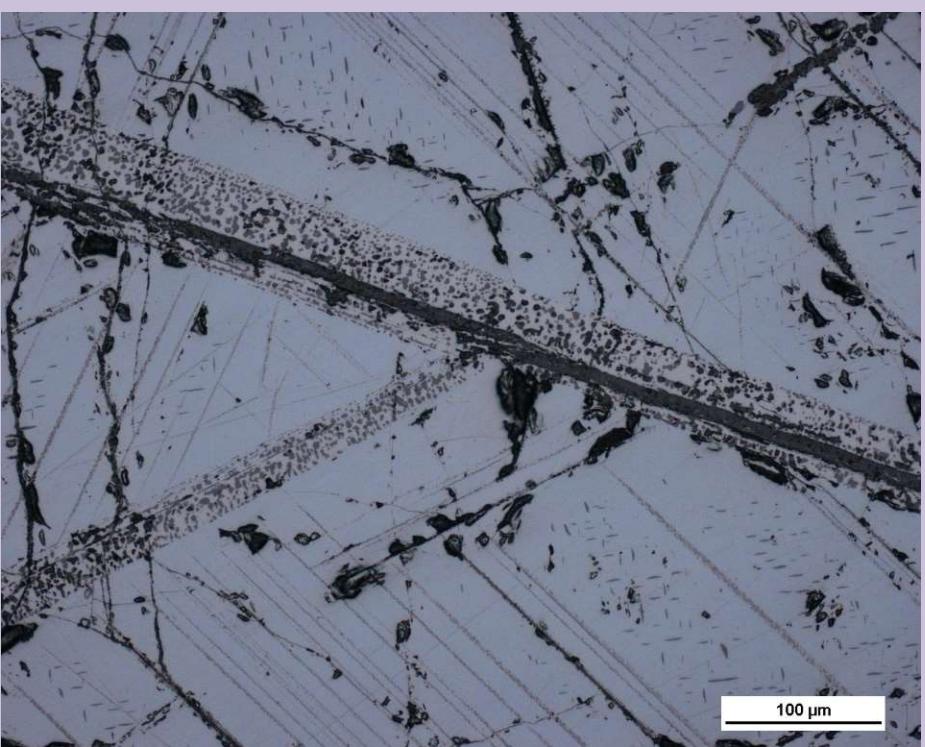
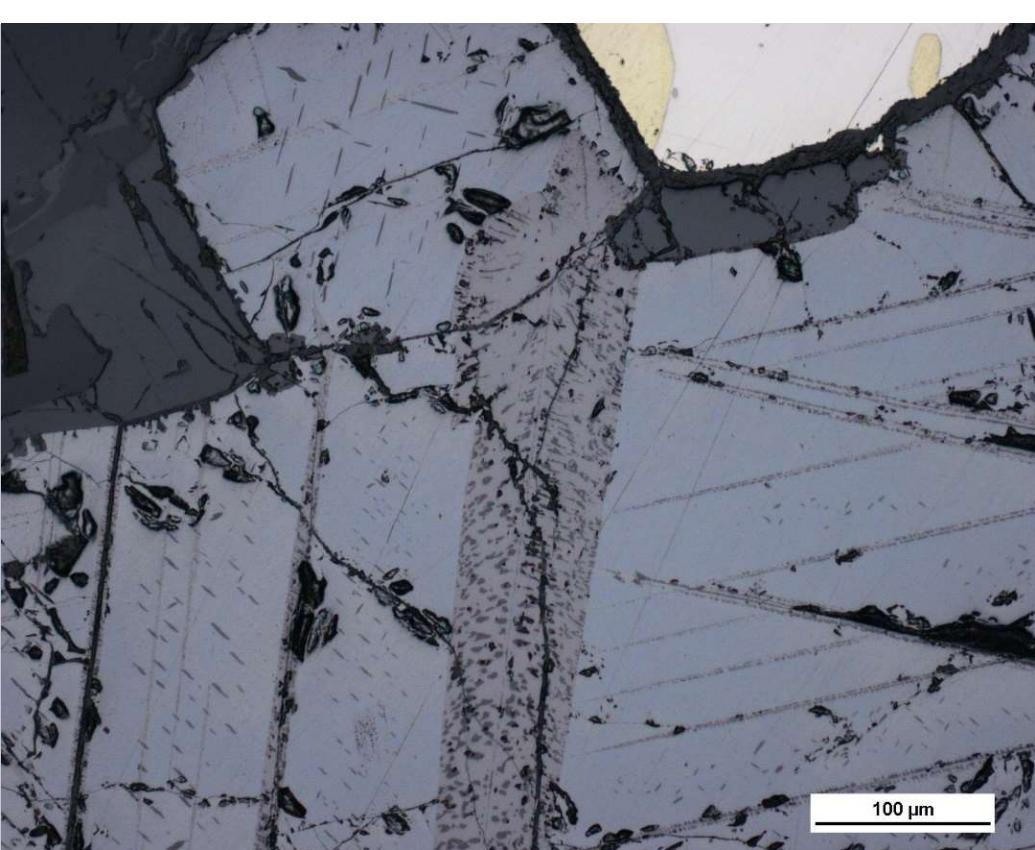
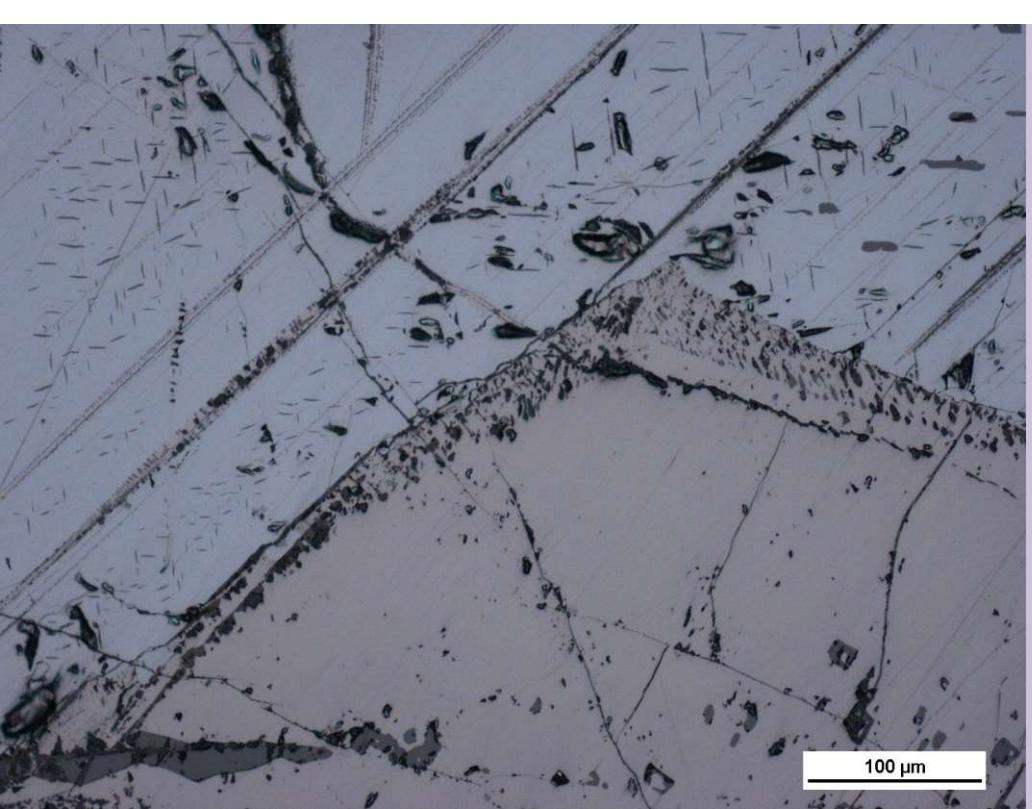
1. Perydotyt
2. Gabro oliwinowe
3. Gabro leukokratyczne
4. Gabro pegmatoidalne
5. Gabro-noryt (grubokrystaliczne)
6. tektonika



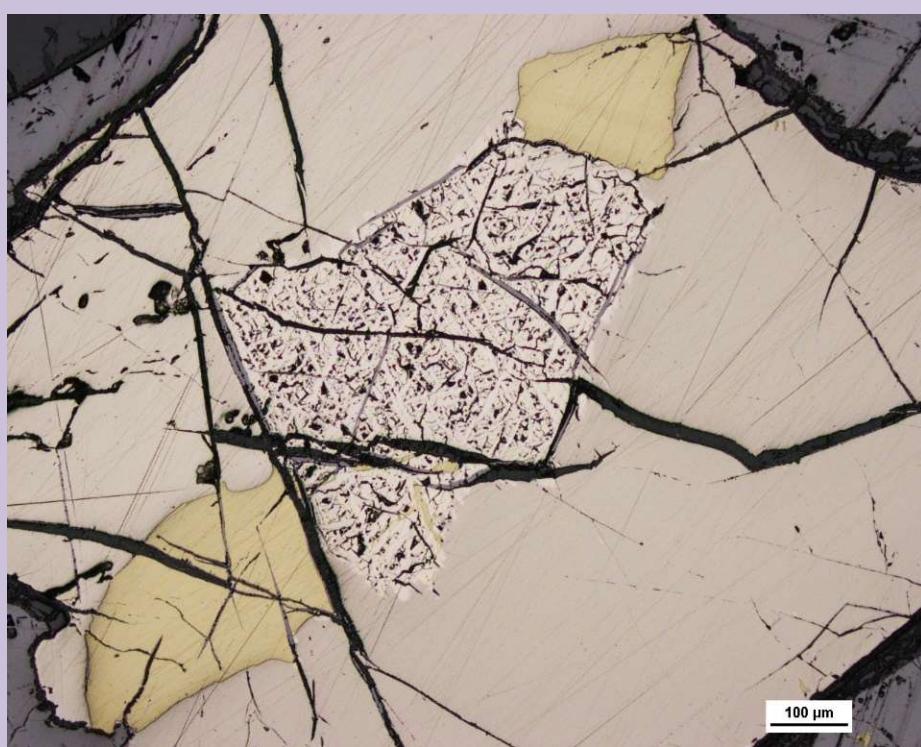
Minerały	Stremyhorodzkie			Fedorivka
	gabbro	troktolit	perydotyt	Ruda Ti - gabro
Plagioklazy (N-40-55)	60,6-64,4	37,1-46,0	25,5-31,6	29,9
Pyrokseny	0,6-3,2	0,4-1,4	<0,7	28,6
Oliviny Fo_{35-45} Fa_{50-58}	3,3-8,4	17,5-22,7	20,1-26,4	20,0
Ilmenite	4,95-11,4	11,6-12,6	11,6-15,1	11,09
Ti-magnetyt	0,4-0,85	1,2-1,9	0,55-3,87	3,4
Apatit	1,1-3,0	4,5-6,0	8,1-10,1	7,0
Amfibole, talk, chloryty	15,1-19,8	17,9-21,7	16,8-21,7	

Kulish E.A., Gurskij D.C., 2005: Black metals- iron. W: Mineral deposits of Ukraine, vol. 1, Scherbak M.P. i Bobrow ed., 59-106 (in Russian)



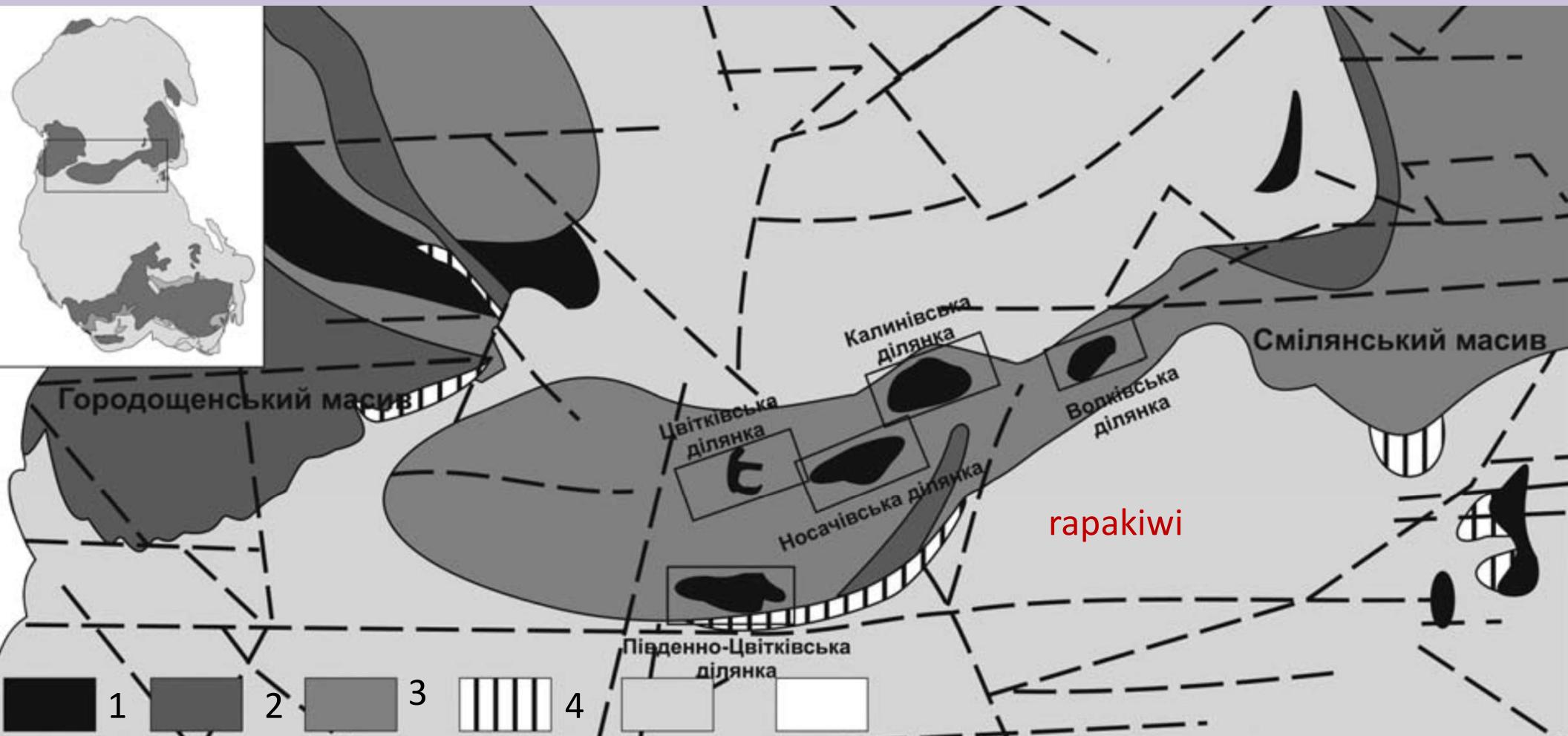


Krzemianka



Nosachiv

przy drodze Czerkasy - Uhman

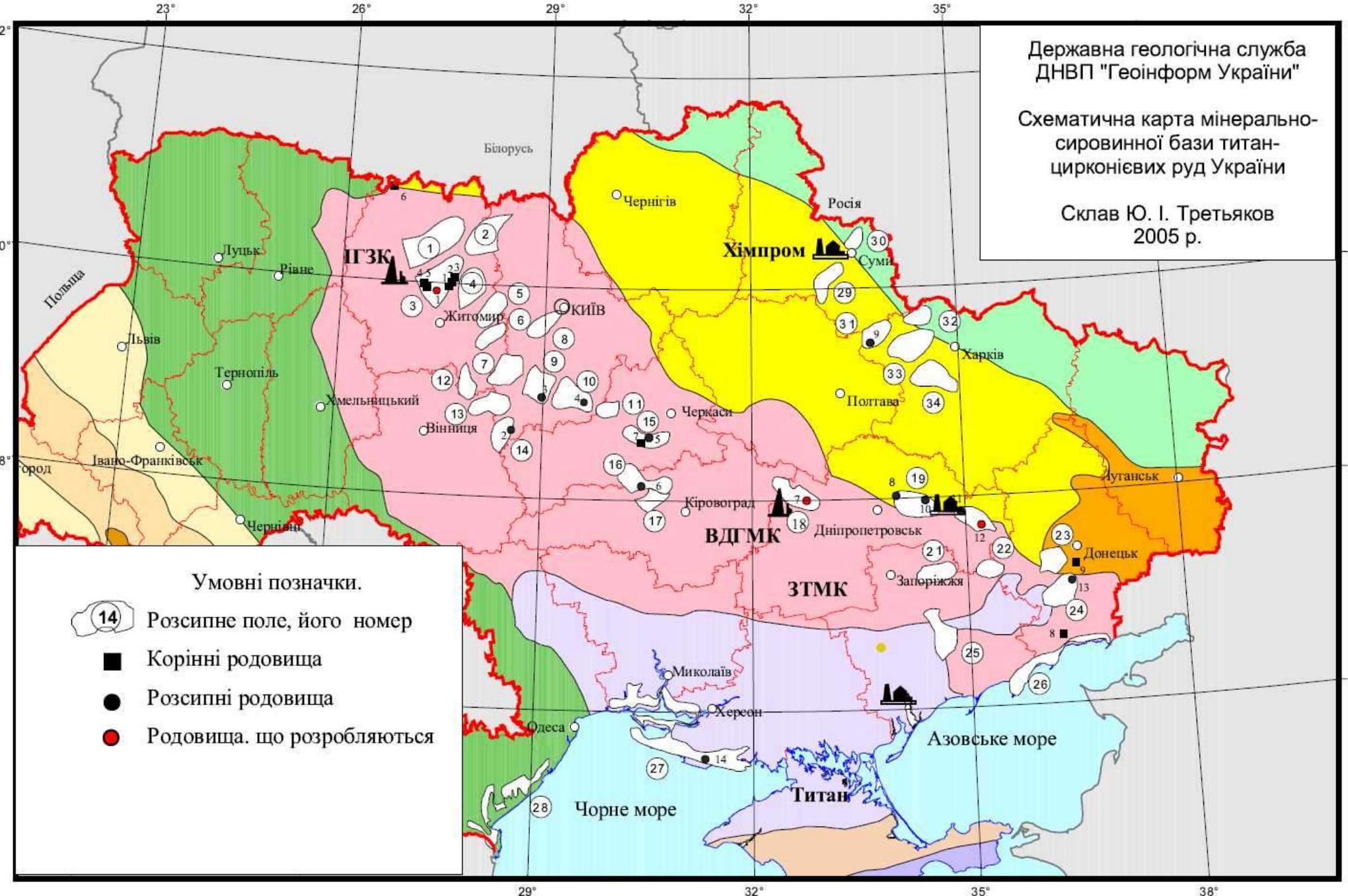


1- gabro-noryty, 2- gabro-anortozyty, 3- anortozyty, 4-monzonity, sjenity

Державна геологічна служба
ДНВП "Геоінформ України"

Схематична карта мінерально-
сировинної бази титан-цирконієвих руд України

Склад Ю. І. Трет'яков
2005 р.

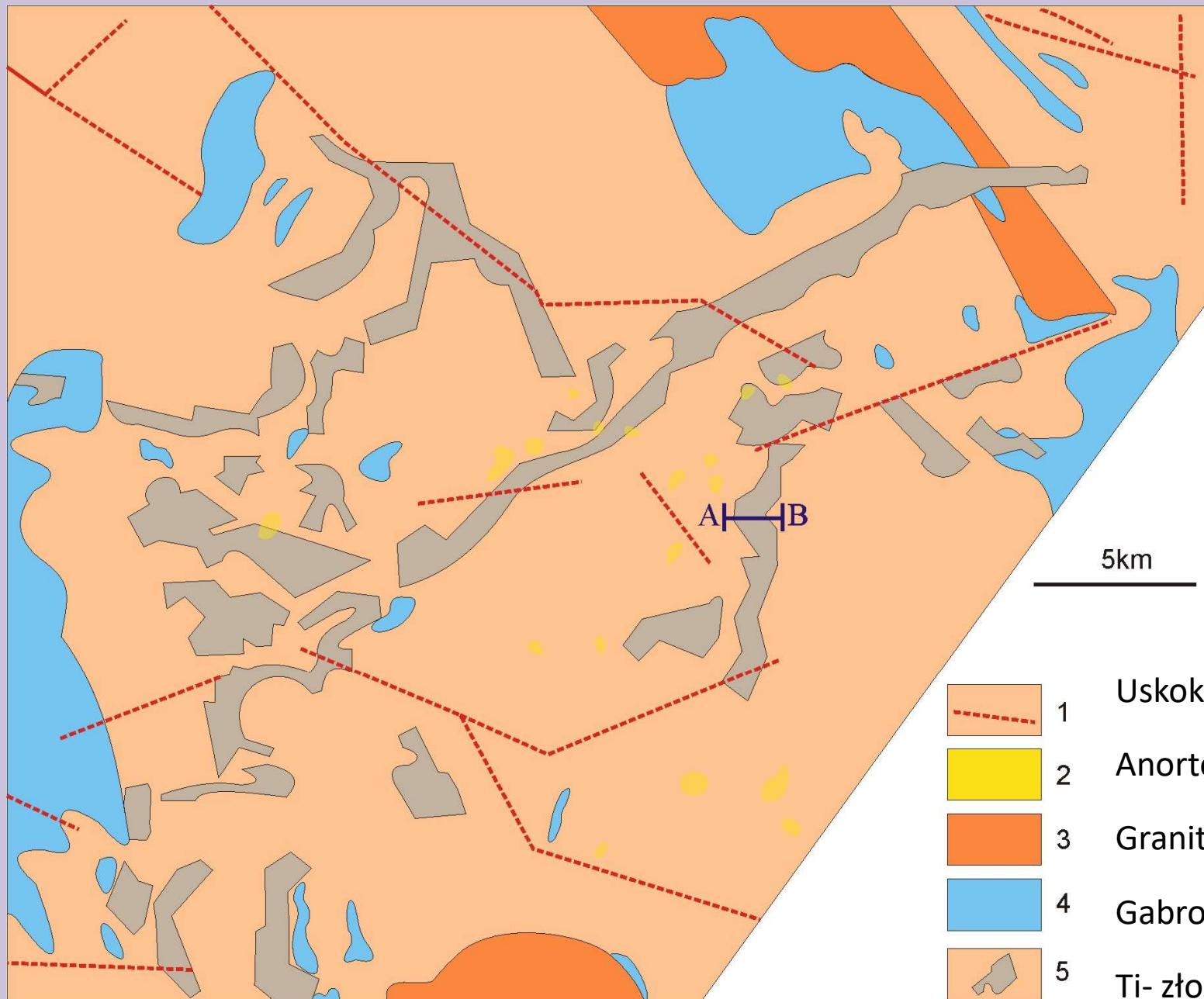


Мінерально-сировинна база титан-цирконієвих руд України
(за матеріалами Л. В. Бочая)

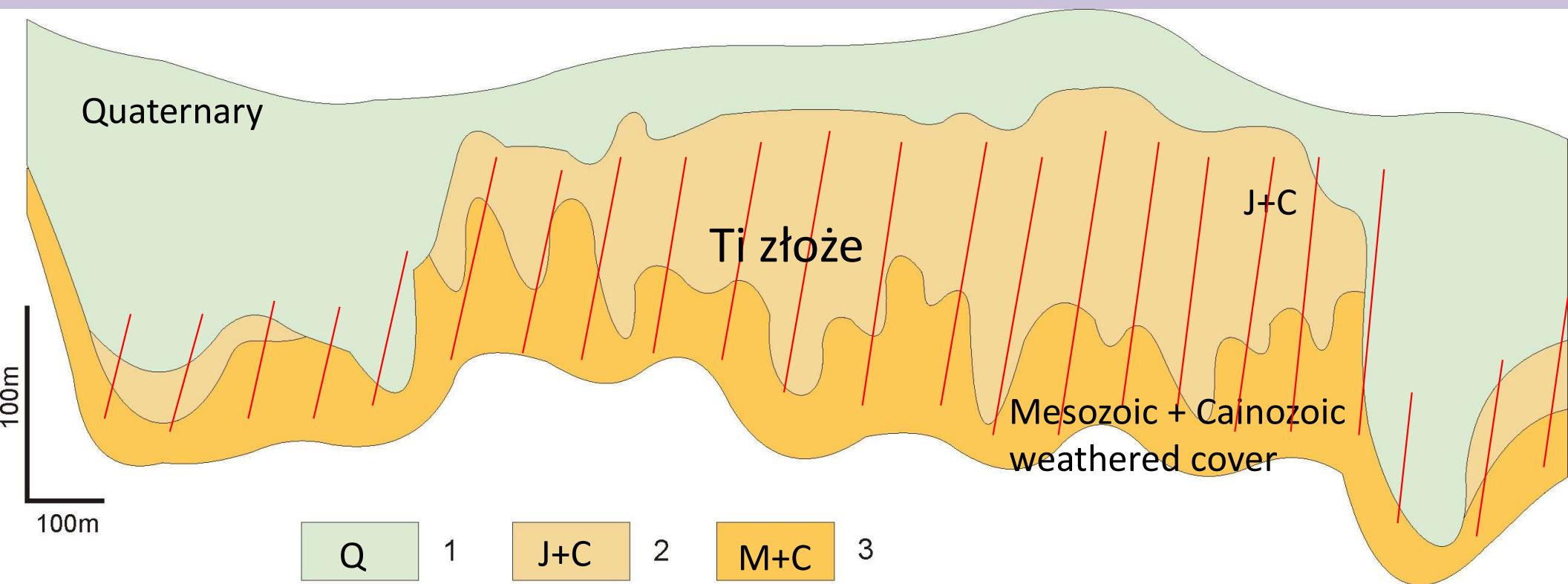


Irshansk, 2010

Irshansk, Złoża Ti

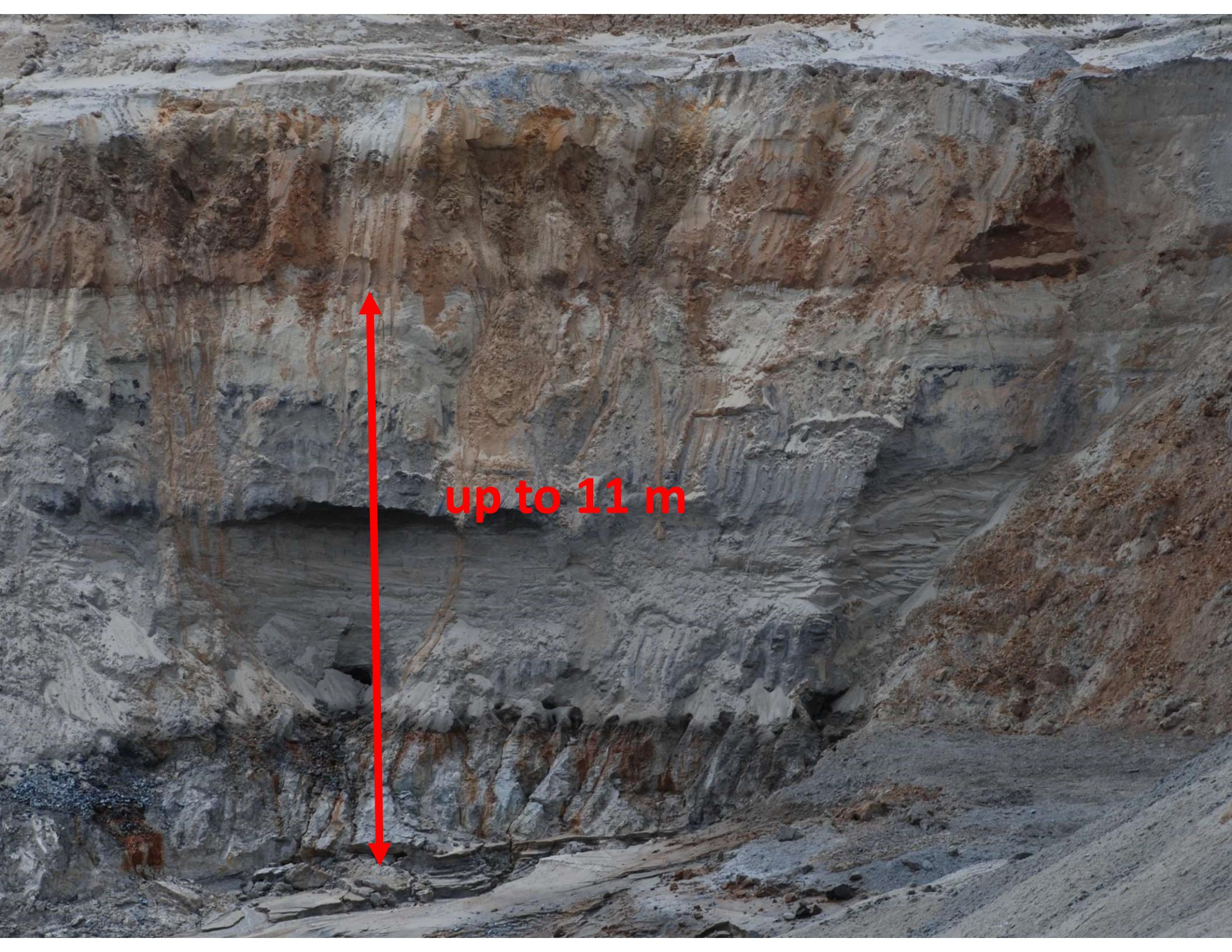


Irshansk





Irshansk, 2009



A photograph of a steep, layered rock face, likely a quarry or cliff. The rock is primarily grey and white, with prominent vertical reddish-brown streaks and horizontal sedimentary layering. A large red arrow is drawn vertically across the center of the image, pointing upwards from the base of the cliff to the top. To the right of the arrow, the text "up to 11 m" is written in red.

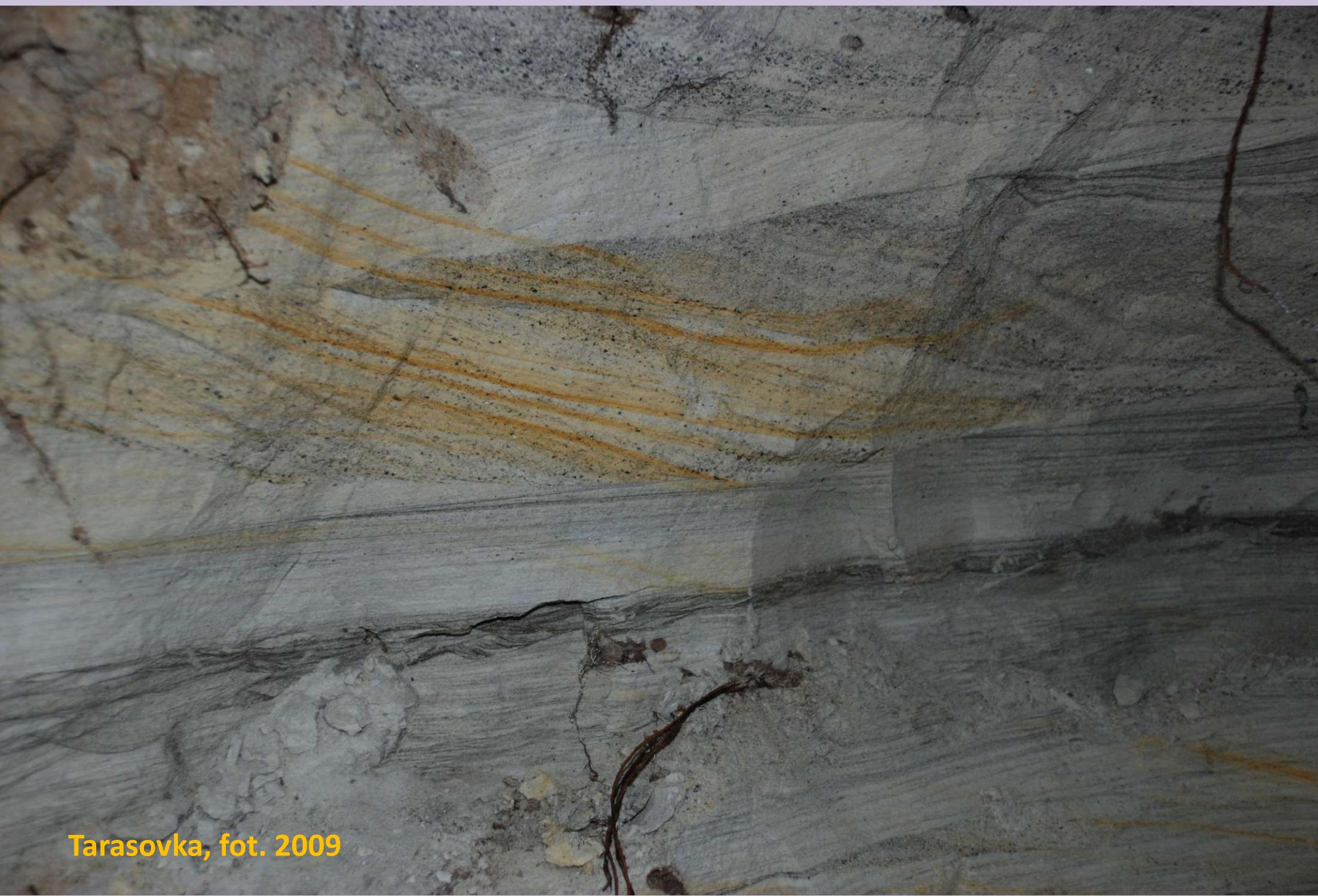
up to 11 m

Tarasovka, Ti



Tarasovka, fot. 2009

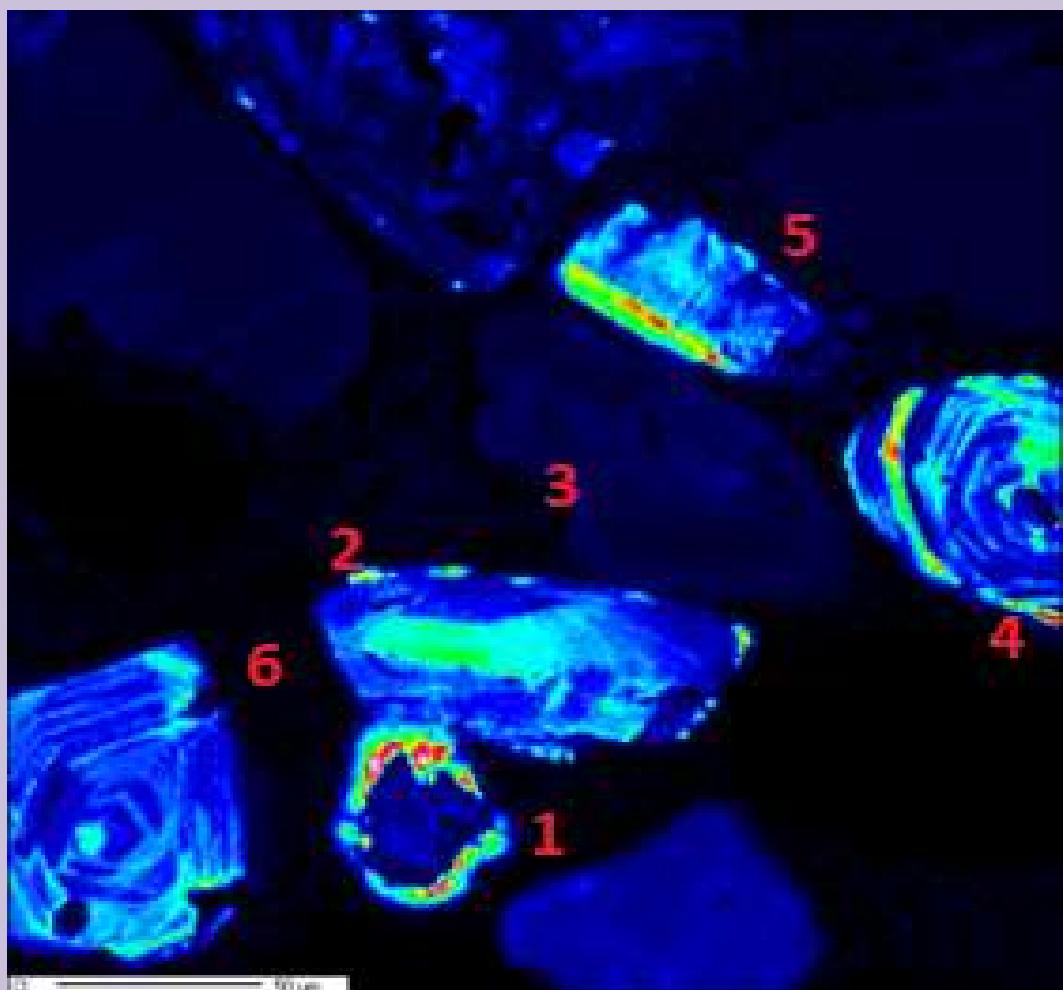
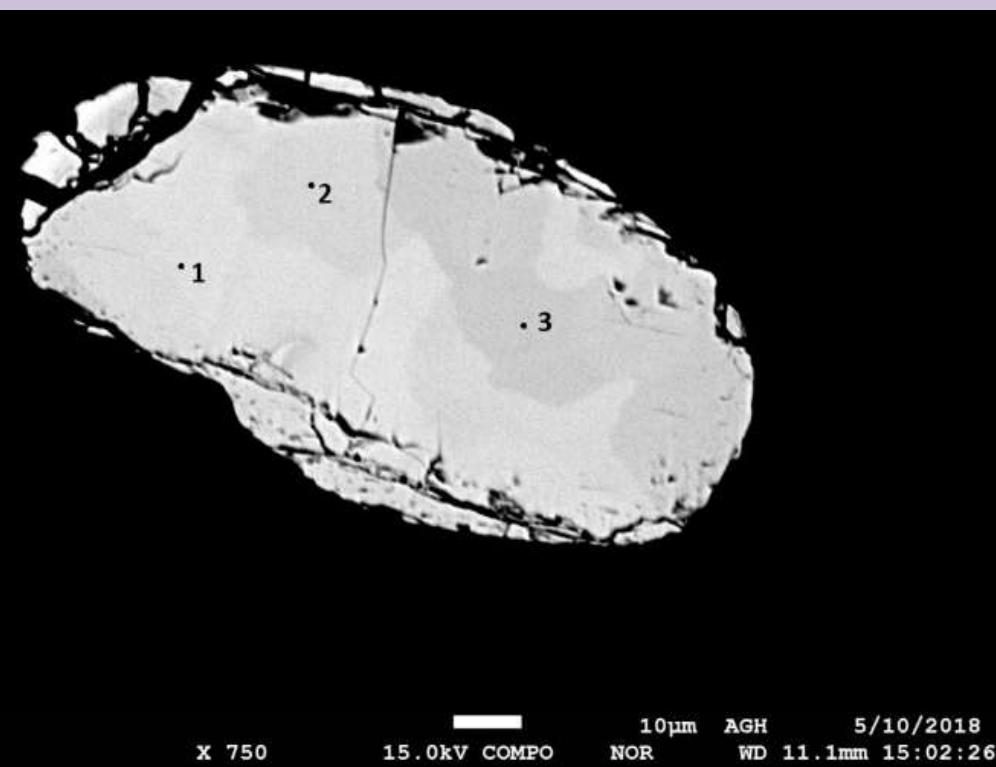
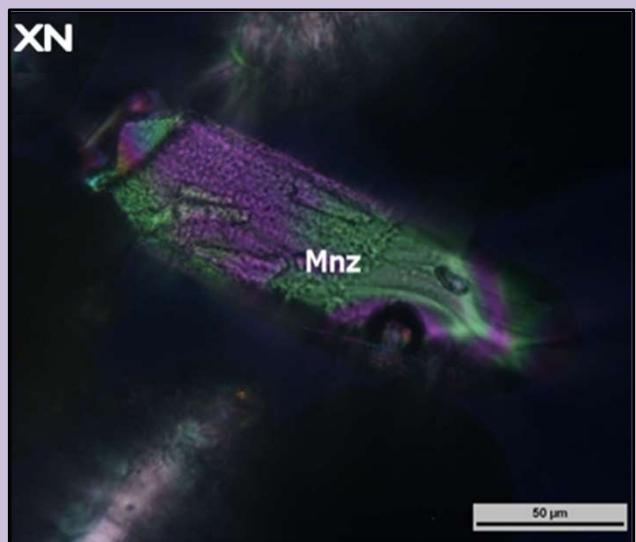
Tarasovka, Ti



Tarasovka, fot. 2009

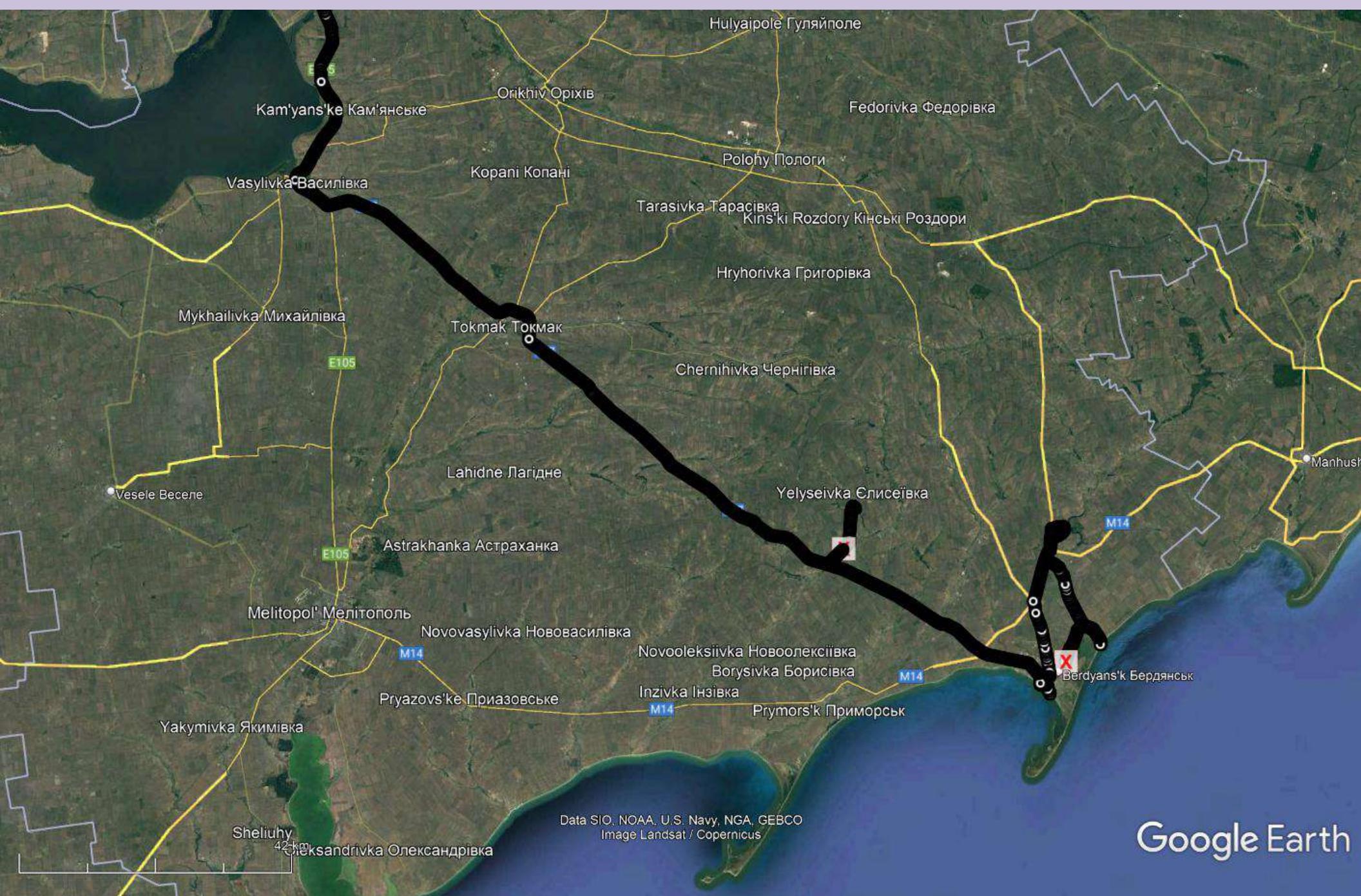


Tarasovka, fot. 2019



Tarasowka

no	ThO2	UO2	PbO	Age Ma	Comment
1	5.156	0.717	0.137	430	AP468_mnz1_p1
2	5.085	0.698	0.133	425	AP468_mnz1_p2
3	5.152	0.701	0.133	421	AP468_mnz1_p3
4	9.629	0.494	0.895	1,779	AP468_mnz1_p4
5	9.626	0.499	0.884	1,756	AP468_mnz1_p5
6	2.721	0.591	0.098	494	AP468_mnz1_p6
7	5.109	0.373	0.118	439	AP468_mnz1_p7
8	4.905	0.353	0.110	428	AP468_mnz1_p8
9	3.872	0.038	0.331	1,874	AP468_mnz2_p9
10	6.584	0.222	0.624	1,910	AP468_mnz2_p10
11	7.426	0.163	0.678	1,915	AP468_mnz2_p11
12	7.101	0.066	0.566	1,757	AP468_mnz3_p12
13	3.559	0.016	0.267	1,686	AP468_mnz3_p13
14	2.946	0.013	0.239	1,817	AP468_mnz3_p14
15	7.309	0.079	0.580	1,740	AP468_mnz3_p15
16	4.127	0.040	0.336	1,790	AP468_mnz3_p16
17	6.610	0.088	0.517	1,702	AP468_mnz3_p17
18	3.455	0.025	0.287	1,840	AP468_mnz3_p18
19	3.043	0.053	0.081	596	AP468_mnz4_p19
20	5.484	0.088	0.136	553	AP468_mnz4_p20
21	5.019	0.058	0.132	594	AP468_mnz4_p21
22	5.443	0.088	0.143	585	AP468_mnz4_p22
23	5.005	0.085	0.117	520	AP468_mnz4_p23
24	4.599	0.025	0.079	398	AP468_mnz5_p24



Google Earth

Morze Azowskie



Monacytowe piaski, k. Berdianska, 2019

Monacytowe piaski, k. Berdianska, 2019

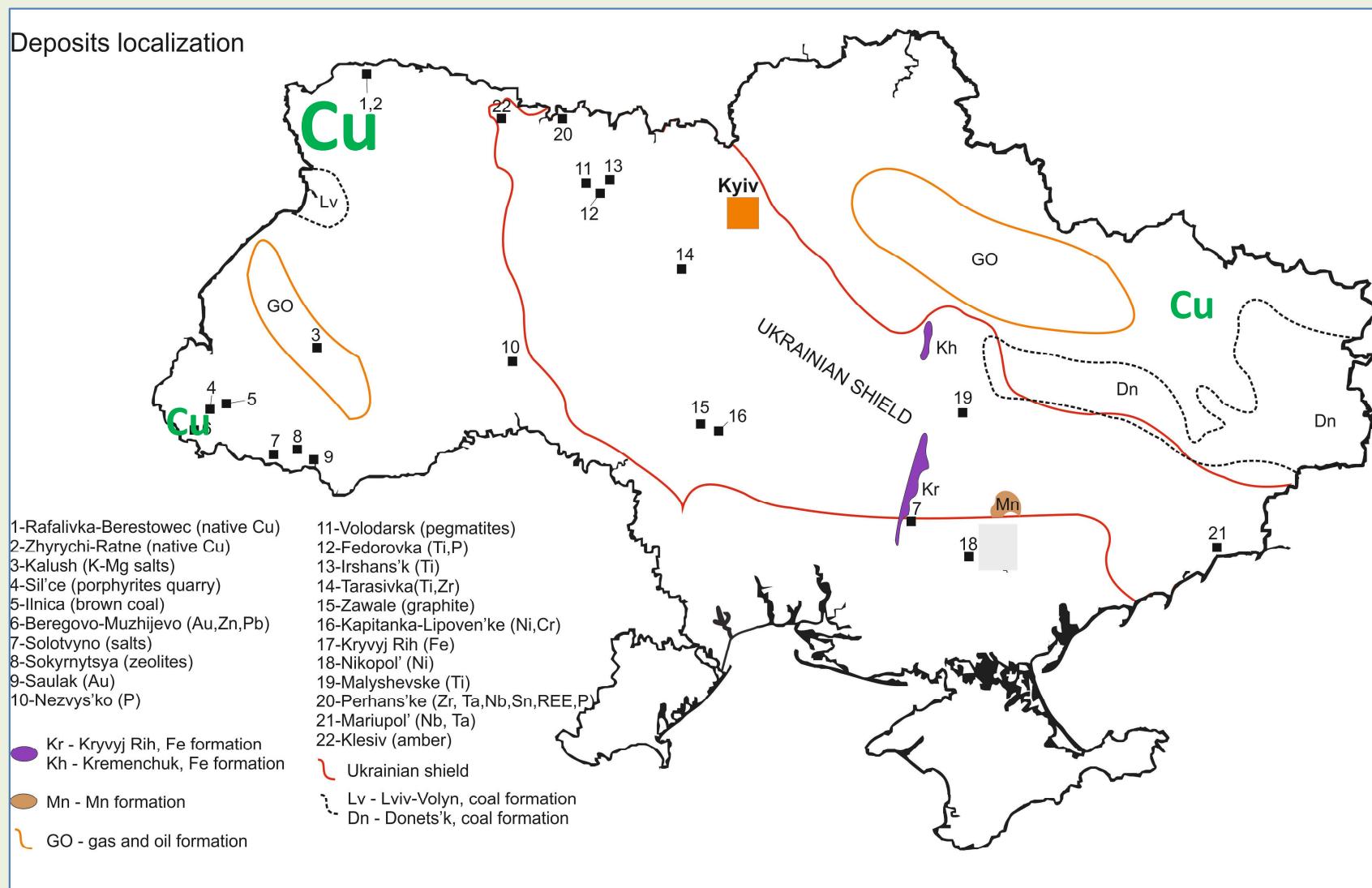
stages are calculated from each individual data point.

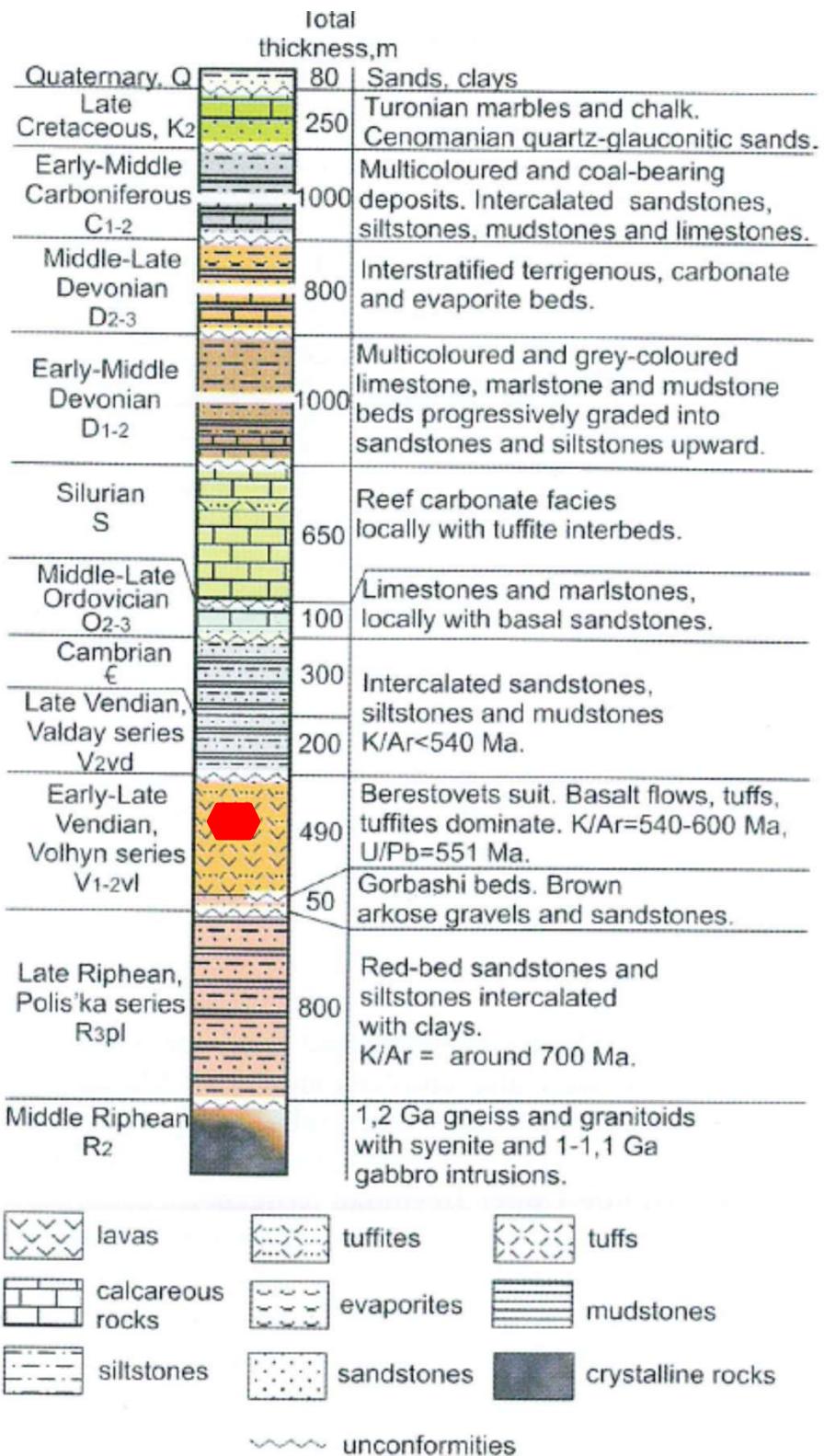
Stage #	ThO ₂	UO ₂	PbO	Age (Ma)	Comment
0001	7.455	0.256	0.692	1,869	1_mnz1_1
0002	2.764	0.202	0.292	1,884	1_mnz1_2
0003	3.092	0.193	0.361	2,125	1_mnz1_3
0004	5.891	0.139	0.560	1,978	1_mnz1_4
0005	2.363	0.134	0.286	2,231	1_mnz1_5
0006	6.164	0.179	0.639	2,107	1_mnz2_1
0007	5.368	0.166	0.470	1,789	1_mnz2_2
0008	4.998	0.172	0.565	2,243	1_mnz2_3
0009	6.301	0.252	0.684	2,124	1_mnz2_4
0010	11.421	0.179	1.057	1,980	1_mnz3_1
0011	10.249	0.195	0.985	2,029	1_mnz3_2
0012	10.842	0.251	0.941	1,819	1_mnz3_3
0013	10.083	0.249	0.955	1,964	1_mnz3_4
0014	9.106	0.270	0.824	1,852	1_mnz3_5
0015	9.779	0.251	0.864	1,835	1_mnz3_6

Złoża Cu

(Vohlyn) 4 złoża zasoby: Zhyrychi 1.5 Mt + Rafalovka 3 Mt (25 Mt P3)

Bahmutskhaya: 4 złoża: 3.1 Mt (P2+P3)





after: Emetz et al., 2004

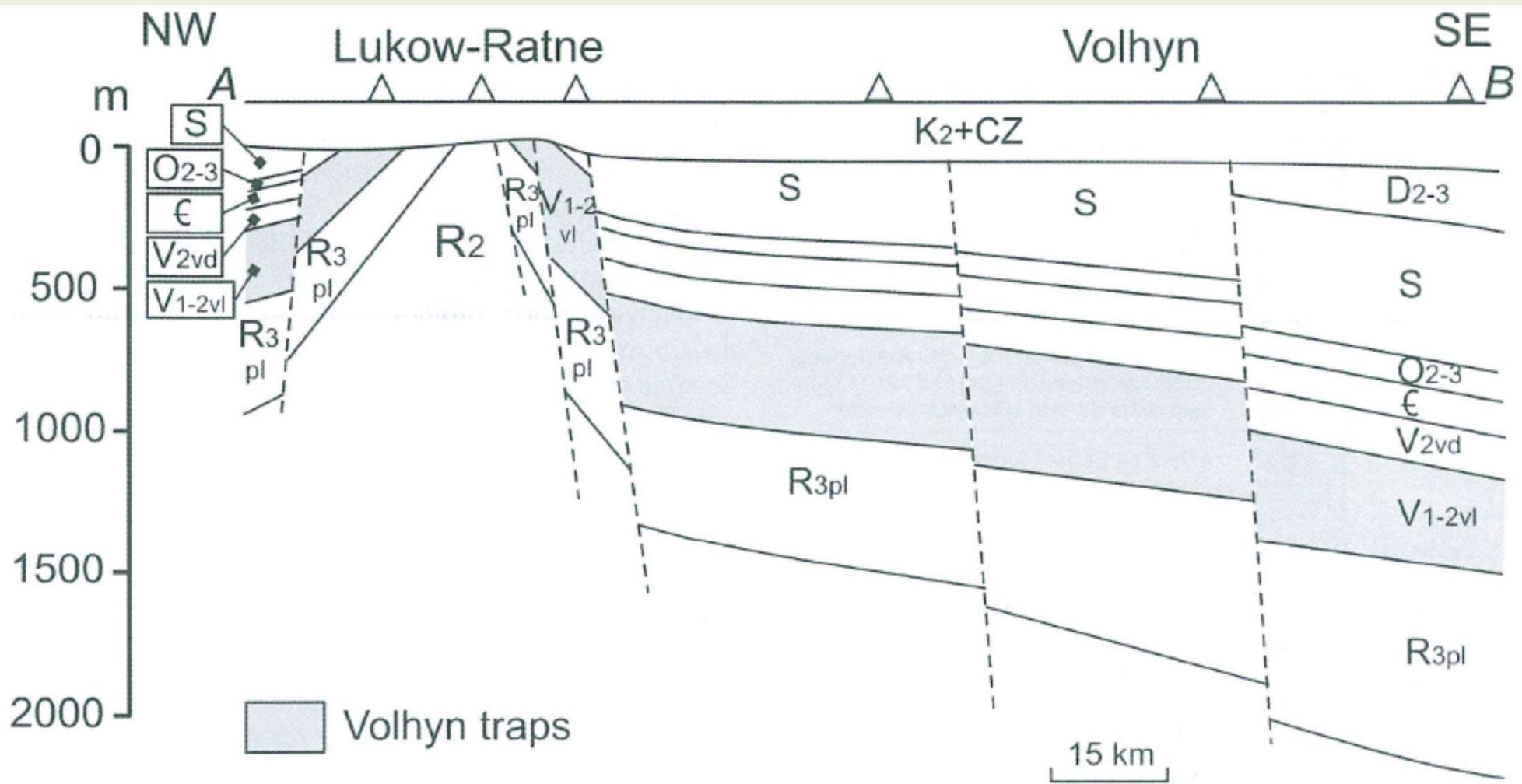
Basalt flows



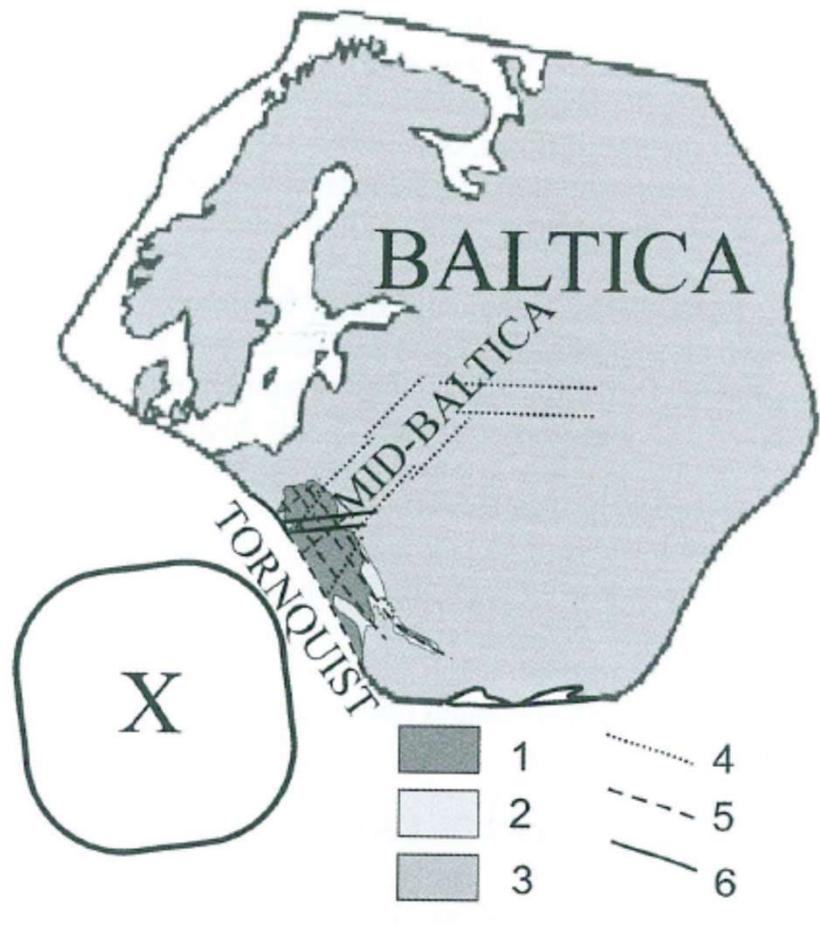
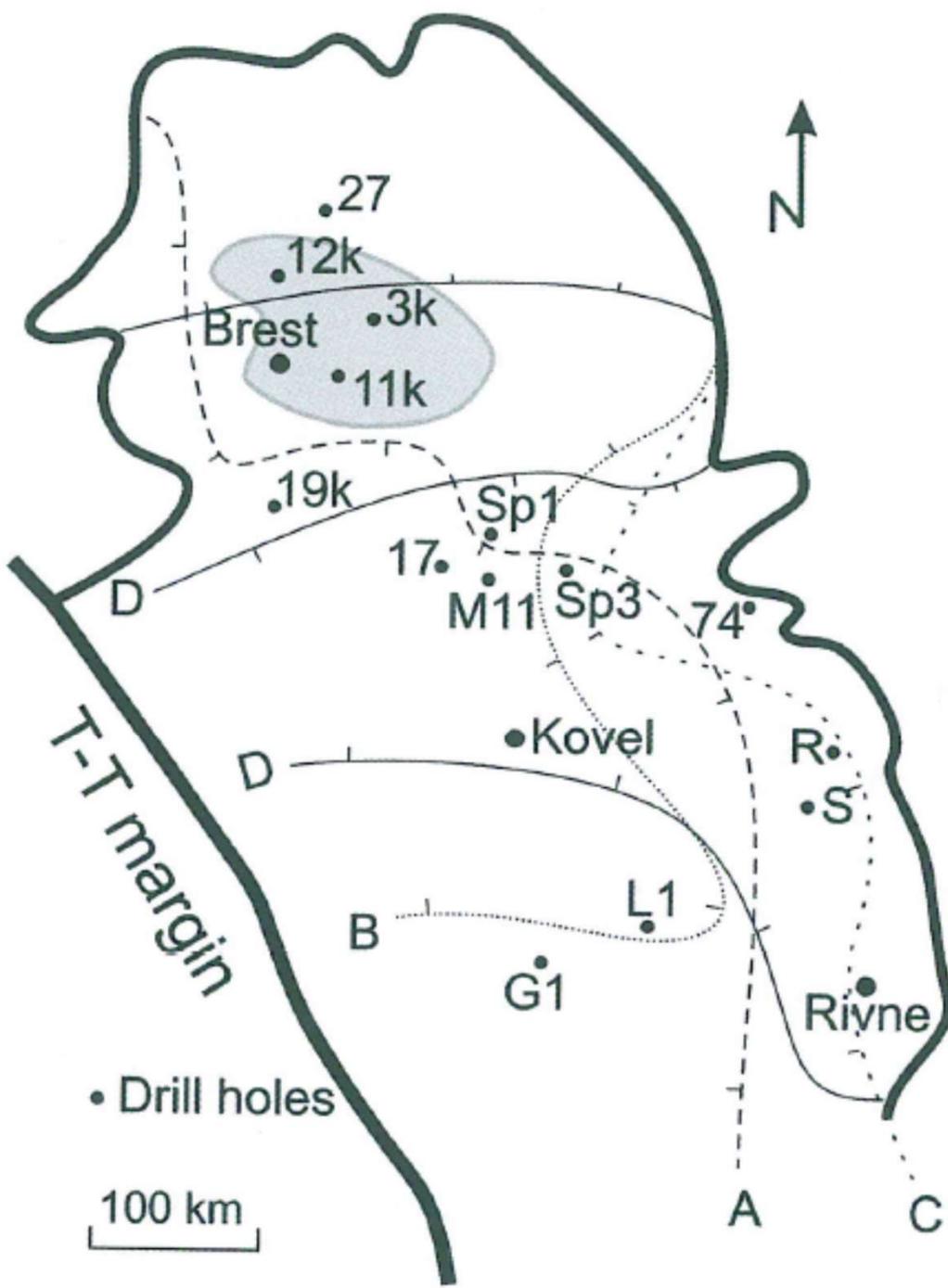
Ratne, 2009

A

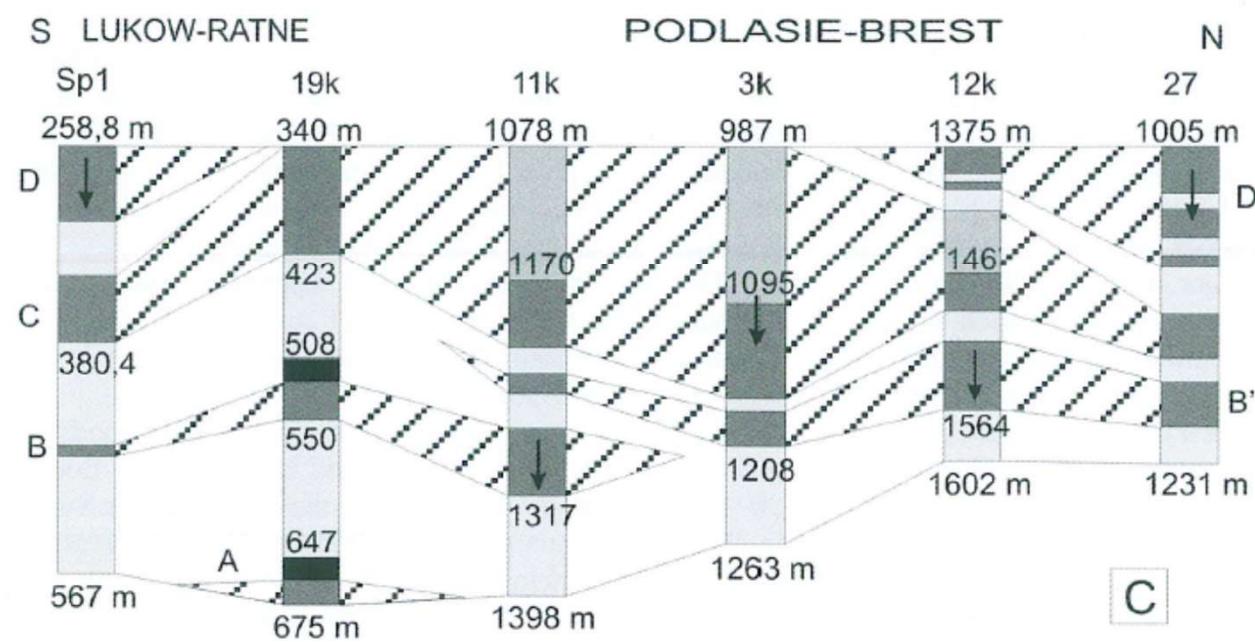
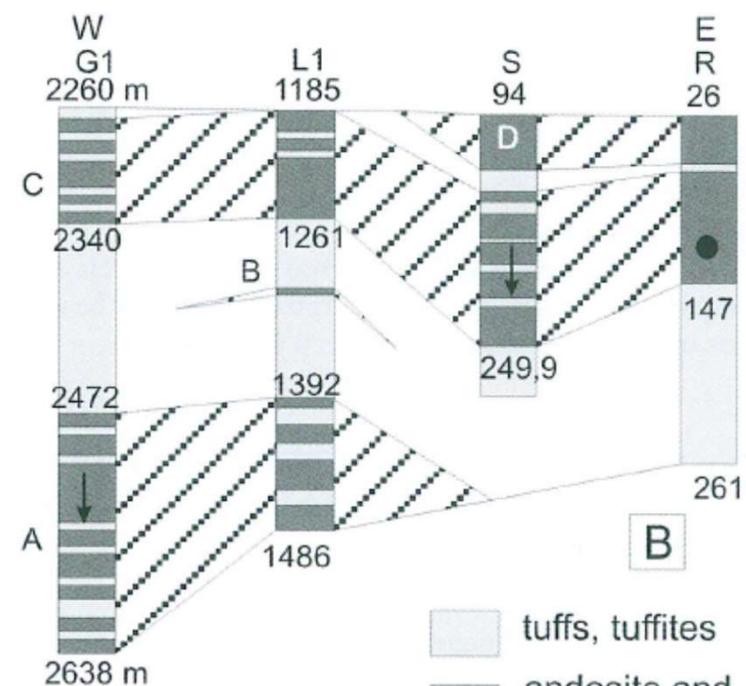
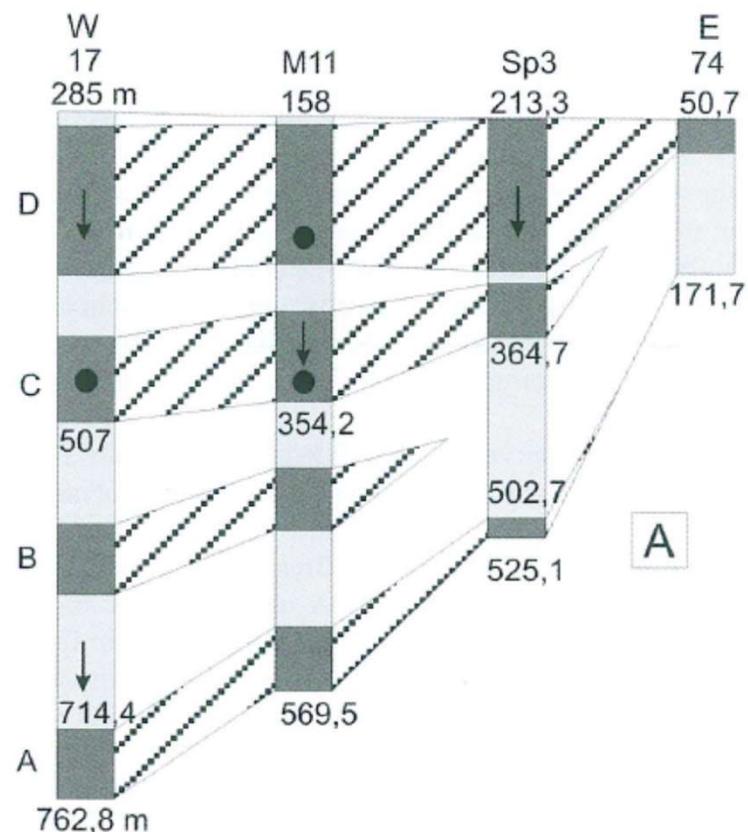
B



VOLHYN



1. Volhyn traps
 2. Volhyn tuffs and tuffites
 3. Present day land area
- Faults: 4- Riphean, 5-Vendian,
6-Caledonian-Hercenian

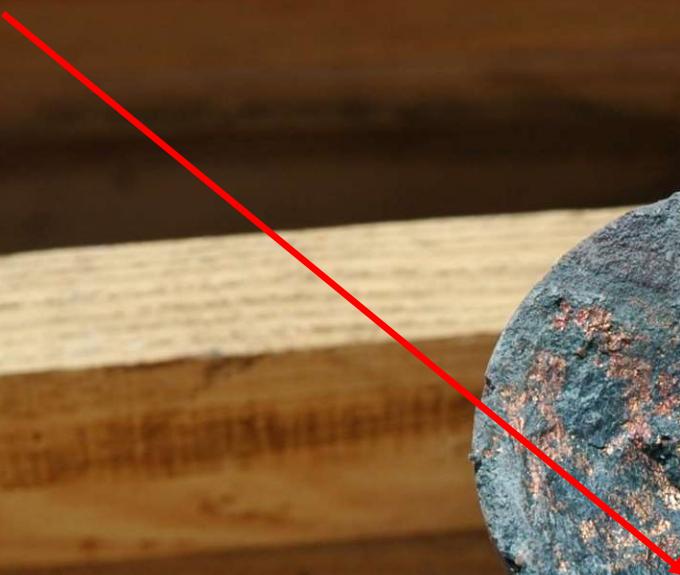


- [Light gray square] tuffs, tuffites
- [Medium gray square] andesite and dacite lavas
- [Dark gray square] basaltic mainly lava flows
- [Very dark gray square] gabbro-dolerite dikes and sills
- [Hatched square] correlated lava floods
- [Downward arrow] maximal subsidence
- [Black circle] Cu ore



cm

Tectonic mirror



Be- deposit

Perzhans'ke area: Be, Zr, Ta, Nb, Sn, REE, P, F, Y, Ag

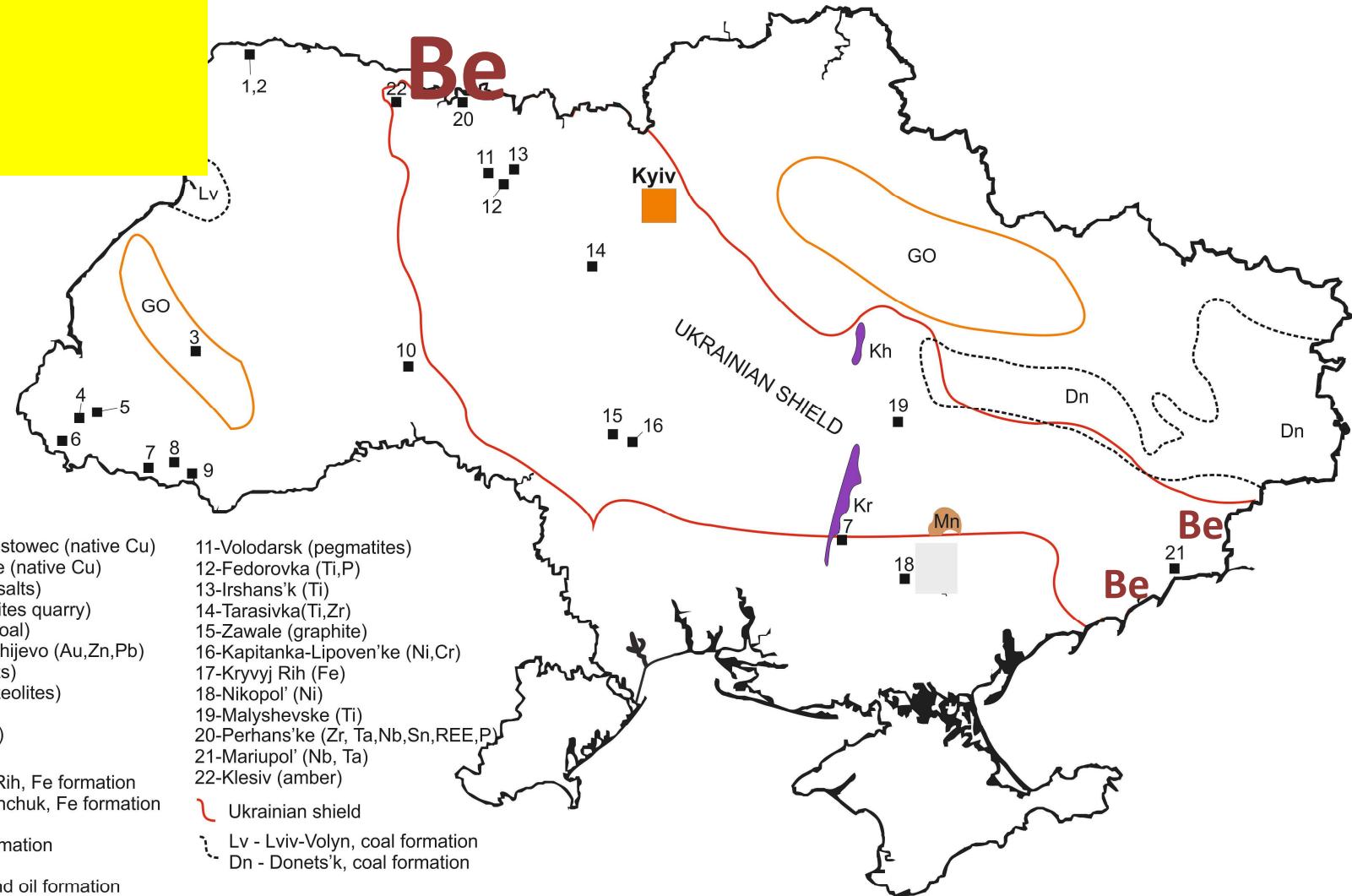
Resources: confidential

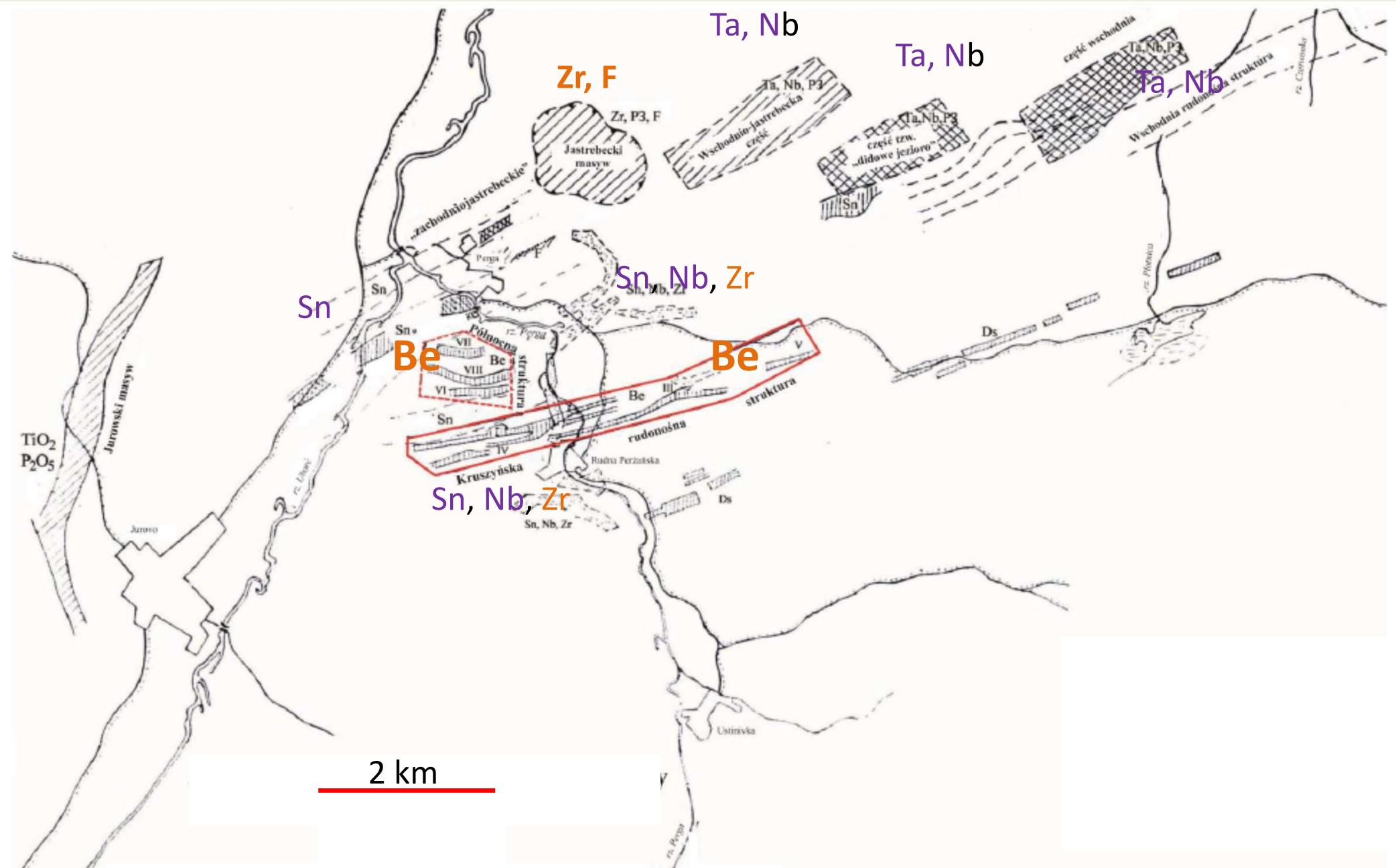
C₁+C₂

BeO= 0.5%



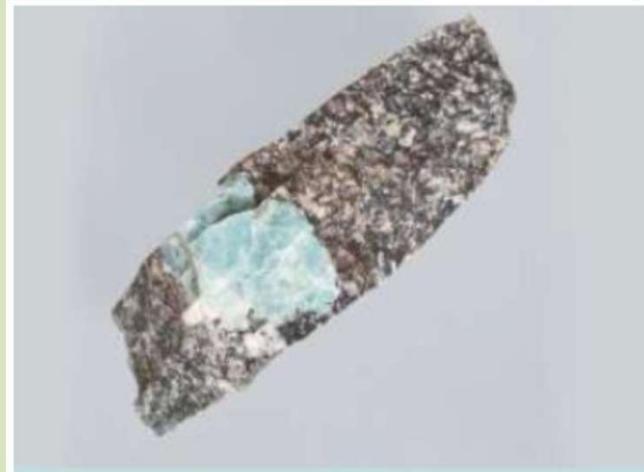
Genthelvite
 $Zn_4Be_3Si_3O_{12}S$



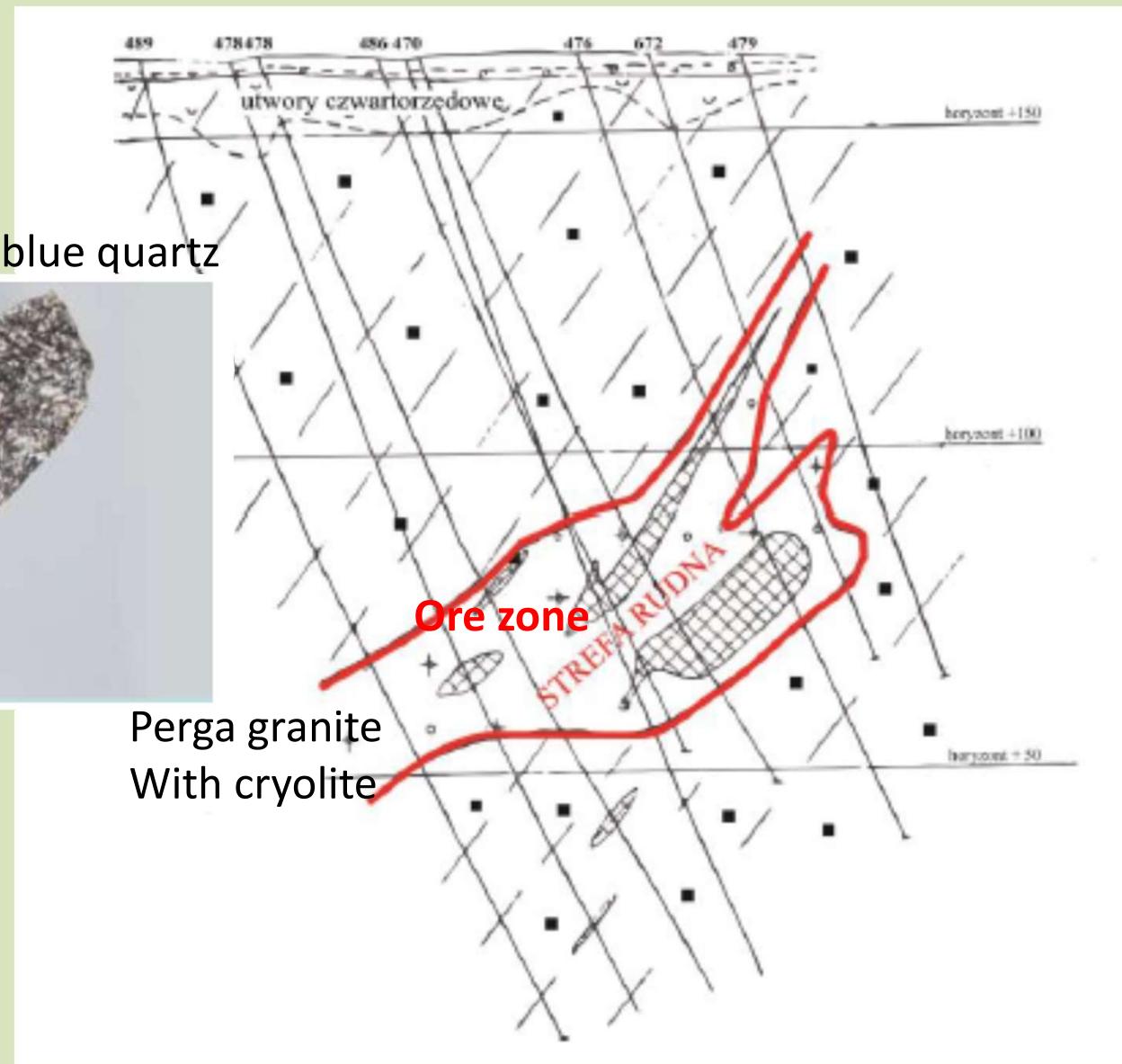


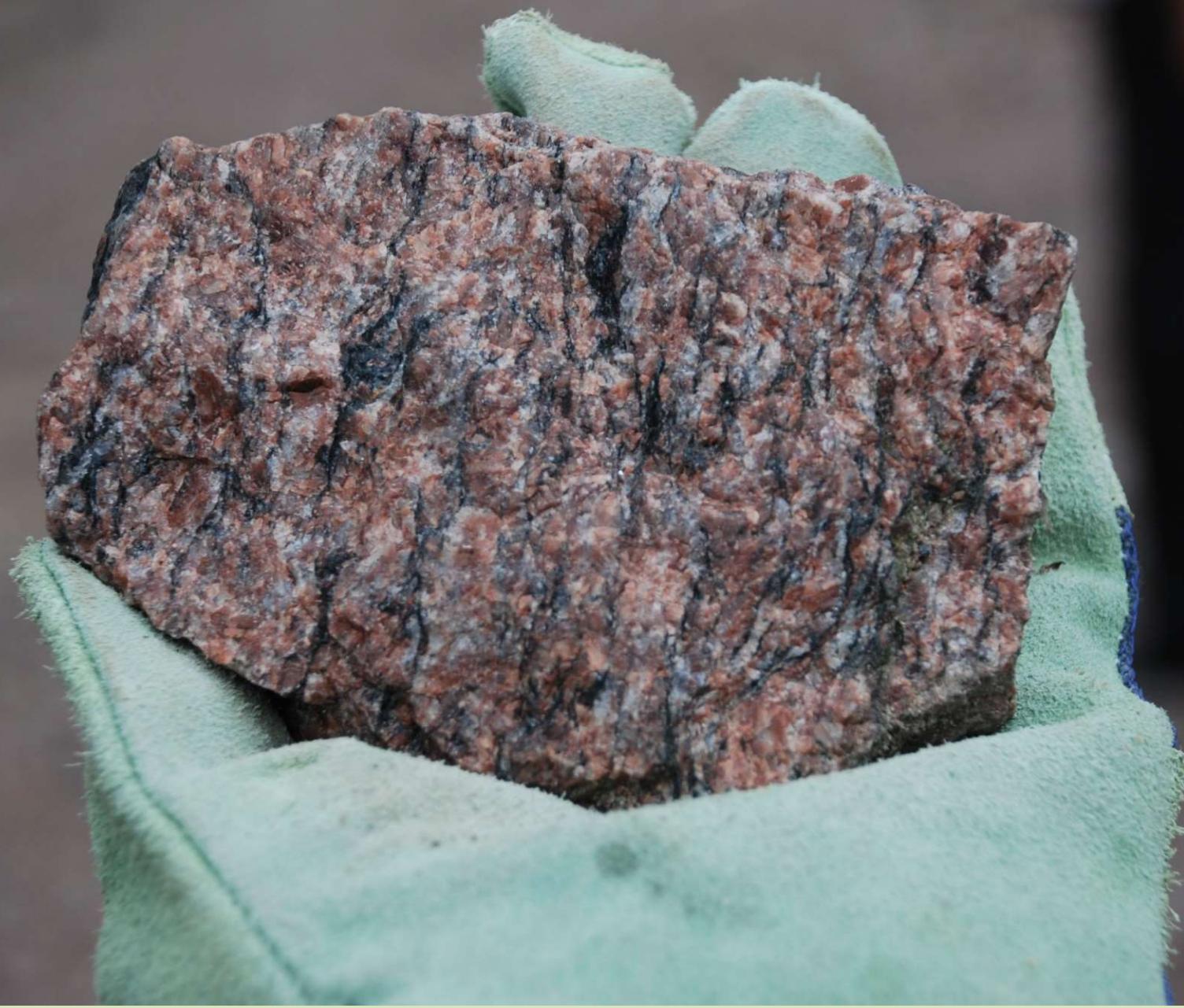
Złoża strefy Pergi

Garnite with blue quartz



Perga granite
With cryolite





Perga, 2015

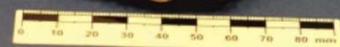
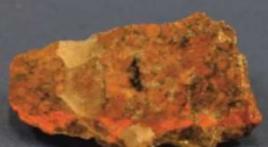
PRG17-03



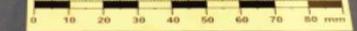
PRG17-11



PRG17-06



PRG17-04



PRG17-02



PRG18-01



PRG18-02



PRG18-03



genthelvite

PRG17-05



PRG17-09



willemite

Mineralogy

Al-F association

cryolite
weberite
elpasoite
prosopite
chiolite
pachnolite
thomsenolite
ralstonite
gearchutite

Be, Zr

genthelvite
phenakite ,
zircon

REE

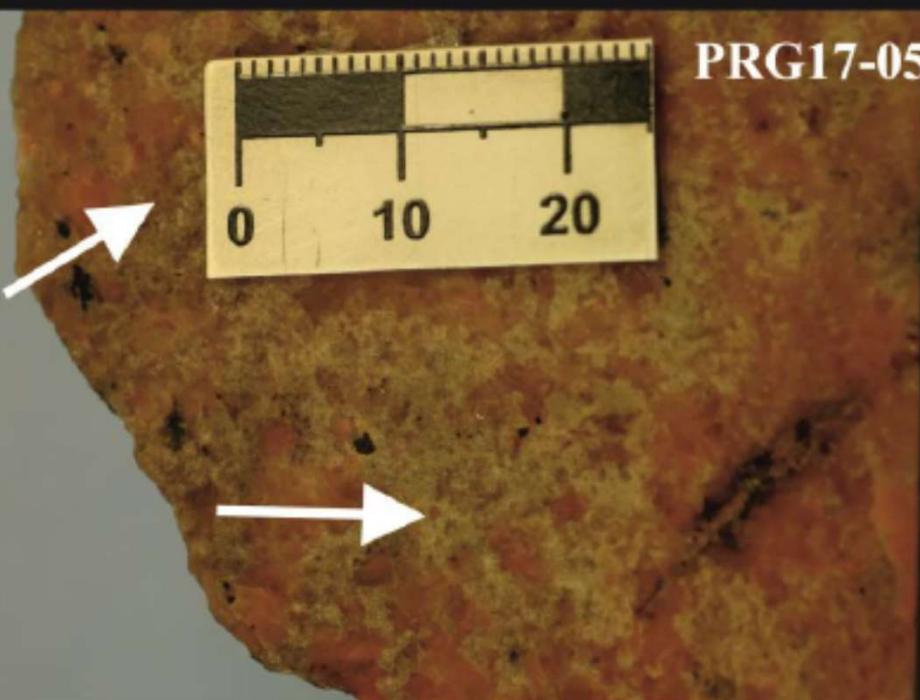
F-cerite
bastnesite

Nb-Ta, Sn, W, Ti

columbite
tantalite
cassiterite
wolframite

pyrite
arsenopyrite
chalcopyrite
Molybdenite
chalcocite
bornite
covellite
wittichenite
sphalerite
Galena
Te-Ag-sulfosalts

silicates



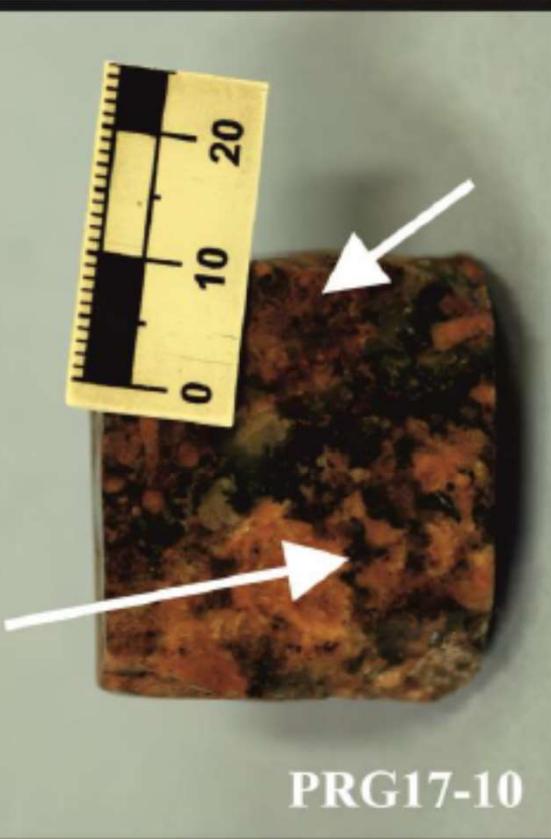
PRG17-05



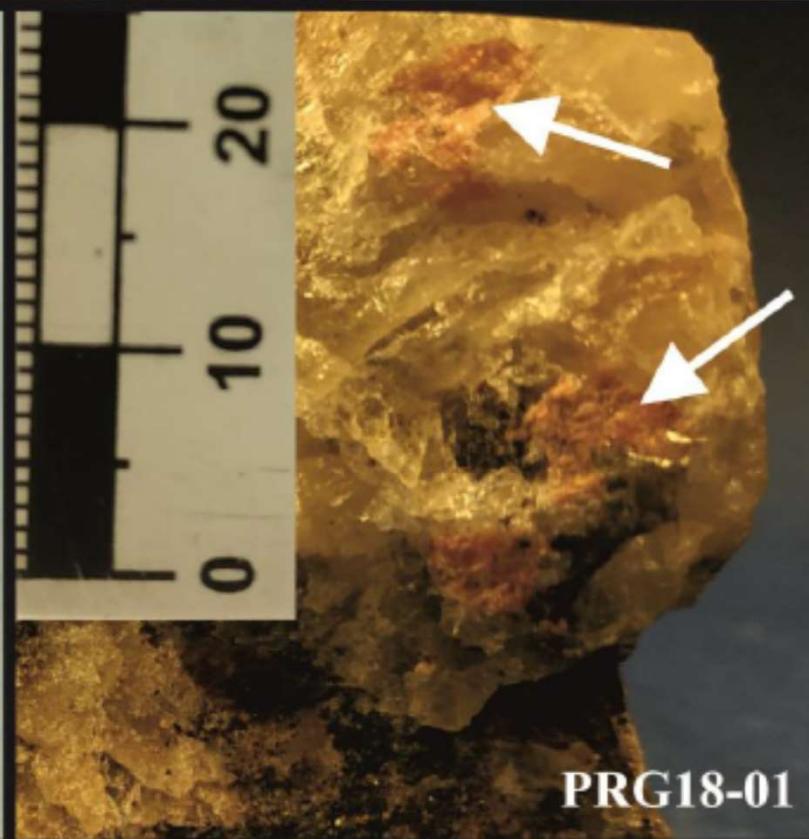
PRG17-08

Different genlthelvine

- beige-green 2%Fe
- maroon–brown 16%Fe
- pink 8%Fe



PRG17-10

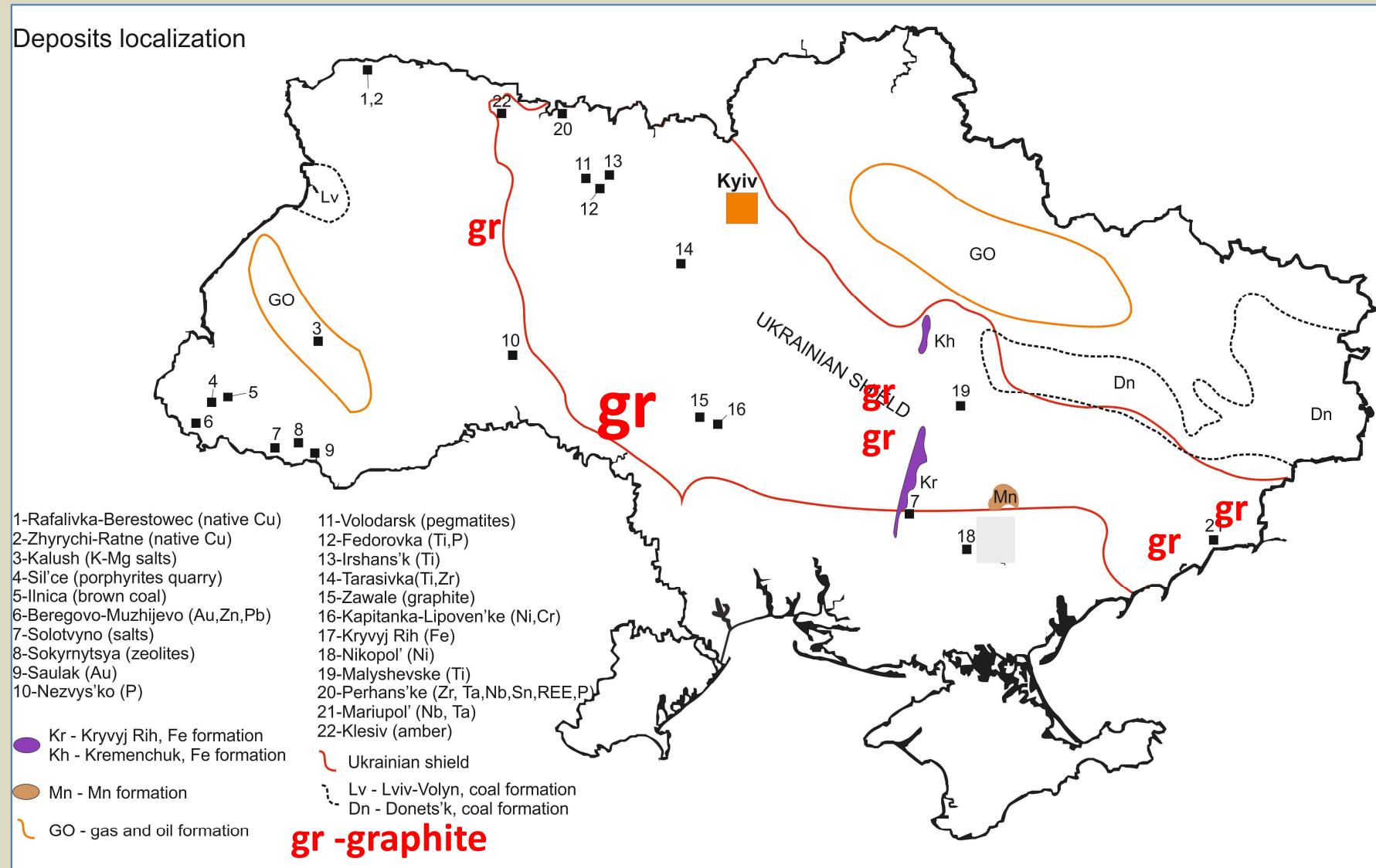


PRG18-01

- $ZnO - 42,65\%$,
- $SiO_2 - 31,36\%$,
- $BeO - 12,28\%$,
- $FeO - 8,59 \%$,
- S – 5,69%,
- $MnO - 0,88\%$,
- $Al_2O_3 - 0,02\%$,
- $K_2O - 0,01\%$,
- $CaO - 0,01\%$.

Złoża Grafitu deposits

6 złóż: Zvalivskie, Burtinskie, Balahivskiye, Petrivskie, Troickie, Mariupolskie





Zavalie, 2005



Zavalie, 2011

Calciphire 3.2-3.4 Ga:

dolomit

kalcyt

olivin

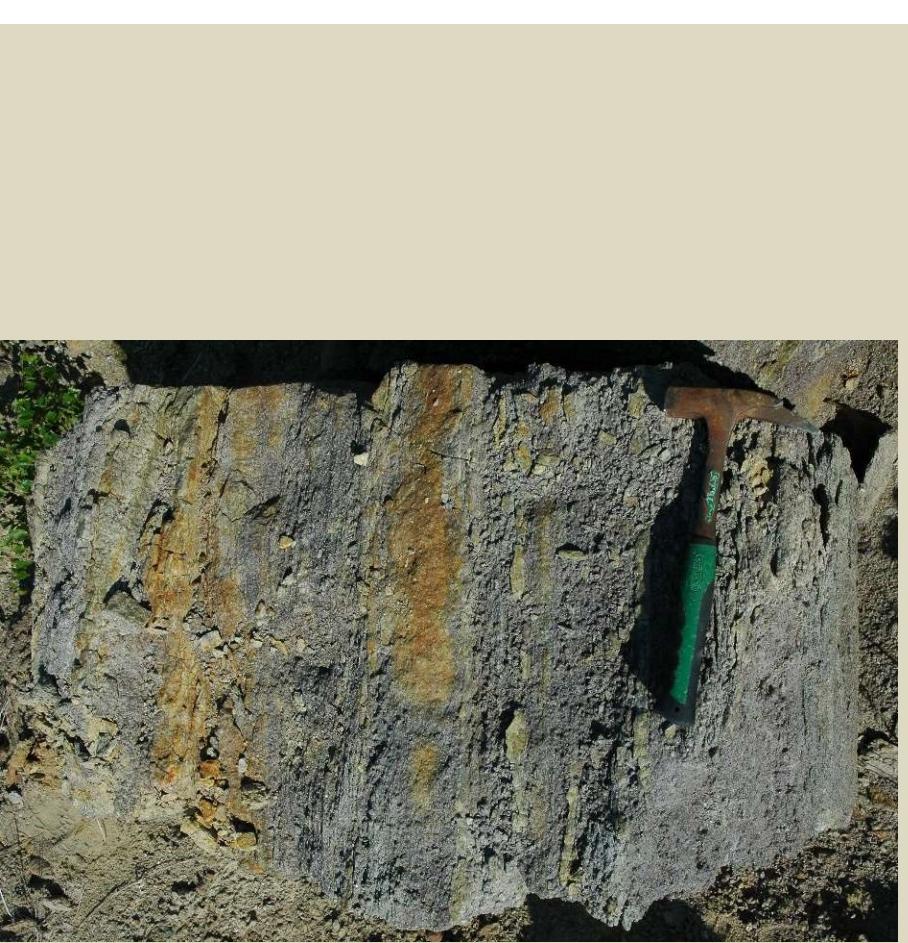
magnetyt

diopsyd

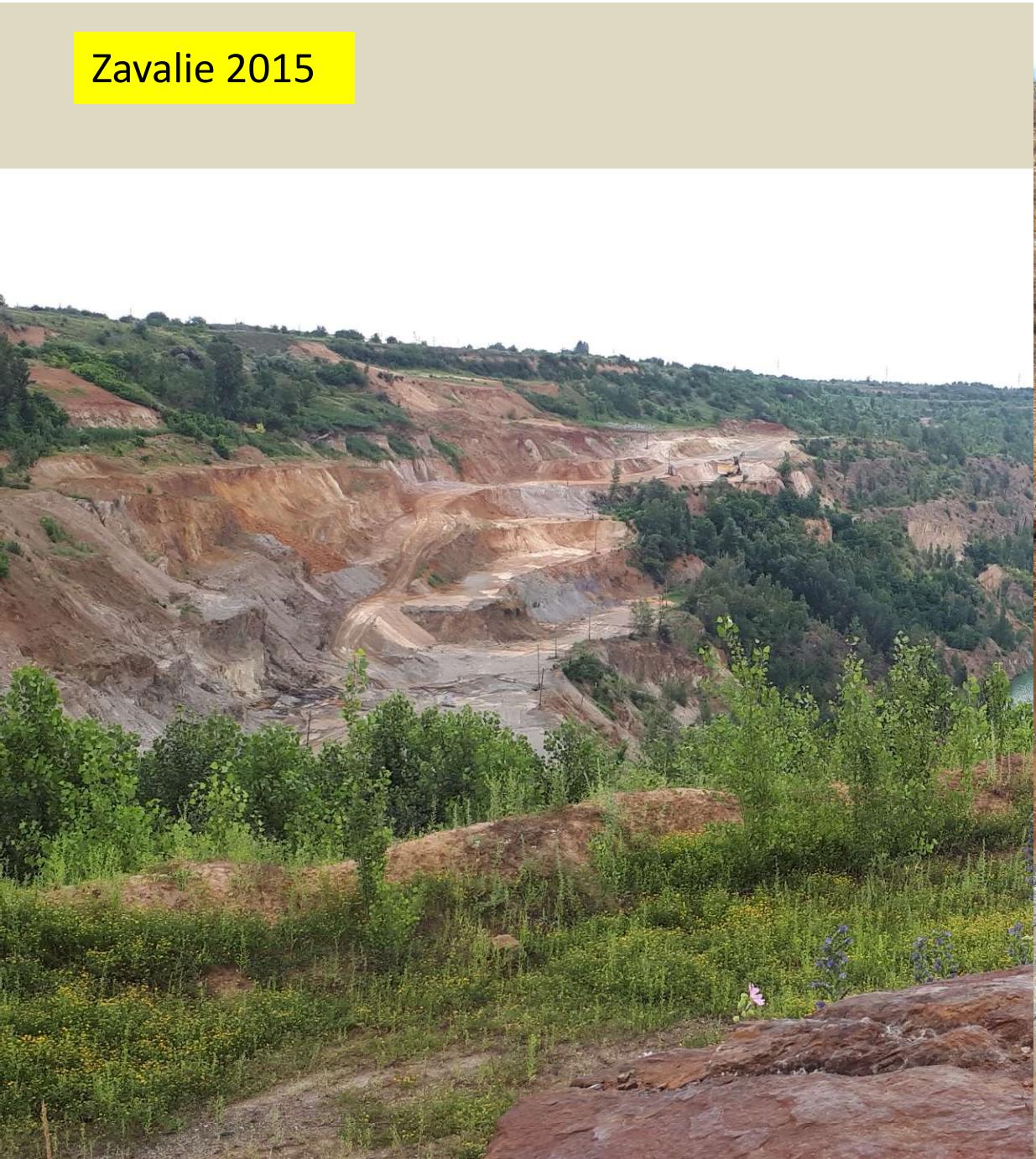
amfibol

spinel





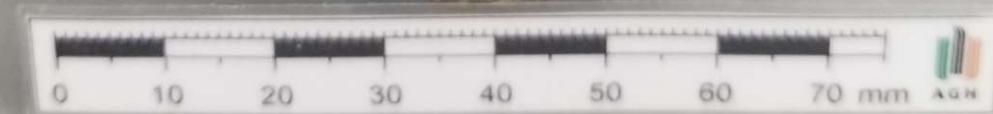
Zavalie 2015





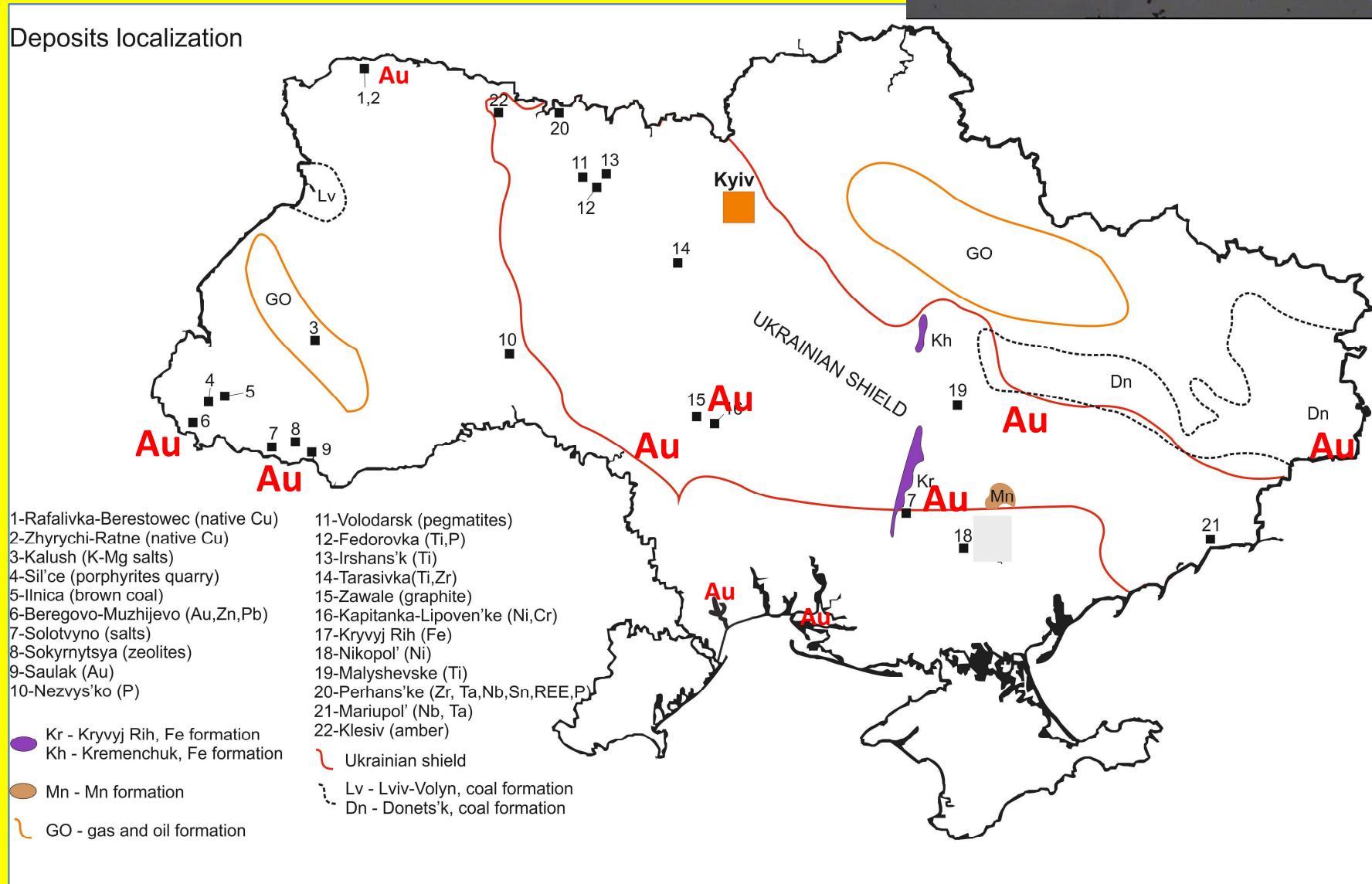
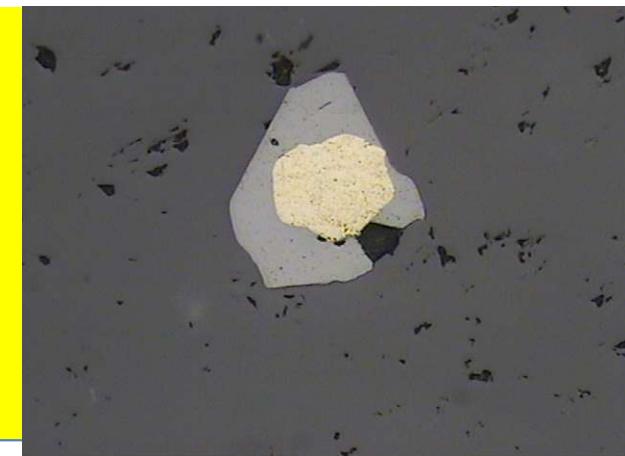
Zavalie, 2015

grafit



Au i metale kolorowe

22 Au złoża i wystąpienia



Inner Carpathians Deposits and occurrences

Legenda:



Carpathian sub province

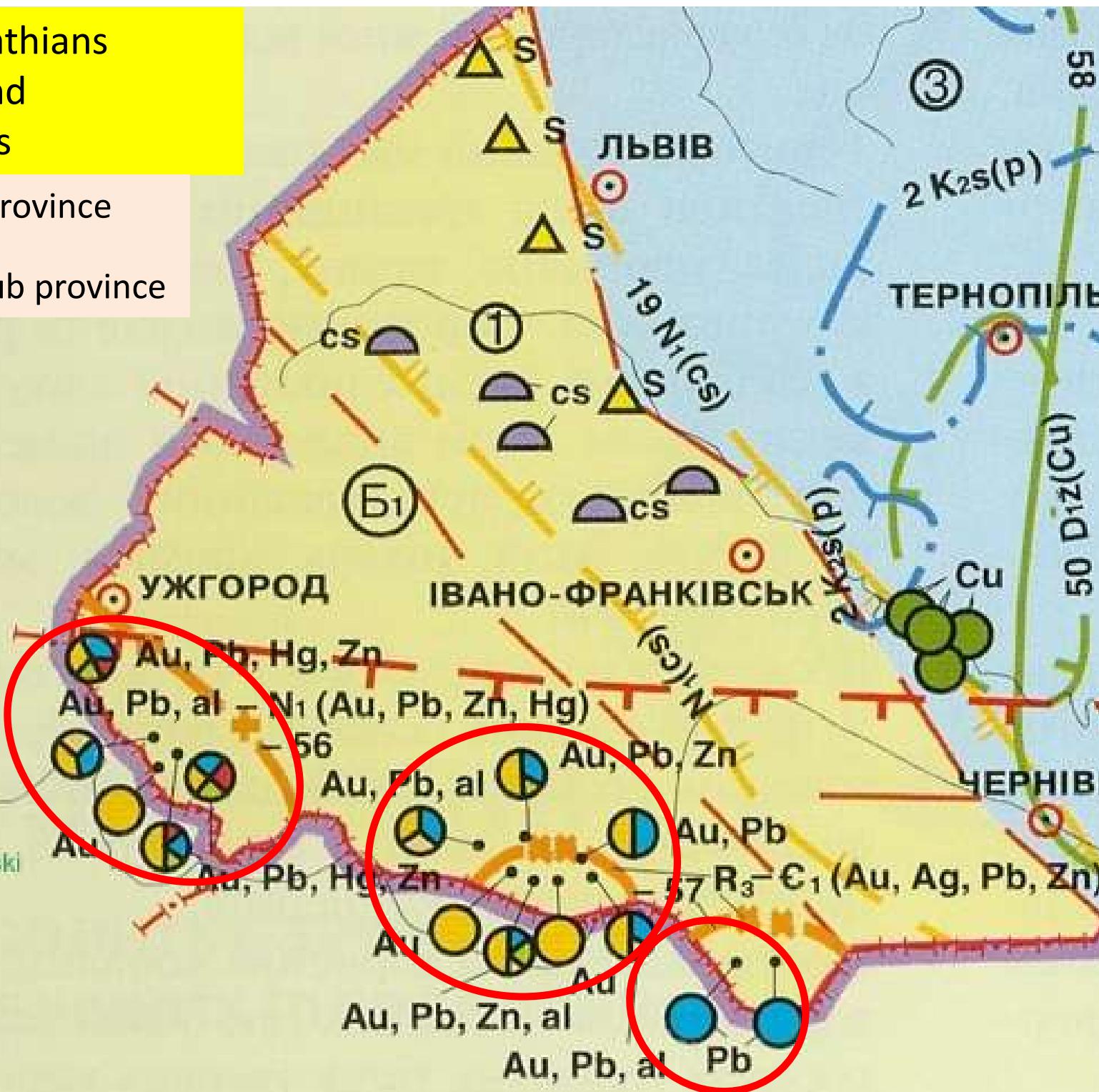


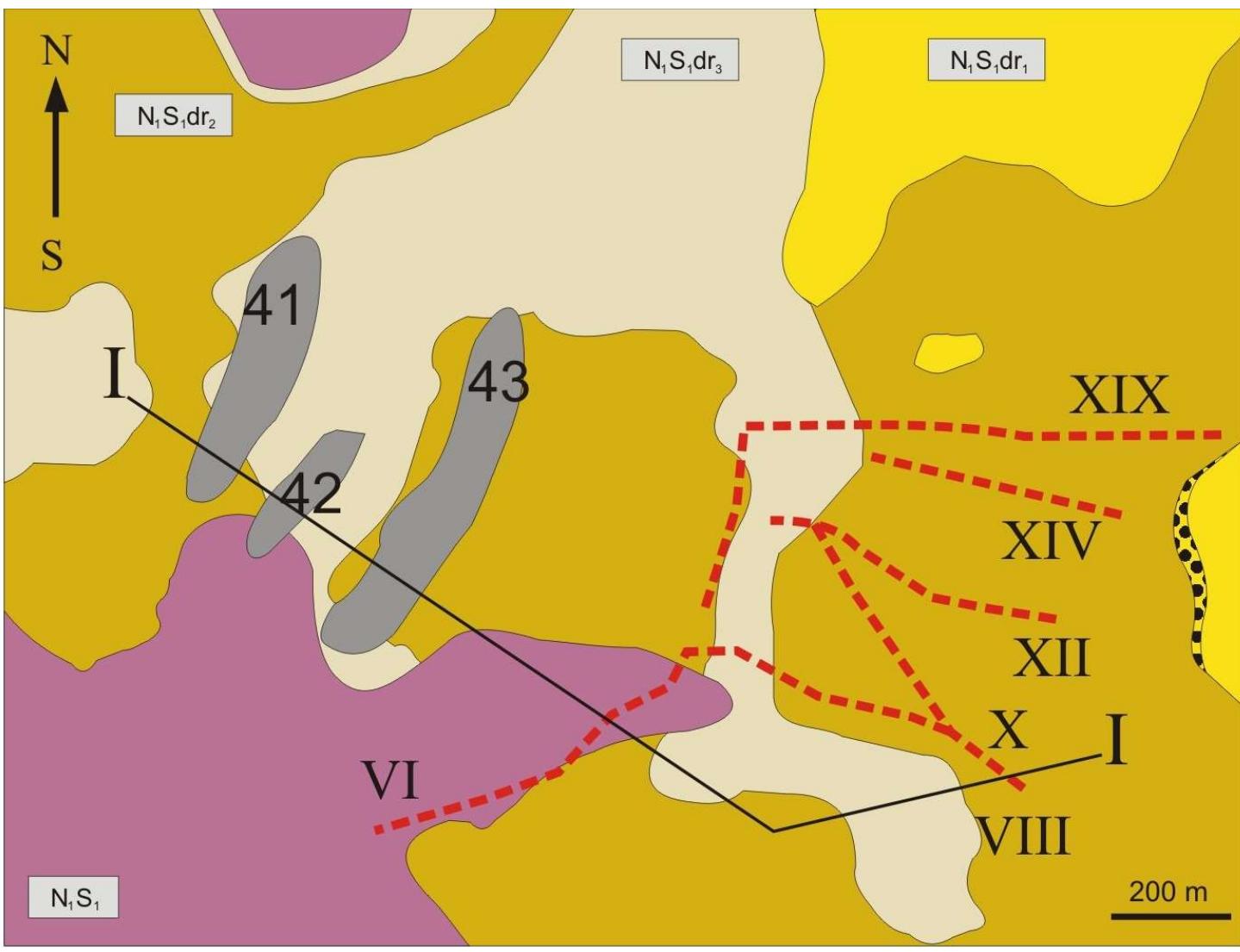
Vohlyn-Podole sub province

	Cu	1	Copper
	Pb	2	Lead
	Zn	3	Zinc
	Hg	4	Mercury
	Au	5	Gold
	al	6	Alunite
	cs	7	Rock salt
	S	8	sulphur

Beregowsko-Bigański rejon mineralizacji Au-polimetalicznej

Rachowsko-Czywczynski rejon mineralizacji Au-polimetalicznej

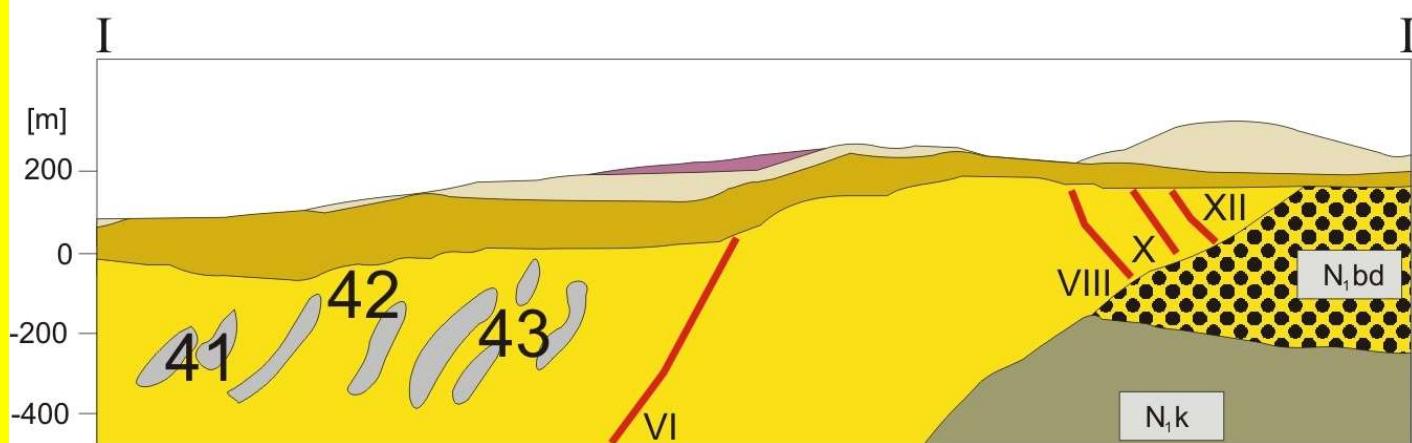




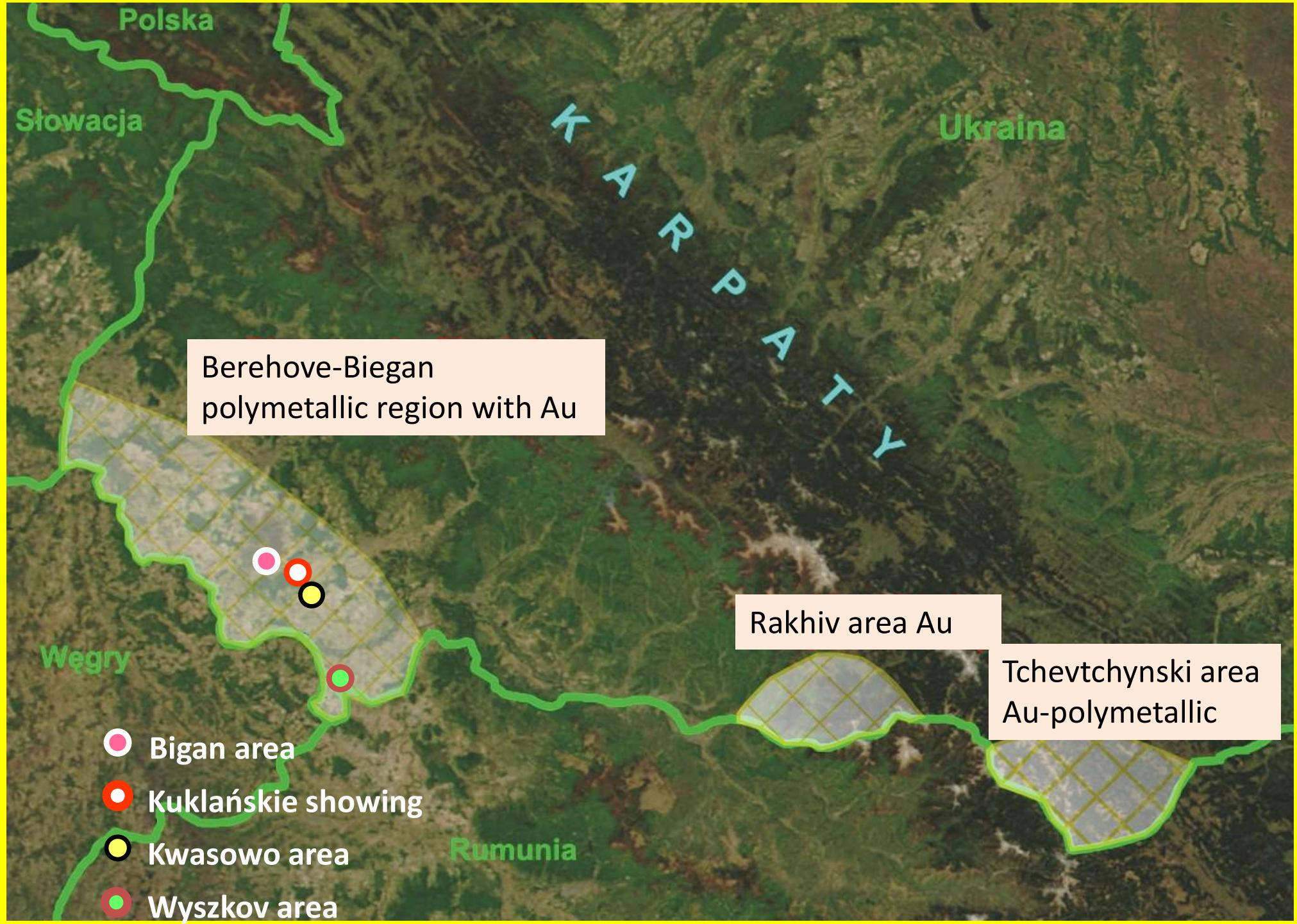
Berehove

- | | |
|---|---|
| 1 | N ₁ S ₁ dr ₃ |
| 2 | N ₁ S ₁ dr ₂ |
| 3 | N ₁ S ₁ dr ₁ |
| 4 | N ₁ bd |
| 5 | N ₁ k ₁ |
| 6 | N ₁ S ₁ |

- 7 VIII
8 42



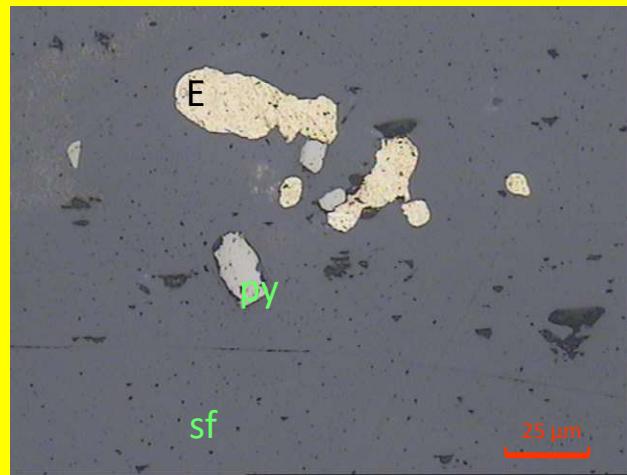
Avellana Gold ?





Muzhijev, Ukraina, 2012

Muzhijevo



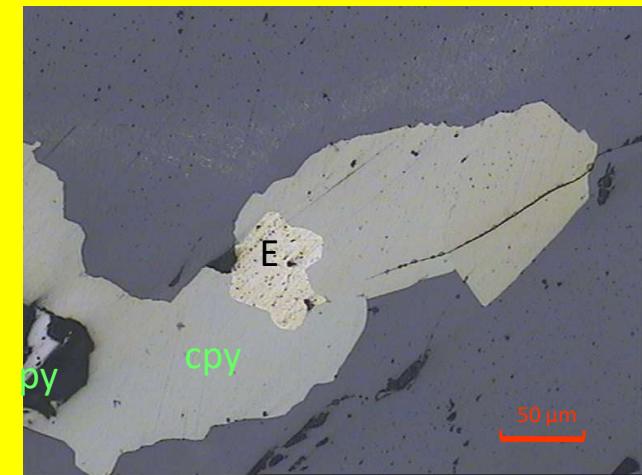
Au – native

E - electrum



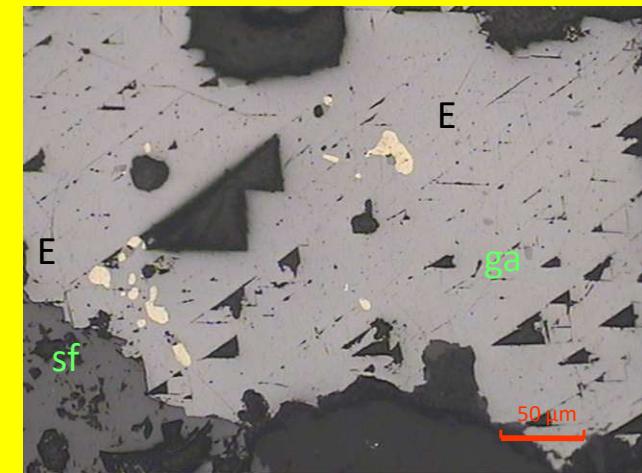
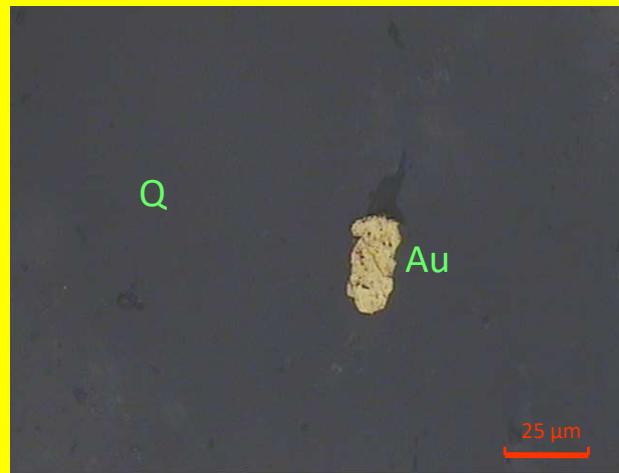
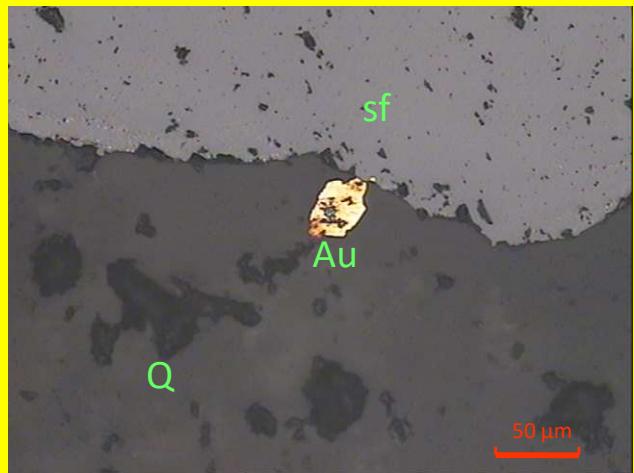
sf – sphalerite

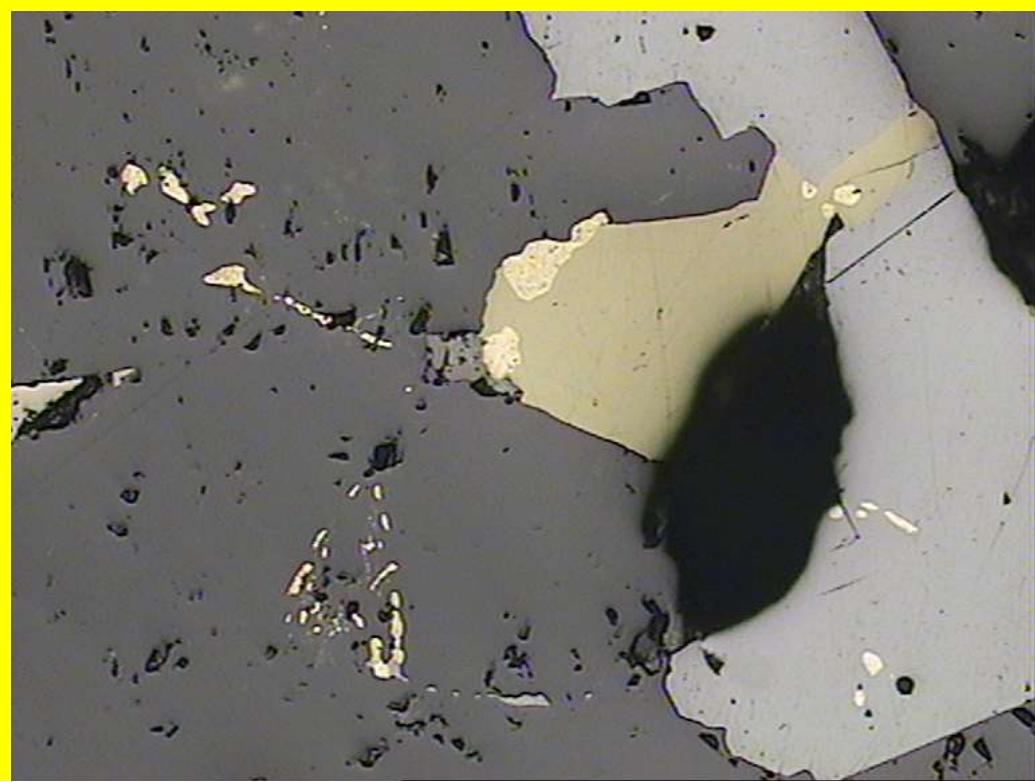
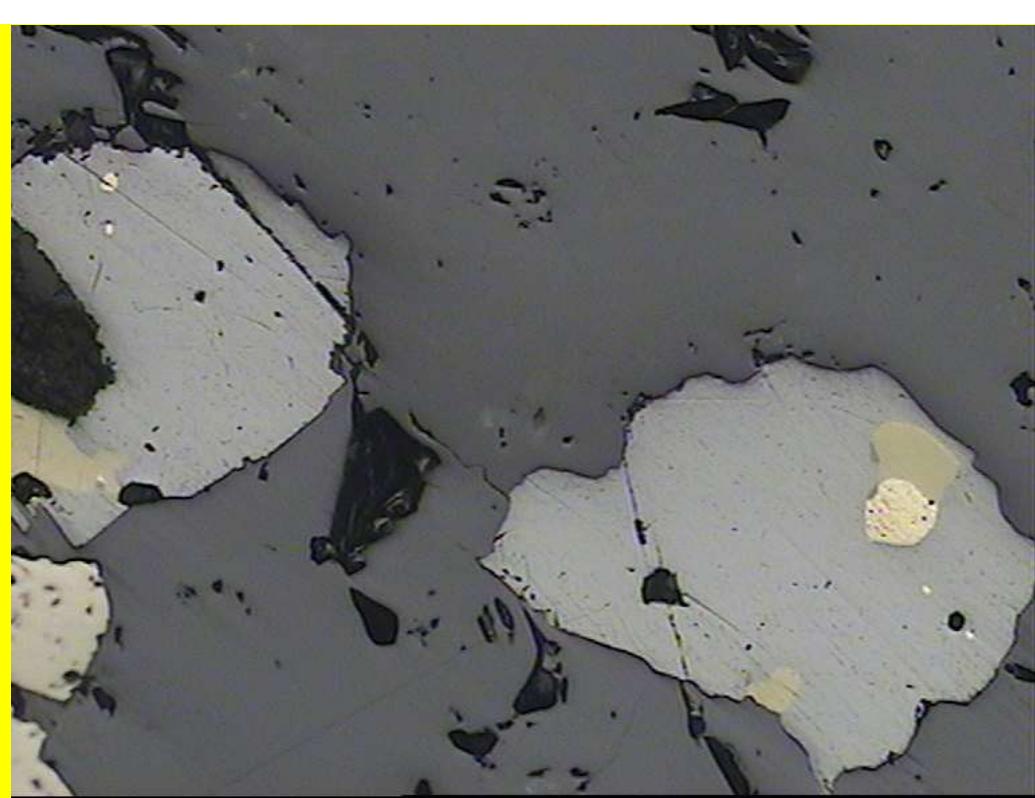
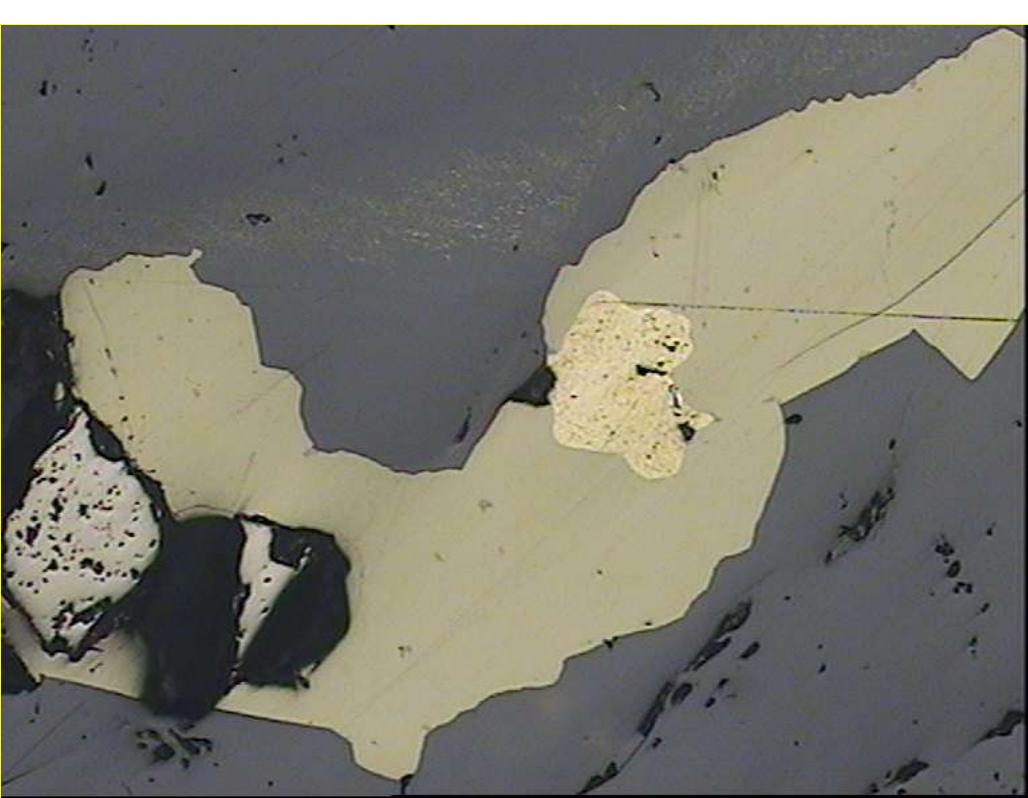
py - pyrite



Q – quartz

ga - galena



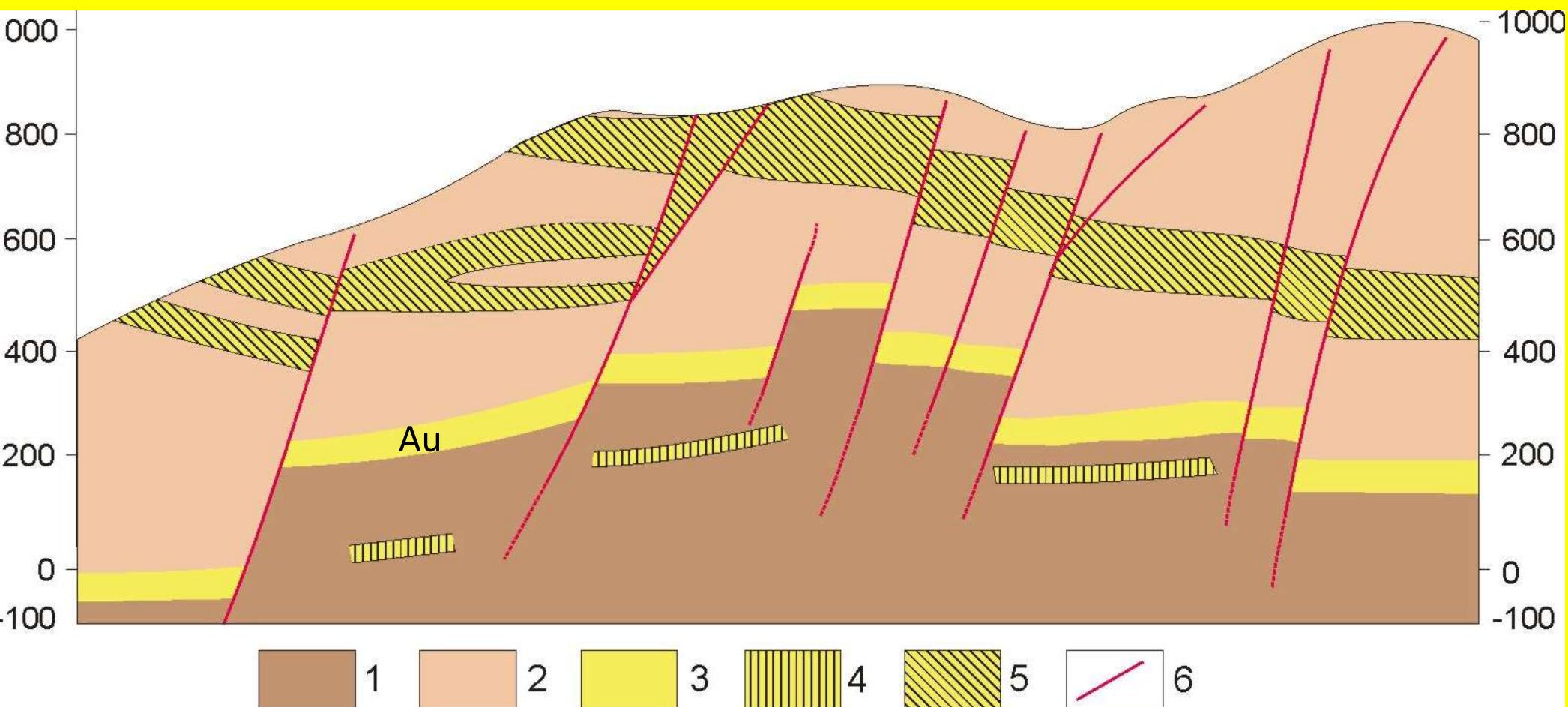


Saulak

Złoże Au



Złoże Au Saulak



1- jednostka bielopotocka, 2- jednostka dilove, 3- główne strefy rudne, 4- strefy rudne w jednostce dilove

Wychodnia złoża Saulak





Saulak, 2019

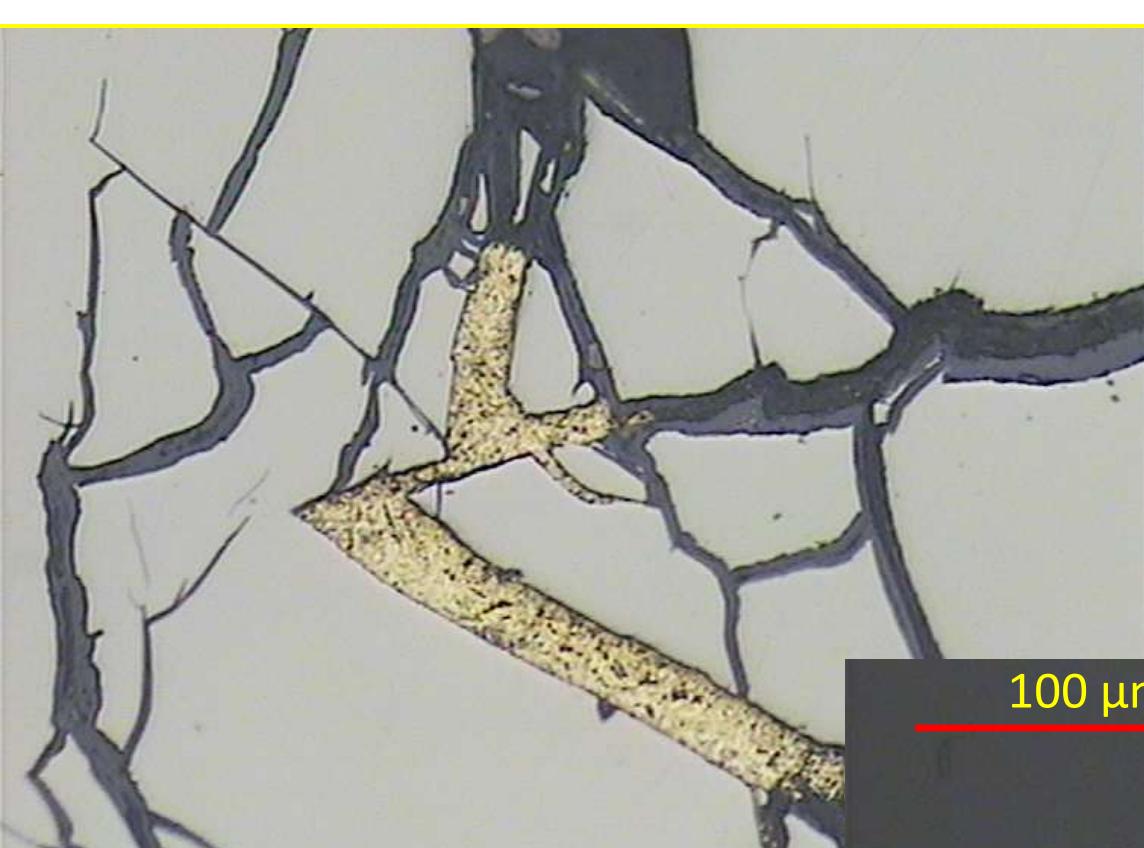




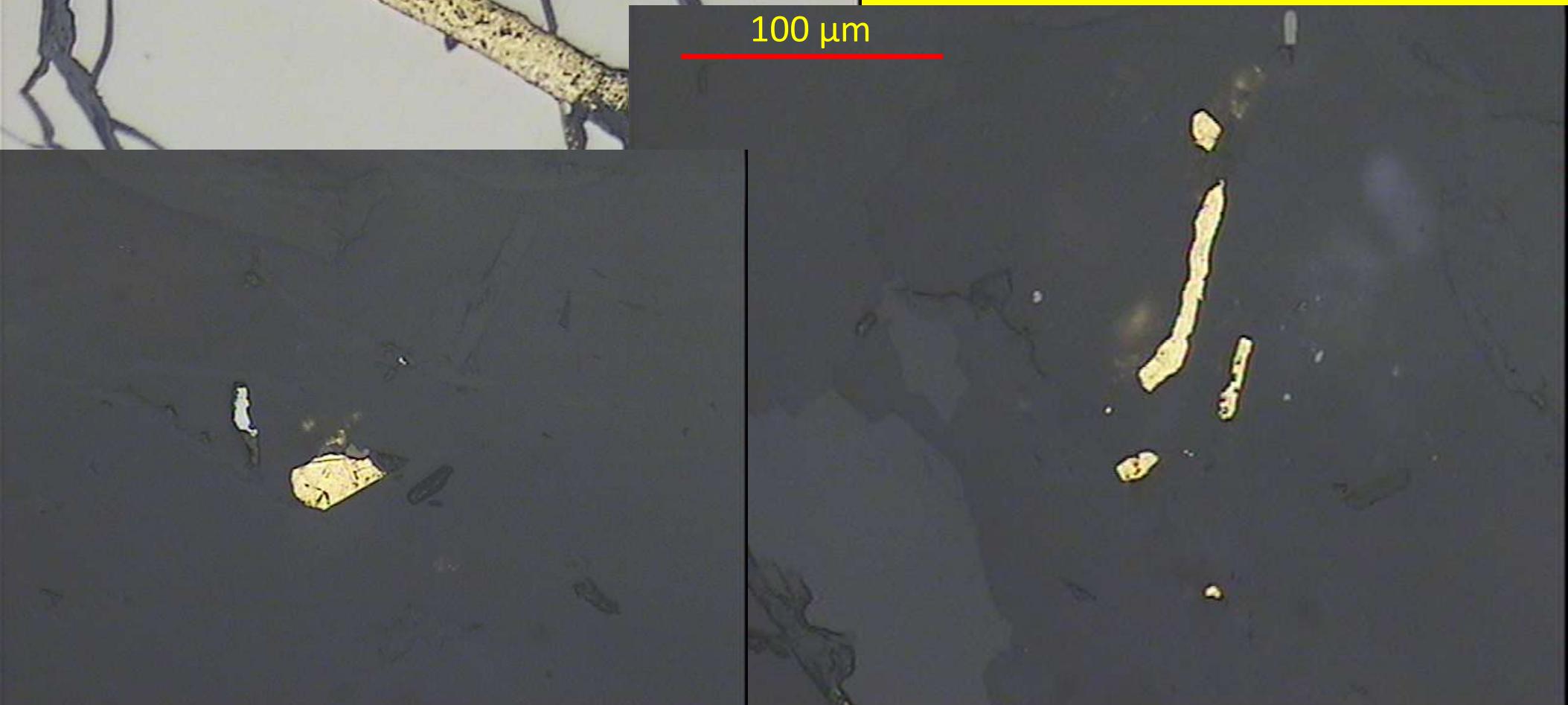
2m

Sztolnia Saulak, 2016, fot. J. Pieczonka

Złoto ze strefy
złożowej, Saulak

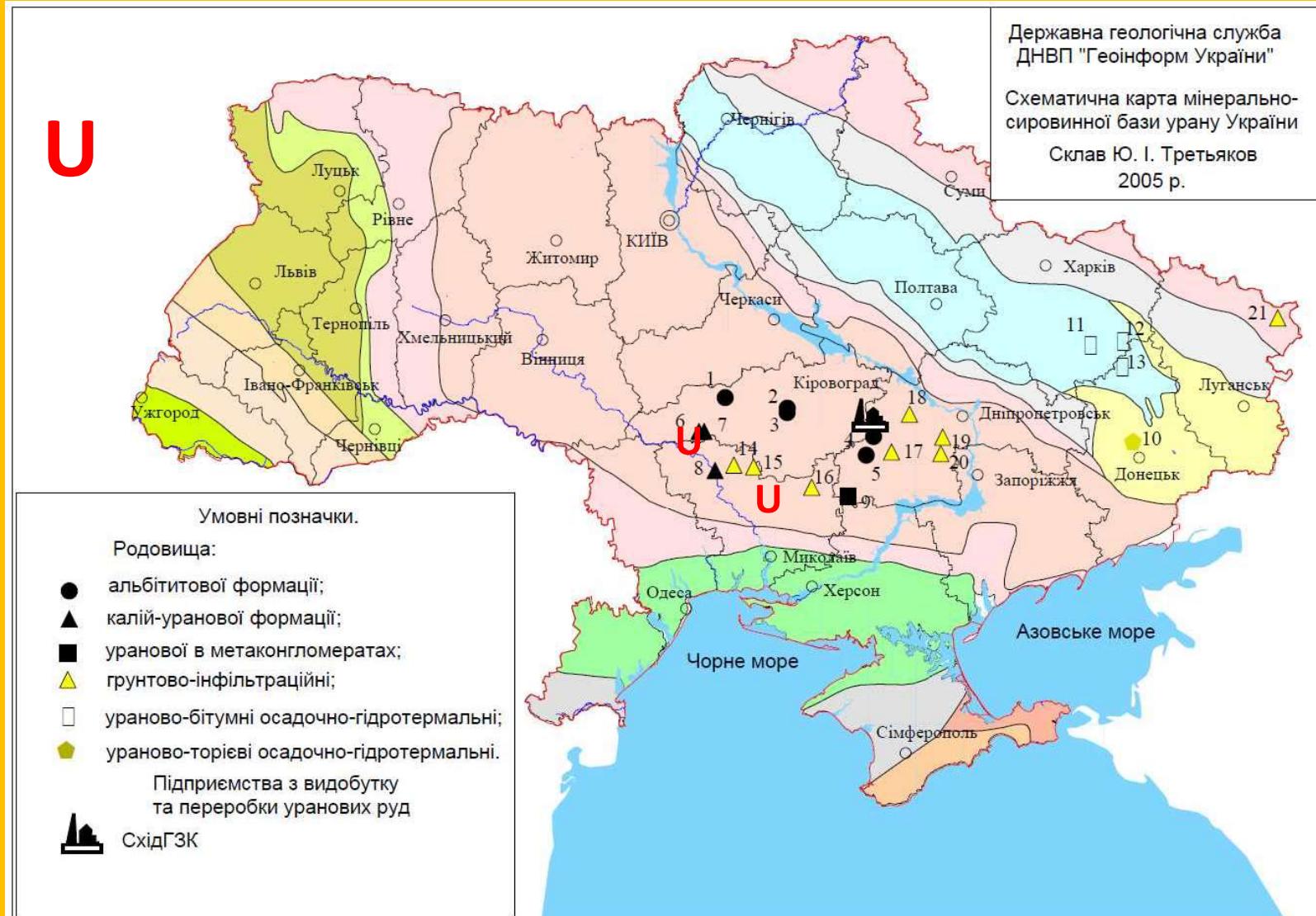


100 μm



U deposits

21 złóż ale tylko 2 eksploatowane: Vatutinkiye, Mitchurinskoye



Мінерально-сировинна база урану України
(за матеріалами КП "Кривогеологія")

Мінерально-сировинна база урану України (За матеріалами КП "Кіровгеологія")

Родовища урану на рис.

1. Ватутінське

2. Северинівське

3. Мічурінське

4. Жовторіченське

5. Первомайське

6. Лозуватське

7. Калинівське

8. Південне

9. Ніколокозельське

10. Миколаївське

11. Берекське

12. Червонооскольське

13. Адамовське

14. Садово-Костянтинівське

15. Братське

16. Сафонівське

17. Девладівське

18. Ново-Гур'ївське

19. Сурське

20. Червоноярське

21. Марковське

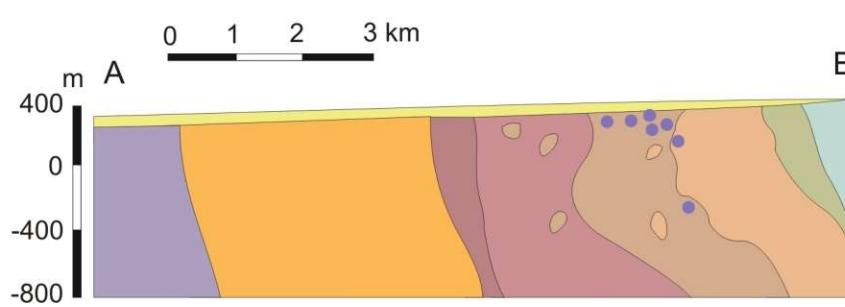
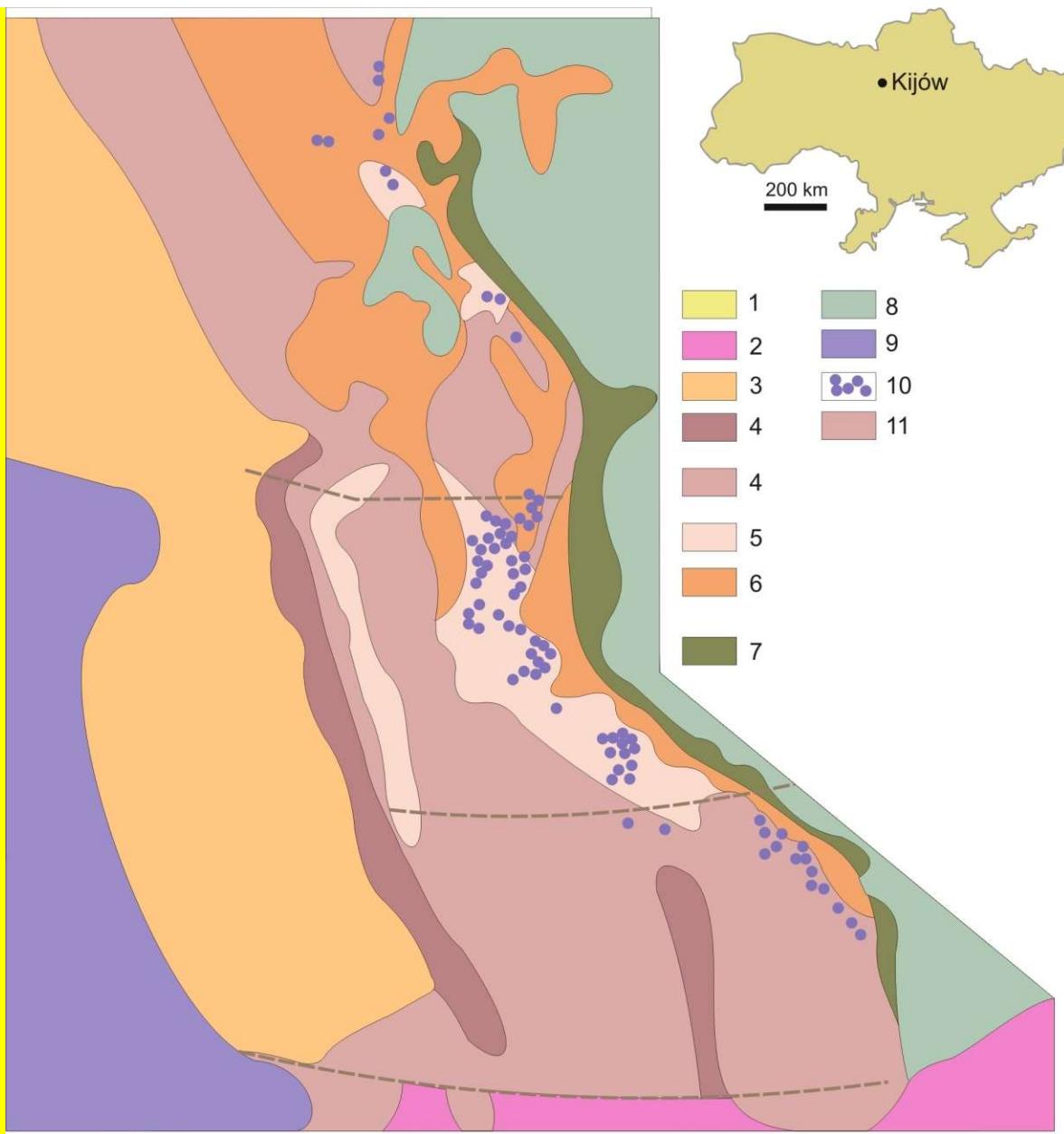
Примітка:

Мічурінське

Братське

- родовища що експлуатуються

- відпрацьовані родовища



pegmatyty

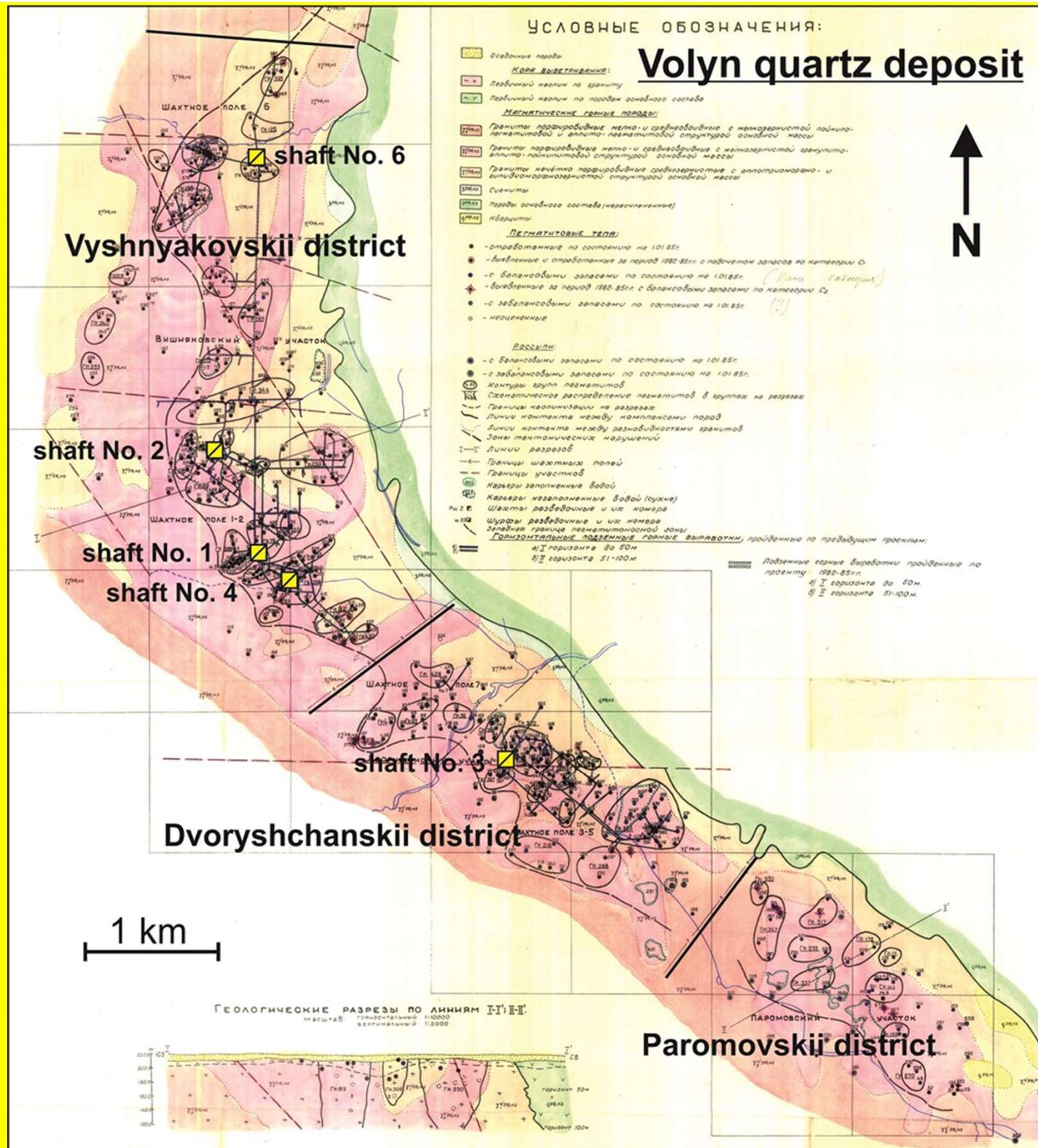


Kwarc dymny, Wołyń

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ:

Volyn quartz deposit

↑
N



Volodarsk Volynskij (Horyszew), pegmatyty gnizdowe



2015

webmineral.n

2017



2015



2017



2017





heliodor





Flowers of Ukraine:Topaz, Aquamarine, Heliodor



Since 2000 geology has gon to war

dziękujemy



**Zeolite
Sokirnica open pit**



Sołotwino, rock salt diapire



K-rock salt, and Na, Kałusz



15.5.22