UDK 550.93

GEOCHRONOLOGY OF GRANITOIDS OF THE EASTERN PART OF THE INHUL REGION (THE UKRAINIAN SHIELD)

L.M. Stepanyuk, S.I. Kurylo, T.I. Dovbush, O.V. Grinchenko, V.O. Syomka, S.M. Bondarenko, L.V. Shumlyanskyy

M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation
of the National Academy of Sciences of Ukraine
03142, просп. акад. Палладіна, 34, м. Київ, Україна
E-mail: stepaniuk@nas.gov.ua

Several massifs of biotite uneven-grained, porphyric, pegmatite and aplite-pegmatite granites of the Kirovohrad Complex, and of hypesthene-bearing (charnockites) granites, monzonites and black-quartz granites of the Novoukrainka Complex are distributed within the eastern part of the Inhul region.
The ages of granite crystallization were determined by U-Pb isotope method on multigrain fractions of monazite. Granites of the Pavlivka, Verblyuzhka, and Krynytchuvatska massifs were formed within the age interval of 2038-2046 Ma (within the error of measurement). Monazites sampled from aplite-pegmatite granites that widely crop out a long the right bank of the Bokovenka River (northwards of the Novooleksandrivka village) yielded a younger age of 2030.0 ± 0.3 Ma.Granitoids located in other parts of the Inhul region, i. e. Novoukrainka, Voznesensk, Lisohirska and some other smaller granite massifs, were formed during the same time interval.
Keywords: Ingul region, granite, monazite, isotope age.

Introduction. Numerous small massifs of biotite uneven-grained, porphyric, pegmatitic and aplite-pegmatitic granites of the Kirovohrad Complex, and of hypersthene-bearing granites (charnockites), monzonites and black-quartz granites of the Novoukrainka Complex [5] are widely distributed in the eastern part of the Ingul region. According to [16], these massifs are commonly elongated in shape reaching 2-2.5 km in width and 15-18 km in length. They are usually confined to the southwest-striking faults. All these massifs occur comfortably to the host metamorphic rocks of the Spasivka and Tchetcheliivka Suites of the Inhul-Inhulets Series.

Granitoids of the Kirovohrad complex are uneven-grained, porphyric and aplite-pegmatitic in appearance. They can be found in outcrops along both banks of the Bokovenka River from Hrystoforivka to Oleksandrivka villages and in many open pits (e. g. near Malofedorivka village). The Pavlivka massif was mapped by geologists of the Krivyi Rih geological enterprise near Pavlivka village in the lower course of the Bokovenka River. Aplite-pegmatitic granites of Krynytchuvatka massif crop out along the Berezivka River upstream of the Krynytchuvatka village. Red aplite-like granites of the Zvenihorodka-Oleksandriya massif occur in outcrops near the Oleksandriya-Krementchug road, on the left bank of the Inhulets River [6].

Granitoids of the Novoukrainka Complex crop out in large quarries located on the left bank of the Bokovenka River, in the area between Oleksandrivka and Ivanivka villages (the Bokovyanka massif). They also crop out along the Valley of the Verblyuzhka River, to the east of Spasove village (the Verblyuzka massif).

Despite the large variability and wide distribution of granitoids within the Ingul region, there is a lack of precise determinations of their ages. Some previous age determinations have been done using the out-of-date K-Ar method and sporadic determinations were made by the U-Pb method on zircons and monazites. Results of these determinations are summarized in [4]. A few U-Pb isochronous ages on zircons were also produced [15]. Recently, monazites from granitoids of the Novoukrainka Complex [8], and of the Dolinsky [11], Voznesensky [12], Taburishchensky, Lipnyazhsky [14], Lisohirsky [9] and some other massifs [10] of the Kirovohrad Complex, as well as monazites from the granite + granite vein + gneiss (xenolith) association – sampled at the Novhorodkivka quarry [14] were dated by U-Pb method.

Objects and methods of investigation. In this paper we discusse results of the U-Pb isotope dating of monazites from granitoids that crop out along the Bokovenka (Pavlivka and Oleksandrivka villages), Verblyuzhka (Spasove village), Berezivka (Krynytchuvatka village) and Inhulets (area to the north of the town of Oleksandriya) rivers. We provide a new age data for aplite-pegmatitic granite (sample 14/15) sampled at the right bank of the Bokovenka river (area to the north of Novooleksandrivka village); for uneven-grained granite (sample 32) of the Pavlivka massif; for coarse-grained black-quartz (sample 28/15) and aplite-pegmatitic (sample 29/15) granite sampled on the right bank of left tributary of the Verblyuzhka River (Spasove village, the Verblyuzhka massif); for aplite-pegmatitic granite (sample 12/10) that crop out to the north of Krynytchuvatka village (the Krynytchuvatka massif) and for aplite granite (sample 14/10) that was sampled to the north of the town of Oleksandriya.

Monazite ages are determined by the conventional U-Pb method at the Department of Radiogeochronology, Institute of Geochemistry, Mineralogy and Ore Formation, NAS of Ukraine. For the purposes of isotope dating, light yellow transparent grains without any indications of the presence of intergrowths and inclusions of other minerals were selected manually under the binocular microscope from different size fractions. The technique of chemical treatment of monazites for the mass-spectrometric investigation is described in [17]. For determination of U and Pb concentrations the mixed $^{235}U+^{206}Pb$ tracer was used.

Lead and uranium isotope measurements were carried out using the 8-collector mass spectrometer MI-1201 AT that was run in a static mode. Mathematical data interpretation is made applying Pb Dat and ISOPLOT software [18, 19]. Age determination errors are given at 2σ. Zircon standard *IGMR*-1 [1] is used for the metrological control of the method.

This investigation was aimed at establishing of precise U-Pb ages of various granite massifs in the eastern part of the Inhul region of the Ukrainian Shield.

Results and discussion. A wide zone of metamorphic rocks of the Inhul-Inhulets Series intruded by numerous small granite massifs of the Kirovohrad Complex is situated along the Bokovenka River, in the area near Novooleksandrivka village [2]. One body of porphyry-like coarse-grained garnet-biotite granite that is cut by veins of aplite-pegmatite and pegmatite granites crops out on the right bank of the Bokovenka River, northwards of Novooleksandrivka village. The thicknesses of these veins range from several tens of centimeters to several meters. On the northern flank of the outcrop aplite-pegmatite granites prevail and it is that location where sample 14/15 was collected from ~1,5 m thick vein.

Light-pink biotite-garnet **aplite-pegmatite granite** (sample 14/15), right bank of the Bokovenka River, northwards of the Novooleksandrivka village.The unidirectional orientation of elongated grains of microcline and quartz results in the development of a weakly manifested gneissic texture. The presence of aggregations of large microcline crystals causes spotted texture.The structure is quite heterogeneous due to the presence of large microcline tabular crystals that reach 4-7 mm in size. These crystals form aggregates and

Table 1. **Chemical composition of granites of the eastern part of the Inhul region, the Ukrainian Shield**

Field sample #	Oxides, %														
	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	S	H_2O	LOI	Total
14/15	70.93	0.09	13.74	0.33	1.86	0.63	0.82	0.97	2.49	7.58	0.22	0.03	<0.01	0.48	100.17
28/15	71.92	0.37	11.98	0.23	3.74	0.04	0.24	1.68	3.03	4.88	0.15	0.02	0.24	1.04	99.56
29/15	71.69	0.22	12.27	0.41	3.17	0.03	0.08	2.62	3.35	4.56	0.19	0.02	0.09	0.91	99.61
32	72.42	0.21	13.61	0.58	1.05	0.03	0.62	1.15	3.72	5.58	0.21	0.03	0.31	0.35	99.87
12/10	74.96	0.25	11.31	0.17	2.16	<0.02	0.32	1.54	2.90	4.78	0.08	<0.02	0.15	0.91	99.53
14/10	74.74	0.25	11.96	0.02	2.16	<0.02	0.32	1.56	3.10	4.78	0.06	<0.02	0.11	0.66	99.72

Notes. 14/15 - aplite-pegmate granite; 28/15 - porphyric and coarse-grained granite; 29/15 - aplite granite; 32 - even-grained, medium- and fine-grained granite; 12/10 - aplite-pegmate granite; 14/10 - aplite granite. Analyses were carried out in the laboratory of the IGMR, NAS of Ukraine. Analyst Krasyuk O.P.

comprise 25 to 40% of the rock volume. A fine-grained matrix made of 1.7 to 2.0 mm grains occurs between microcline plates. Feldspar crystals are usually anhedral whereas quartz and garnet are commonly found as distinct hexahedrons.The rock has a porphyry texture and is characterized by a uniform medium-grained matrix. Locally, it is uneven-grained and indistinctly granulitic. The cataclasis is rather weak and can be revealed in the blocky and wavy extinction of quartz.

Granite has the following mineral composition (vol. %): microcline (45-50), plagioclase (20-25), quartz (20-25); biotite (3-4), and garnet (2-3). Accessory minerals are apatite, monazite, and zircon. A list of secondary minerals includes chlorite, muscovite formed after biotite, and sericite developed after plagioclase. Table 1 shows chemical composition of granite.

Microcline occurs as anhedral or tabular grains that range in size from 1.5 to 7 mm. Most of the grains have irregular, solid, cell- and sheaf-like microcline lattice and contain numerous perthites of two morphological types: 1) widely distributed small, disk-shaped micro and mesoperthites of a regular shape; 2) irregular string-type perthites. Inclusions of rounded and occasionally tabular plagioclase, rounded and euhedral quartz and monazite, and euhedral biotite can be found in microcline crystals.

Quartz forms rounded and lens-like anhedral and euhedral (hexahedrons) grains that range in size from 0.5 to 2.2 mm. Quartz grains are evenly distributed in the matrix and also occur as euhedral inclusions in microcline. They show weak wavy and rare block-and-wavy extinctions. Rarely, they contain small grains of rounded microcline.

Plagioclase occurs as fine grains reaching 0.1-0.5 mm in size that may form aggregates. It is located on intergranular boundaries, mainly between microcline crystals and rarely between microcline and quartz. It also occurs as inclusions in microcline. Matrix plagioclase is anhedral and rarely tabular in shape. Plagioclase inclusions in microcline occur as tabular, elongated and rounded grains. Many of the plagioclase grains have thin twins, and commonly contain myrmekites and partly replaced by sericite. Albite is formed at grain rims of plagioclase included in microcline and rarely in the matrix. Sometimes albite is replaced by microcline.

Biotite forms euhedral and subhedral flakes ranging from 0.1 to 1 mm in size, with some flakes reaching 2,2 mm. These flakes occur as single grains or form small aggregates. Biotite is grayish brown in color and shows distinct pleochroism. Biotite contains small inclusions of apatite, quartz and zircon, and rare titanite. Some of the flakes are slightly replaced by muscovite. Locally muscovite occurs as pseudomorphs after biotite with fine grains of iron oxides distributed along cleavage.

Garnet is represented by rounded, anhedral and euhedral grains varying is size from 0.4 to 1.2 mm. It usually occurs on intergranular boundaries between microcline and quartz.

Zircon forms prismatic and rounded tiny brown and dark brown crystals. It occurs as inclusions in microcline and at boundaries between quartz and microcline grains.

Monazite forms light yellow transparent crystals (about 10%) that have rounded outlines, rather small size (<0.04 mm), equant and cake-like shape. Large (<0.05 mm) light yellow and yellow, transparent and semi-transparent monazite crystals are more common (about 60%). They occur as equant cake-like or flattened disk-shaped crystals with rounded outlines. Large (>0.05 mm) transparent yellow crystals with distinct facets are also common (about 30%). Besides their pinacoidal habit, these crystals show the presence of other facets and even distinct edges. Most of the monazite crystals have even and lustrous surfaces; in contrast, semi-transparent grains have rough surfaces that possibly cause their low transparency. In thin sections, monazite is found as inclusions in microcline, rarely in biotite and in plagioclase. Sometimes it is located at intergranular boundaries.

The ages of monazite are determined for three multigrain dimensional fractions of light yellow transparent crystals and for one multigrain fraction of yellow transparent crystals. Results of dating are reported in Table 2. The age of 2022 ± 26 Ma is defined by the upper intercept of concordia with discordia where as the lower intercept has an age of 328 ± 704 Ma. As the U-Pb results demonstrate rather small scatter and small discordance (from -3.6 to 4.2 %, see Table 2), the weighted average $^{207}Pb/^{206}Pb$ isotope age of 2030.0 ± 0.3 Ma is accepted as the age of granite formation.

The Verblyuzhka massif. The massif has a crescent shape with a convexity directed towards the southwest. The northern contact of the massif with the host gneisses can be traced along the left bank of the Verblyuzhka River over the whole distance between Tchetcheliivka to Spasove villages. Massif restores its northwest strike in the area between Spasove village and the Beshki River. Rocks of the massif are exposed along the Inhulets River which intersects the eastern part of the massif in the area located downstream of the Verblyuzhka River. Another branch of the massif crops out along the

Vodyana River. Numerous apophysis of red aplitic granites that cut migmatites and gray granites are distributed along the lower contact of the massif [7].

The massif is made of porphyric coarse-grained granites which gradually become greenish-gray in color and more coarse-grained over the distance from the area west of Malynivka village up to Spasove village. They gradually become enriched in pyroxene and turn into charnockite, and then into black monzonite that occurs near Spasove village. Red coarse-grained granite with black quartz occurs in the area above Spasove village [7].

Monazites are sampled from porphyric coarse-grained black-quartz granite (sample 28/15) and from 15 cm-thick aplite vein (sample 29/15) that cuts mentioned above coarse-grained granites. These rocks crop out on the right bank of the left tributary of the Verblyuzhka River, near the eastern boundary of Spasove village. The distance between samples 28/15 and 29/15 is about 2 meters.

Porphyric coarse-grained granite (sample 28/15) is a dark-red rock that contains black quartz and shows the massive structure and porphyric texture. It hosts phenocrysts of elongated tabular grains of microcline that reach 1.5-3.0 cm in length and 0.5-1.0 cm in width. Phenocrysts comprise about 25% of the rock volume. The subhedral granular matrix is evenly coarse-grained and it is comprised of grains with an average size of 3-6 mm. The cataclasis is revealed by the blocky and wavy extinction of quartz.

The mineral composition is as follows (vol. %): microcline (25-30), plagioclase (45-50), quartz (25-30) and biotite (8-10). Accessory minerals are apatite, zircon, and monazite. A list of secondary minerals includes chlorite and muscovite that are developed after biotite. The chemical composition of granite is listed in Table 1.

Microcline occurs in thematrix as subhedral and anhedral grains that reach 3-4 mm in size. Microcline lattice is cell- and sheaf-like and of middle perfection. Microcline grains contain small disk-shaped microperthites.

Plagioclase forms predominantly tabular grains that range from 3 to 5 mm in size. Most grains have thin twins and some grains contain small tabular antiperthites distributed along cleavage planes. Plagioclase is weakly sericitised and contains rare small inclusions of quartz and biotite.

Quartz forms rounded and anhedral grains that reach 1.5-4 mm in size and has weak blocky and wavy extinction. Quartz also forms small grain aggregates up to 7 mm in size.

Biotite forms euhedral to anhedral flakes that have splited terminations and range in size from 0.5 to 3.5 mm. Biotite occurs as single grains or grain aggregates that reach up to 4-5 mm in size. It is brown in color and shows distinct pleochroism. Locally, biotite forms fine intergrowths with quartz that occur at the contact with microcline. Inclusions of zircon and apatite are very common.

Zircon occurs as light brown prismatic and rounded grains that form inclusions in biotite and rarely in quartz. Zircon is commonly fractured and some grains contain inherited cores.

Monazite forms light yellow transparent equant and cake-like crystals that are rather large in size, with size fraction of 0.05-0.07 mm being predominant. Two varieties of monazite were distinguished, i.e. water-transparent and transparent crystals. Water-transparent crystals have smooth lustrous surface and commonly less than 0.05 mm in size. Transparent crystals have rough lusterless surface.

In general, monazite crystals have rounded outlines and only a few grains had distinct facets and rare edges. Inclusions of sulfides and rarely rock-forming minerals were found in some crystals of monazite. After the treatment with diluted HCl some of the monazite crystals, especially those that contained inclusions, developed white crusts.

One multigrain fraction of light yellow water-transparent crystals, two multigrain dimensional fractions of light yellow transparent crystals, and one multigrain fraction of monazite that became covered with solid white crusts after the treatment with HCl were used for the age determination. Results of isotope analyses are listed in Table 2. The upper intercept of the regression line with concordia indicates the age of 2041.2 ± 1.0 Ma (Fig. 2). The $^{207}Pb/^{206}Pb$ weighted average age is 2041.6 ± 0.9 Ma. So, the age of 2041±1 Ma is accepted as an age of coarse-grained granite of the Verblyuzka massif.

Aplite uneven-grained granite (sample 29/15). The vein shows indistinct textural zoning. The central part of the vein is made of more coarse-grained rocks in contrast to the fine-grained aplite varieties that compose the vein margins.

Thin section 1. Aplite granite occurs as a light pink rock of massive structure. The granite has uneven and medium-grained texture, with average graine size being about 2-2.5 mm and some of the feldspar grains reaching 3-5 mm. All grains are equally euhedral that results in the aplitic texture. The cataclasis is rather weak and revealed in the blocky and wavy extinction of quartz and wavy extinction of feldspars.

Table 2. **Concentrations of U and Pb, and Pb isotope composition in monazites from granitoids of the eastern part of the Inhul region**

Mineral fraction	Concentration, ppm		Isotope ratios					Age, Ma		
	U	Pb	$^{206}Pb/^{204}Pb$	$^{206}Pb/^{207}Pb$	$^{206}Pb/^{208}Pb$	$^{206}Pb_r/^{238}U$	$^{207}Pb_r/^{35}U$	$^{206}Pb_r/^{238}U$	$^{207}Pb_r/^{235}U$	$^{207}Pb_r/^{206}Pbr$
Sample 14/15, aplite-pegmatite granite, Bokovenka River										
L-Y, W-t	2037	5649	32360	7.9777	0.13989	0.38608	6.6576	2105	2067	2029.7
1, L-Y, T	1728	5953	29410	7.9732	0.10927	0.38593	6.6566	2104	2067	2030.1
2, L-Y, T	1537	5239	30310	7.9758	0.11108	0.38746	6.6813	2111	2070	2029.7
3, L-Y, T	1630	5663	29670	7.9726	0.10902	0.38845	6.7007	2116	2073	2030.3
Sample 28/15, porphyry-granite of the Verblyuzhka massif										
L-Y, W-t	3019	6745	28250	7.9277	0.18084	0.38672	6.7075	2108	2074	2040.0
1, L-Y, T	3193	7241	38020	7.9283	0.17823	0.38784	6.7331	2113	2077	2041.6
2, L-Y, T	3217	7274	54640	7.9359	0.17826	0.38682	6.7144	2108	2075	2041.4
L-Y, T, C	4523	7155	12370	7.8796	0.19278	0.28847	5.0101	1634	1821	2042.4
Sample 29/15, aplite granite of the Verblyuzhka massif										
L-Y, W-t	1970	6515	34130	7.9246	0.11400	0.38466	6.6788	2098	2070	2041.9
1, L-Y, T	1791	6865	22030	7.9026	0.09755	0.38773	6.7395	2112	2078	2043.8
2, L-Y, T	1517	6931	29940	7.9177	0.07989	0.38553	6.6969	2102	2072	2042.7
G-Y, s-T	1528	7076	27300	7.9126	0.07887	0.38605	6.7079	2104	2074	2043.2
Sample 32, medium- to fine-grained granite of the Pavlivka massif										
1, df	4457	6169	906	7.1291	0.21611	0.27204	4.7181	1551	1770	2039.9
2, df	3900	4500	2940	7.6846	0.21624	0.23000	3.9880	1335	1632	2039.4
3, df	7327	11956	3620	7.7369	0.21255	0.32112	5.5663	1795	1911	2039.0
4, df	2906	5609	3390	7.7226	0.21516	0.38347	6.6467	2092	2066	2038.8
Sample 12/10, aplite-pegmatite granite of the Krynytchuvatka massif										
1, df	7006	9502	32780	7.9308	0.32437	0.37166	6.4471	2037	2039	2040.3
2, df	5992	8429	36900	7.9315	0.30748	0.37056	6.4298	2032	2036	2040.7
3, df	7441	10748	35340	7.9371	0.29999	0.37355	6.4764	2046	2043	2039.3
4, df	5526	8490	32150	7.9264	0.27225	0.36912	6.4063	2025	2033	2041.1
Sample 14/10, aplite granite, city of Oleksandriya										
1, df	5337	9074	36630	7.9271	0.22721	0.35455	6.1554	1956	1998	2041.7
2, df	4869	8003	43290	7.9246	0.24411	0.36282	6.3036	1996	2019	2043.0
3, df	5645	9472	36630	7.9365	0.23721	0.36206	6.2783	1992	2015	2039.6
4, df	5827	10263	62900	7.9321	0.22859	0.36912	6.4120	2025	2034	2042.7

Notes. Common Pb correctionsare made according to the Stacey and Kramers model for the age of 2040 Ma, except the sample 14/15, for which the correction age is 2030 Ma. Fractions: L-Y – light yellow, W-t – water-transparent, T – transparent, C – crystals that were coated by white crusts after the treatment with diluted HCl, G-Y – grayish-yellow, s-T – semi-transparent, df – dimensional fractions of light yellow transparent crystals.

Thin section 2. It is a light pink rock of massive structure. Aplite has a uniform and fine-grained (aplitic) microtexture with an average size of grains of about 0.5-1.0 mm.

Mineral composition is as follows (vol. %): plagioclase (44-48), microcline (25-30), quartz (24-28), and biotite (7-9). Accessory minerals are apatite, zircon, monazite, and titanite. Secondary minerals are chlorite and muscovite developed after biotite. The chemical composition of granite is listed in Table 1.

Plagioclase forms subhedral and rounded grains that range in size from 2 to 5 mm in the central part of the vein and from 0.4 to 1.2 mm in the contact zone of the vein. Most grains have twins of the medium and rarely good perfection. Fine myrmekites occur at contacts against microcline.

Plagioclase is weakly sericitised and contains fine grains of apatite.

Microcline forms euhedral to anhedral grains which range in size from 1.8 to 5 mm in the central part of the vein and from 0.4 to 2 mm at the vein margins. Isolated grains reveal the microcline lattice and of the chess-and sheaf-like twins. Microcline contains microperthites and rarely small drop-like perthites. Fine inclusions of quartz and biotite are found in some microcline crystals.

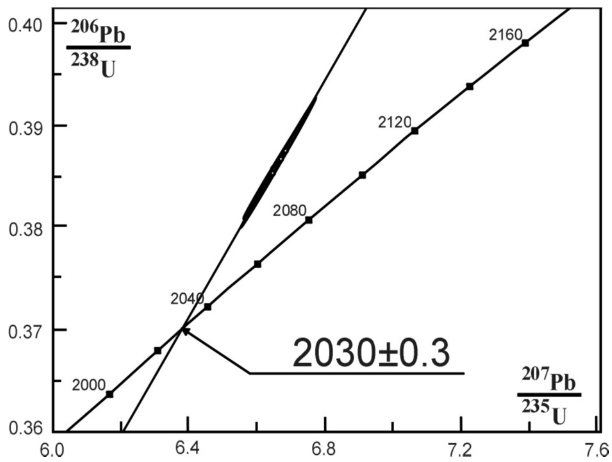

Fig. 1. The U-Pb diagram with concordia for monazites from aplite-pegmatite granite, sample 14/15. The age of monazite is 2030 ± 0.3 Ma

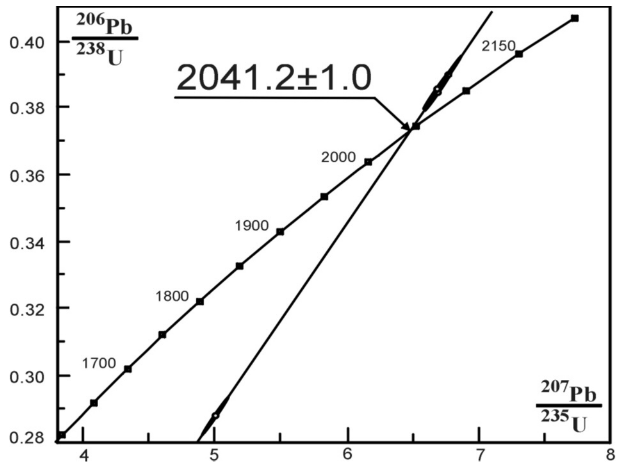

Fig. 2. The U-Pb diagram with concordia for monazites from porphyric granite of the Verblyuzhka massif, sample 28/15. The age of monazite is 2041.2 ± 1 Ma

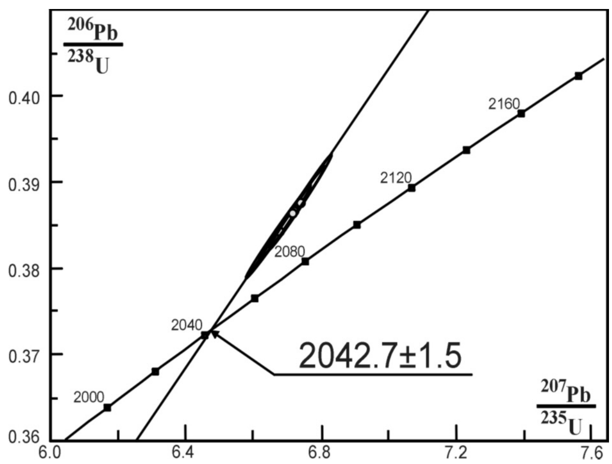

Fig. 3. The U-Pb diagram with concordia for monazites from aplite granite of the Verblyuzhka massif, sample 29/15. The age of monazite is 2042.7 ± 1.5 Ma

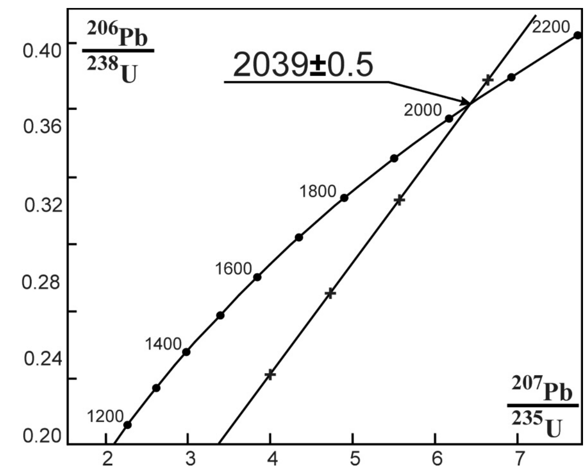

Fig. 4. The U-Pb diagram with concordia for monazites from medium- to fine-grained granite, sample 32.The age of monazite is 2039 ± 0.5 Ma

Quartz occurs as rounded and irregular-shaped grains and locally as hexahedrons that range in size from 0.4 to 4 mm. Usually, quartz occurs as larger grains that are comparable in size to feldspars in the central part of the vein. In places, it may form aggregates of fine grains that reach up to 4 mm in size. Quartz has an indistinct wavy extinction.

Biotite forms predominantly euhedral grains that range in size from 0.5 to 0.8 mm and in places have splited terminations. Biotite occurs as isolated flakes, and rarely as small aggregates of grains. It is greenish-brown in color and has distinct pleochroism. A few grains are replaced by pale-green chlorite and colorless muscovite.

Titanite forms isolated rounded grains of dark brown color that range in size from 0.3 to 0.4 mm and predominantly confined to biotite.

Zircon occurs as fine inclusion in plagioclase and biotite where pleochroic halos are found.

Apatite forms prismatic and elongated prismatic crystals, that occur as inclusions in plagioclase or associate with biotite.

Monazite forms light yellow (transparent) and brownish-yellow (semi-transparent, obviously ferruginous) disk-shaped grains. Cake-like crystals with rounded contours are less abundant. Light yellow water-transparent monazites are found as isolated grains. Most of the crystals (>70%) have even and lustrous surfaces, whereas the rest 30% of crystals have rough and fine-porous surfaces. Some monazite crystals contain inclusions of the rock-forming minerals and rare inclusions of fine grains of zircon.

After treatment with diluted HCl, the light yellow transparent crystals remain unaltered, whereas some of the brownish-yellow crystals become covered with white spots that occasionally may develop into the solid crust.

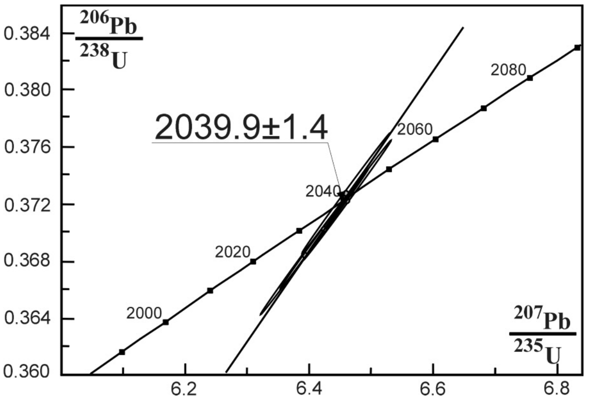

Fig. 5. The U-Pb diagram with concordia for monazites from aplite-pegmatite granite of the Krynytchuvatka massif, sample 12/10. The age of monazite is 2039.9 ± 1.4 Ma

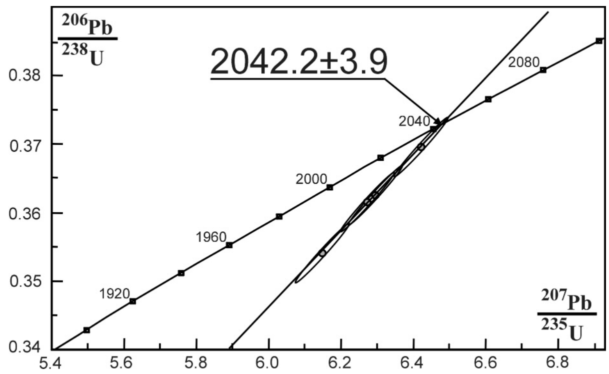

Fig. 6. The U-Pb diagram with concordia for monazites from aplite granite, sample 14/10, collected in the city of Oleksandriya. The age of monazite is 2042.2 ± 3.9 Ma

One multigrain fraction of light yellow water-transparent monazite crystals, two multigrain dimensional fractions of light yellow transparent crystals, and one multigrain fraction of brownish-yellow semi-transparent monazite grains were used for U-Pb isotope dating, results of which are presented in Table 2. The upper intercept corresponds to the age of 2033 Ma, whereas the lower intercept produced an age of 490 Ma. The weighted average $^{207}Pb/^{206}Pb$ age is 2042.7 ± 1.5 Ma (Fig. 3). This age is taken as the age of monazite crystallization and, correspondingly, as the age of aplite of the Verblyuzhka massif.

The Pavlivka massif mainly consists of uneven-grained and aplite-pegmatitic granites. It is located to the north of Pavlivka village. Granites are variable in color, ranging from light gray to white varieties, and biotitic in mineral composition. They crop out along the Bokovenka River and are partially exposed by stripping works carried out on the right bank of the Bokovenka River, in the area located about 1 km northwards of the northern boundary of Pavlivka village. Variably sized relics of supercrustal rocks of the Inhul-Inhulets Series (mainly biotite gneisses) and rare pegmatite veins reaching some tens centimeters in thickness occur in granites of the Pavlivka massif. In the east granites of the massif contact with biotite and biotite-amphibole gneisses of the Inhul-Inhulets Series, whereas the western contact of the massif is of tectonic nature. The age of granite was defined by U-Pb dating of monazites isolated from light-grey massive, medium- to fine-grained, even-grained biotite granite (sample 32). The grain sizes vary from of 0.5 to 2.0 mm. Euhedral plagioclase, subhedral quartz, and mainly anhedral microcline make the hypidiomorphic texture of the rock. The chemical composition of granite is listed in Table 1.

Mineral composition is as follows (vol. %): plagioclase (43-38), microcline (30-32), quartz (23-25), and biotite (4-5) are the main rock-forming minerals. Accessory minerals are apatite, zircon, and monazite. Secondary minerals are chlorite and hydromuscovite that developed after biotite.

Microcline forms subhedral tabular and anhedral grains, which sizes range from 0.2 to 2.0 mm. The microcline lattice is solid, cellular or sheaf-like and of medium perfection. Rarely, microcline contains small isolated microperthites. Rounded inclusions of quartz and plagioclase are found in large microcline crystals.

Plagioclase occurs as tabular and rarely anhedral grains that range from 0.2 to 2.0 mm in size. Twins are thin and well defined. Small myrmekites are rarely observed at the grain boundaries near microcline. Plagioclase is weakly sericitised and containes small inclusions of quartz, microcline, and biotite. In its turn, plagioclase forms rounded and euhedral inclusions in microcline that reach up to 0.1-0.2 mm in size. Commonly, they are surrounded by thin albite mantles.

Quartz is abundant in the matrix and occurs as inclusions in feldspars. In the matrix quartz forms rounded and irregular-shaped grains that are commonly 0.3-0.5 mm in size, with some of them reaching 2 mm.

Biotite forms isolated euhedral flakes varying from 0.1 to 1 mm in size. Flakes are evenly distributed over the rock volume. Colour of biotite is brown with distinct pleochroism. It hosts fine inclusions of apatite and zircon. Some of the flakes are weakly chloritized. Colorless muscovite is found to be confined to biotite. Hydromuscovite occurs at grain boundaries between feldspars and in fractures of microcline grains.

Apatite is rounded, prismatic or elongated-prismatic in shape. It forms inclusions in feldspars, quartz, and biotite.

Zircon is brown in color, prismatic and elongated-prismatic in shape. It occurs as inclusions in biotite or located at intergranular boundaries.

Monazite reaches up to 0.2 mm in size. It is slightly yellow in color, rounded in shape and forms inclusions in feldspars, quartz, and biotite. Under a binocular microscope, monazite appears as light yellow (transparent), brownish-yellow to brown (semi-transparent to opaque), cake- and disk-shaped grains, that have rounded outlines and rough surface. The brown color of monazite possibly develops as a result of ferrugination, which intensity depends on the amount of ferrous hydroxides that precipitated on the grain surface. After the treatment with diluted HCl, almost all monazite crystals became coated with a white crust. In most cases, the crust is formed all over the crystal surface and rare cases it is observed at isolated spots.

The ages of monazite are determined on four multigrain dimensional fractions of light yellow transparent crystals. Results of dating are listed in Table 2. The age of the upper intercept of the regression line with concordiais 2039.0 ± 0.5 Ma (Fig. 4), the lower intercept is at 2.4 ± 2.6 Ma. The $^{207}Pb/^{206}Pb$ weighted average age is 2039.3 ± 1.3 Ma. So, the age of 2039 ± 1 Ma is accepted as the age of granite of the Pavlivka massif.

The Krynytchuvatka massif is clearly manifested in the negative gravity field and positive magnetic field. The massif reveals textural zoning: pegmatite granites and pegmatites of the central part of the massif gradually turn into aplite, two-mica granites, and plagioclase-microcline, two-mica migmatites that prevail in the marginal parts of the massif. The massif hosted by gneisses of the Tchetcheliivka Suite that belongs to the Inhul-Inhulets Series. Rocks of the Krynytchuvatka massif, especially migmatites and aplite granites, contain numerous xenoliths of amphibolites, amphibole-biotite gneisses, hypersthene-biotite and biotite gneisses. Aplite-pegmatite granite (sample 12/10) the Krynytchuvatka massif was dated by the means of U-Pb method on monazite.

Pink massive **aplite-pegmatite granite**, sample 12/10, was collected northwards of Krynytchuvatka village, on the right bank of the Berezivka River, above the dam. This rock has uneven, medium- to fine-grained texture, with average grain size ranging from 0.5 to 1.2 mm, with some grains reaching 3 mm in size. A presence of euhedral plagioclase, and anhedral microcline and quartz results in the formation of an indistinct hypidiomorphic texture. The cataclasis is weakly revealed by the wavy and blocky extinction of quartz.

Mineral composition is as follows (vol. %): plagioclase (30-35), microcline (c. 30), quartz (30-32), biotite (6-8), and muscovite (1-2). A list of accessory minerals includes zircon, monazite, apatite, titanite, and allanite (relics). Secondary minerals are sericite developed after plagioclase and chlorite developed after biotite and allanite. The chemical composition is listed in Table 1.

Plagioclase commonly forms anhedral, rarely euhedral grains ranging from 0.5 to 1.0 mm in size. Mykmekites are commonly found at contacts with microcline, where plagioclase might be in reaction with microcline. Locally, intergrowths of both these minerals are present. Most of plagioclase grains are heavily sericitised. Sericite occurs as isolated spots, commonly in the core parts of plagioclase crystals, and is characterized by solid development.

Microcline forms rounded or anhedral crystals, having 0.4-1 mm in size. Microcline lattice is solid, drop-, sheaf-, and chess-like, usually of medium perfection. Perthites are found in some grains of microcline.

Quartz occurs as anhedral grains having wavy and blocky extinction, 0.4-1.2 mm in size, with some of them being as large as 3 mm. Quartz aggregates occur locally and these are interpreted as fragments of once intact primary grains.

Biotite is represented by euhedral flakes having 0.2-0.7 mm in size. Grain aggregates are rarely found. Biotite is greenish-brown in color with distinct pleochroism. Isolated grains are weakly chloritized. Colorless muscovite commonly develops at biotite margins.

Muscovite occurs in the matrix as separate colorless euhedral flakes reaching 0.5 mm in size. In places muscovite develop after biotite.

Zircon occurs as inclusions in feldspars, quartz, and biotite, and can be also found at intergranular boundaries.

Monazite forms cake- and disk-shaped crystals with rounded outlines. Light yellow transparent (about 2%), yellow and greyish-yellow semi-transparent (about 98%), and greenish-yellow opaque (isolated grains) crystals can be distinguished. Light yellow grains are usually very fine (<0.04 mm), have cake-like shape and flat lustrous surface. In contrast, yellow- and greyish-brown grains are mostly disk-shaped, have numerous cavities, fine outgrowths, and warts on their surface. In thin sections, monazites are mainly confined to microcline and plagioclase and can occur at contacts between these two minerals.

Four dimensional fractions of the yellow transparent monazite crystals were used for U-Pb isotope dating. Results of analytical investigations are presented in Table 2. The upper intercept of the regression line with concordia yields an age of 2039.9 ± 1.4 Ma (Fig. 5), whereas the lower intercepts has an age of -379 ± 752 Ma. The $^{207}Pb/^{206}Pb$ weighted average age is 2040.5 ± 0.8 Ma. We accept an age of 2040 ± 1 Ma as the age of granite crystallization.

The **Zvenihorodka-Oleksandriya massif** of red aplite granites [6]. The massif is extended along the Inhulets River, from Oleksandro-Stepanivka through Zvenihorodka and Oleksandriya to Voynivka villages. In its southeastern part, the massif is comprised of migmatites developed after red aplite granites. Migmatites form antiform fold with gently (10-20°) dipping limbs [6]. For the geochronological investigation biotite aplite granite (sample 14/10) was collected from the outcrops situated near the road southwards of the railway bridge (railway platform Mala Berezivka, in the area located northwards of the city of Oleksandriya).

Biotite aplite granite, sample 14/10. Granite has light pink color and massive structure. It is evenly fine-grained aplitic rock with an average grain size ranging from 0.5 to 1.0 mm. Mineral composition is as follows (vol. %): plagioclase (34-38), microcline (25-27), quartz (c. 30), biotite (6-8) and garnet (2-3). Accessory minerals are monazite, zircon, apatite, and titanite. Secondary minerals are sericite developed after plagioclase and chlorite developed after biotite. The chemical composition of granite is listed in Table 1.

Plagioclase mainly forms euhedral tabular crystals, rarely anhedral grains, ranging from 0.5 to 0.8 mm in size. Plagioclase crystals have thin distinct polysynthetic twins. Some myrmekites occur at the boundaries with microcline. All plagioclase crystals are weakly sericitised. Plagioclase contains fine inclusions of garnet and rare rounded quartz. Some grains are mantled by microcline and contain small antiperthites.

Microcline forms both anhedral and euhedral grains reaching 0.4-1.2 mm in size. Microcline lattice is solid, drop-like, rarely sheaf- and chess-like, and imperfect. Microcline is mostly perthitic, with perfect perthites comprising from 5 to 20% of grain volume. Locally, microcline contains small rounded inclusions of poikilitic quartz.

Quartz occurs as rounded and euhedral grains reaching 0.3-0.7 mm in size. It shows weak wavy extinction.

Biotite forms isolated flakes reaching 0.2-0.5 mm in size. It has brown color and distinct pleochroism; some of the grains are weakly chloritised.

Garnet occurs as euhedral, rounded or lens-shaped crystals that range from 0.1 to 0.5 mm in size. Garnet forms isolated grains in the matrix, but more often found as inclusions in plagioclase. Garnet has light pink color.

Zircon is represented by very fine grains which are found at intergranular boundaries between feldspars and feldspar and quartz. Rarely, it forms inclusions in quartz.

Monazite forms greyish-yellow, brown, reddish-yellow (possibly ferruginated), light yellow (isolated fine grains) crystals that are equant, cake-like and disk-like in shape and have rounded outlines. Crystals reveal several facets, commonly of pinacoid habit.The lighter crystals have lustrous surface whereas brown crystals are fine-pitted at their surface. Many grains show pits and outgrowths on their surface that are interpreted as a result of interaction with surrounding minerals. After the treatment with diluted HCl, the intensively colored monazite grains became coated with solid white crust, whereas the light yellow crystals remained almost unaltered. White crusts occur as isolated spots mostly formed at crystal edges. In thin sections, monazites are found as inclusions in microcline or as grains located at the boundary between feldspar and quartz.

The U-Pb ages are determined on dimensional fractions of monazite crystals.The most transparent grains without inclusions were selected for the analysis. Results of analyses are represented in Table 2. The upper intercept of the regression line with Concordia defines the age of 2044 ± 11 Ma, whereas the lower intercept yielded and age of -129 ± 652 Ma. The $^{207}Pb/^{206}Pb$ weighted average age is 2042.2 ± 3.9 Ma (Fig. 6). The age of 2042 ± 4 Ma is accepted as the age of aplite granite of the Zvenihorodka-Oleksandriya massif.

Conclusions. Irrespective of their composition, textural and structural features, granites of the eastern part of the Inhul region were formed within the narrow time interval, from 2044 to 2030 Ma. Granitoids located in the other parts of the region, i. e. the Novoukrainka, Voznesensk, Lisohirska and some other smaller granite massifs, were formed during the same time interval.

Biotite and garnet-biotite granitoids of the Kirovograd Complex, i. e. the Pavlivka, Krynytchuvatka and other small massifs – are formed simultaneously with hypersthene-bearing granitoids of the Novoukrainka Complex (the Novoukrainka and Verblyuzhka massifs). The higher-temperature mineral paragenesis typical for granitoids of the Novoukrainka Complex have probably developed due to crystallization at larger depths and (or) at higher heat flow.

References

1. Bartnitsky E.N., Bibikova E.V., Verkhohliad V.M., Lehkova G.V., Skobelev V.M., Terets G.Ya. (1995). IGMR-1 – an international standard of zircon for uranium-lead isotope researches. *Geochemistry and Ore Formation*. **21**. pp. 164-167. [in Russian].
2. The state geological map of Ukraine, scale 1:200 000, Central Ukraine Series. Sheet M-36-XXX III (Kirovohrad) / Prepared by Nechaenko O.M., Nedomolkin V.F., Nikitchenko I.M., Tkachenko K.O. et al. Kyiv. 103 p. [in Ukrainian].
3. Shcherbak N.P., Artemenko G.V., Lesnaya I.M., Ponomarenko A.N., Shumlyanskyy L.V. (2008). Geochronology of the early Precambrian of the Ukrainian Shield. Proterozoic. Kyiv. 238 p. [in Russian].
4. Shcherbak N.P., Zlobenko V.G., Zhukov G.V., Kotovskaya F.I., Polevaya N.I., Komlev L.V., Kovalenko N.K, Nosok G.M., Pochtarenko V.I. (1978). Catalogue of isotope ages of rocks of the Ukrainian Shield. Kyiv. 224 p. [in Russian].
5. Esipchuk K.Yu., Bobrov O.B., Stepanyuk L.M., Shcherbak M.P., Glevasky E.B., Skobelev V.M., Drannik A.S., Geychenko M.V. (2004). Correlative chronostratigraphic chart of the early Precambrian of the Ukrainian Shield (an explanatory note).Kyiv. 30 p. [in Ukrainian].
6. Semenenko N.P., Siroshtan R.I., Stepanets V.D. (1954). The field of migmatites and granites of Inhulets River. Kyiv. 163 p. [in Russian].
7. Semenenko N.P. (1958). The Verblyuzsky intrusive massif. *Geology of the USSR*, V. 5. Ukrainian SSR, Moldavian SSR. Part 1. A geological description of the platformal part. Moskow. pp. 264-266. [in Russian].
8. Stepanyuk L.M., Andrienko O.M., Dovbush T.I., Bondarenko V.K. (2004). Crystallogenesis and age of zircon and monazite in rocks of the Novoukrainka massif. *Proceedings of UkrDGRI*, No. 1. pp. 64-72. [in Ukrainian].
9. Stepanyuk L.M., Dovbush T.I., Bondarenko S.M., Syomka V.O., Grinchenko O.V. (2012). The uranium-lead geochronology of rocks of the potassium-uranium formation of the Inhul region of the Ukrainian Shield. *Mineral. Journ. (Ukraine)*. **34**, No. 3. pp. 55-63. [in Ukrainian].
10. Stepanyuk L.M., Syomka V.O., Karly Z.V., Bondarenko S.M., Dovbush T.I., Kurylo S.I. (2015). The BalkaKorabelna deposit (mineralogy, geochronology) in the Bug uranium district of the Ukrainian Shield. *Geochemistry and Ore Formation*. No. 35. pp. 3-10. [in Ukrainian].
11. Stepanyuk L.M., Kurylo S.I. Dovbush T.I. (2015). The uranium-lead geochronology on monazite of granites of the Dolinsky massif of Inhul region of the Ukrainian Shield. *Visn. Nac. Acad. Nauk Ukr*. No. 10. pp. 46-49. [in Ukrainian].
12. Stepanyuk L.M., Syomka V.O., Kurylo S.I., Bondarenko S.M., Dovbush T.I. (2016). The uranium-lead isotope age of granites of the Voznesensky massif (the Inhul region of the Ukrainian Shield). *Reports of the NAS of Ukraine*. No. 8. pp. 79-84. [in Ukrainian].
13. Stepanyuk L.M., Kurylo S.I., Syomka V.O., Bondarenko S.M., Kovalenko O.O., Dovbush T.I., Vysotsky O.B. (2017). The features of the U-Pb isotopic systems of zircons and monazites in the granite-«xenolith» association: petrological and geological consequences. *Mineral. Journ. (Ukraine)*. **39**, No. 1. pp. 63-74. [in Ukrainian].
14. Stepanyuk L.M., Grinchenko O.V., Syomka V.O., Bondarenko S.M., Kurylo S.I., Dovbush T.I. (2016). Geochronology of granitoids of the Ingul region in connection with their lithium productivity. *Proceedings of the Kyiv National University*. No. 4 (74). pp. 43-50 ([in Ukrainian].
15. Shcherbak D.N., Ponomarenko A.N., Makarenko I.D. (1995). Geochronology of granitoids of the Inhul-Inhulets region of the Ukrainian Shield. *Geochemistry and Ore Formation*. No. 21. pp. 74-88. [in Russian].
16. Shcherbakov I.B. (2005). Petrology of the Ukrainian Shield. Lviv. 366 p. [in Ukrainian].
17. Krough T.E. (1973). A low contamination method for hydrothermal decomposition of zircon and extraction of U and Pb for isotopic age determination. *Geochim. Cosmochim. Acta*. **37**, No. 3. pp. 485-494.
18. Ludwig K.R. (1989). Pb Dat for MS-DOS, version 1.06. *U.S. Geol. Survey Open-File Report*. No. 88–542. pp. 40.
19. Ludwig K.R. (1990). ISOPLOT for MS-DOS, version 2.0. U.S. *Geol. Survey Open-File Report*. 1990. No. 88–557. pp. 38.

Література

1. Бартницкий Е.Н., Бибикова Е.В., Верхогляд В.М., Легкова Г.В., Скобелев В.М., Терец Г.Я. ИГМР-1 – Международный стандарт циркона для уран-свинцовых изотопных исследований. *Геохимия и рудообразование*. 1995. Вып. 21. С.164–167.
2. Державна геологічна карта України масштабу 1 : 200 000, Центральноукраїнська серія. Аркуш M-36-XXXIII (Кіровоград) / Нечаєнко О.М., Недомолкін В.Ф., Нікітченко І.М., Ткаченко К.О. і ін. Київ, 2007. 103 с.
3. Геохронология раннего докембрия Украинского щита. Протерозой / Щербак Н.П., Артеменко Г.В., Лесная И.М., Пономаренко А.Н., Шумлянский Л.В. Киев: Наук. думка, 2008. 238 с.
4. Каталог изотопных дат пород Украинского щита / Н.П.Щербак, Злобенко В.Г., Жуков Г.В., Котдовская Ф.И., Полевая Н.И., Комлев Л.В., Коваленко Н.К., Носок Г.М., Почтаренко В.И. Киев: Наук. думка, 1978. 224 с.
5. Кореляційна хроностратиграфічна схема раннього докембрію Українського щита (пояснювальна записка) / Єсипчук К.Ю., Бобров О.Б., Степанюк Л.М., Щербак М.П., Глеваський Є.Б., Скобелєв В.М., Дранник А.С., Гейченко М.В. Київ, 2004. 30 с.
6. Семененко Н.П., Сироштан Р.И., Степанец В.Д. Поле мигматитов и гранитов р. Ингульца. Киев, 1954. 163 с.
7. Семененко Н.П. Верблюжский интрузивный массив. Геология СССР, т. 5. Украинская ССР, Молдавская ССР. Часть 1. Геологическое описание платформенной части. Москва, 1958. С. 264-266
8. Степанюк Л.М., Андрієнко О.М., Довбуш Т.І., Бондаренко В.К. Кристалогенезис і вік циркону та монациту в породах Новоукраїнського масиву. *Зб. наукових праць УкрДГРІ*. 2004. № 1. С. 64–72.

9. Степанюк Л.М., Довбуш Т.І., Бондаренко С.М., Сьомка В.О., Грінченко О.В. Уран-свинцева геохронологія порід калій-уранової формації Інгульського мегаблоку Українського щита. *Мінерал. журн*. 2012. **34**, № 3. С. 55–63.
10. Степанюк Л.М., Сьомка В.О., Карли З.В., Бондаренко С.М., Довбуш Т.І., Курило С.І. Родовище Балка Корабельна (мінералогія, геохронологія) в Побузькому урановорудному районі Українського щита. *Геохімія та рудоутворення*. 2015. Вип. 35. С. 3–10.
11. Степанюк Л.М., Курило С.І. Довбуш Т.І. Уран-свинцева геохронологія за монацитом гранітів Долинського масиву Інгульського мегаблоку Українського щита. *Вісник НАН України*. 2015. № 10. С. 46–49.
12. Степанюк Л.М., Сьомка В.О., Курило С.І., Бондаренко С.М., Довбуш Т.І. Уран-свинцевий ізотопний вік гранітів Вознесенського масиву (Інгульський мегаблок Українського щита). *Доповіді НАН України*. 2016. № 8. С. 79–84.
13. Степанюк Л.М., Курило С.І., Сьомка В.О., Бондаренко С.М., Коваленко О.О., Довбуш Т.І., Висоцький О.Б. Особливості U-Pb ізотопних систем цирконів і монацитів асоціації граніт – «ксеноліт»: петрологічні та геологічні наслідки. *Мінерал. журн*. 2017. **39**, № 1. С. 63–74.
14. Степанюк Л.М., Грінченко О.В., Сьомка В.О., Бондаренко С.М., Курило С.І., Довбуш Т.І. Геохронологія гранітоїдів Інгульського мегаблоку в зв’язку з їх літієносністюю. *Вісник КНУ*. 2016. № 4 (74). С. 43–50.
15. Щербак Д.Н., Пономаренко А.Н., Макаренко И.Д. Геохронология гранитоидов Ингуло-Ингулецкого мегаблока Украинского щита. *Геохимия и рудообразование*. 1995. № 21. С. 74–88.
16. Щербаков І.Б. Петрологія Українського щита. Львів : ЗУКЦ, 2005. 366 с.
17. Krough T.E. A low contamination method for hydrotermal decomposition of zircon and extraction of U and Pb for isotopic age determination. *Geochim. Cosmochim. Acta*. 1973. **37**, № 3. P. 485–494.
18. Ludwig K.R. Pb Dat for MS-DOS, version 1.06. *U.S. Geol. Survey Open-File Rept*. 1989. № 88–542. P. 40.
19. Ludwig K.R. ISOPLOT for MS-DOS, version 2.0. *U.S. Geol. Survey Open-File Rept*. 1990. № 88–557. P. 38.

Степанюк Л.М., Курило С.І., Довбуш Т.І., Грінченко О.В., Сьомка В.О., Бондаренко С.М., Шумлянський Л.В.
Інститут геохімії, мніералогії та рудоутворення ім. М.П. Семененка НАН України, Київ

Геохронологія гранітоїдів східної частини Інгульського мегаблоку Українського щита

У східній частині Інгульського мегаблоку знаходиться ряд масивів гранітоїдів, представлених біотитовими нерівномірнозернистими, порфіроподібними, пегматоїдними та апліто-пегматоїдними гранітами (кіровоградський комплекс), гіперстенвмісними (чарнокіти) гранітами, монцонітоїдами та чорнокварцовими гранітами, віднесеними до новоукраїнського комплексу. Час формування гранітів визначали уран-свинцевим ізотопним методом за мультизерновими наважками монациту. Граніти Павлівського, Верблюзького та Криничувацького масивів були сформовані у віковому інтервалі 2038–2046 млн років тому (з урахуванням похибок визначення). Дещо молодший вік отримано для монацитів апліто-пегматоїдних гранітів, що поширені у берегових відслоненнях правого берега р. Боковенька, північніше с. Новоолександрівка – 2030,0 ± 0,3 млн років. У цьому ж віковому інтервалі були сформовані і гранітоїди, поширені на решті території мегаблоку (Новоукраїнського, Вознесенського, Лисогірського масивів і ряду інших дрібніших тіл).
Ключові слова: Інгульський мегаблок, граніт, монацит, ізотопний вік.

Степанюк Л.М., Курило С.И., Довбуш Т.И., Гринченко А.В., Семка В.А., Бондаренко С.Н., Шумлянский Л.В.
Институт геохимии, минералогии и рудообразования им. Н.П. Семененко НАН Украины, Киев

Геохронология гранитоидов восточной части Ингульського мегаблока Украинского щита

В восточной части Ингульського мегаблока находится ряд массивов гранитоидов, представленных биотитовыми неравномернозернистыми, порфировидными, пегматоидными и аплито-пегматоидными гранитами (кировоградский комплекс), гиперстен-содержащими (чарнокиты) гранитами, монцонитоидами и чернокварцевыми гранитами, отнесенными к новоукраинскому комплексу. Время формирования гранитов определяли уран-свинцовым изотопным методом по мультизерновым навесками монацита. Граниты Павловского, Верблюжского и Криничеватского массивов были сформированы в возрастном интервале 2038–2046 млн лет (с учетом погрешностей определения). Отчасти более молодой возраст был получен для монацитов аплито-пегматоидных гранитов, распространенных в береговых обнажениях правого берега р. Боковенька, севернее с. Новоалександровка – 2030,0 ± 0,3 млн лет. В этом же возрастном интервале были сформированы и гранитоиды, распространенные на остальной территории мегаблока (Новоукраинского, Вознесенского, Лысогорского массивов и ряда других более мелких тел).
Ключевые слова: Ингульский мегаблок, гранит, монацит, изотопный возраст.

Received 25.05.2017