LEGEND

TO THE GEOLOGICAL MAP AND MAP OF MINERAL RESOURCES OF PRE-QUATERNARY UNITS

Geochronological Scale / Regional Stratigraphic Scale

Columns: Acron | Eon | Era | Period | Period | Sub-Epoch | Stage | Regio-Stages (Horizons): Southern Area, Central Area | Sub-Regio-Stage

PHANEROZOIC – CENOZOIC:
- QUATERNARY
- NEOGENE – PLIOCENE: LATE – AKCHAGYLIAN; EARLY – CIMMERIAN
- NEOGENE – MIOCENE: LATE – PONTIAN (UPPER, LOWER); MEOTIC (LOWER); SARMATIAN (UPPER, MIDDLE, LOWER); MIDDLE – KONKSKIY, KARAGANSKIY, CHOKRATSKIY (Central Area: NOVOPETRIVSKIY); EARLY – TARKHANSKIY
- PALEOGENE – OLIGOCENE: LATE – CHATTIAN – GORNOSTAIVSKIY, ASKANIYSKIY, SIROGOZKIY (Central Area: BEREKSKIY); EARLY – RUPELIAN – MOLOCHANSKIY, PLANOR-BELLOVIY (Central Area: MEZHYGIRSKIY)
- PALEOGENE – EOCENE: LATE – PRYABONIAN – ALMINSKIY (Central Area: OBUKHIVSKIY); MIDDLE – BARTONIAN – KUMKSKIY (Central Area: KYIVSKIY); LUTETIAN – NOVOPAVLIVSKIY, SIMFEROPOLSKIY (Central Area: BUCHATSKIY); EARLY – YPRESIAN – BAKHCHYSARAYSKIY

MESOZOIC:
- CRETACEOUS – LATE; EARLY – ALBIAN, APTIAN
- TRIASSIC

PALEOZOIC: PERMIAN

PROTEROZOIC: NEO-PROTEROZOIC (Ma: 1700); PALEO-PROTEROZOIC (Ma: 2000, 2100, 2200, 2300, 2400, 2500, 2600)

ARCHEAN: NEO-ARCHEAN (Ma: 2700, 2800, 2900, 3000, 3100, 3200); MESO-ARCHEAN (Ma: 3300, 3400)

LOCAL STRATIGRAPHIC SUBDIVISIONS AND COMPLEXES

Q — Quaternary sediments. Loess-like loams, buried soils (in the cross-sections only)

N_2čb — Sequence of red-brown clays. Brown, red-brown clays with carbonate concretions, gypsum crystals and iron-manganese tarnishes (2-30 m)

N_2ap — Sequence of alluvial sands. Brick-red sands (0-9 m)

SOUTHERN AREA

SHYROKIVSKA LTZ

N_1*ks* — Kosivski layers. Grey, greenish-grey clays (0-8 m)

N_1v — Limestone sequence. Oolite and shelly limestones, brown-yellow, re-crystallized, interbeds of clays and sands (5-14 m)

N_1*bg* — Bagerivski layers. Grey, greenish-grey sands and clays, rarely marls and limestones (0-12 m)

N_1*gl* — Geliksovi layers. Marls, limestones light-grey, oolite, shelly, in places pelitemorphic; greenish-grey clays, sands (5-20 m)

N_1vm — Sequence of limestones and marls. Limestones, often pelitemorphic, shelly; at the bottom clayey sands, clays (8-15 m)

N_1*zb* — Zbruchski layers. Grey, greenish-grey sands intercalating with clays; rarely interbeds of marls and detritic limestones (0-15 m)

N_1*čk* — Chokratski layers. Grey-green, green to black clays and sands with marl interbeds; at the bottom coaliferous clays, diverse-grained sands (0-10 m) (in the cross-sections only)

VYSOKOPILSKA LTZ

Maykopska Series

₽$_3$*ml-as* — Molochanska, Sirogozka and Askaniyska suites undivided. Aleuritic, non-carbonate, slightly-glauconiye clays; rarely (at the bottom) calcareous aleuritic clays (5-45 m)

₽$_3$*bs* — Borysfenska Suite. Aleuritic, greenish-grey, green, layered clays, in places sandy; quartz-glauconite sands; manganese ores (10-90 m)

₽$_2$ *al* — Alminska Suite. Tripoli-like sandstones; clays, in places with glauconite (0-9 m)

₽$_2$*hd* — Khadzhybeyska Suite. Marls, marleous clays, aleurites; clayey sands; at the base - thin conglomerate lenses (10-75 m)

₽$_2$vg — Sequence of coaliferous clays and sands. Secondary kaolines, aleurite marls and green clays. At the base - lenses of bauxite-like rocks (8-35 m) (in the cross-sections only)

K_1*kd* — Kodymska Suite. Coaliferous sands, clays, secondary kaolines; fine-grained sands with aleurite lenses and interbeds (17 m)

CENTRAL AREA

VILNOGIRSKA LTZ

N_1sg — Sequence of parti-coloured clays. Grey, greenish-grey clays with brown, yellow, cherry-red spots and stains (2-18 m)

N_1*gl* — Geliksovi layers. Quartz, light-yellow, light-grey, fine-grained, clayey sands; limestone and marl lenses and interbeds (5-15 m)

N_1p — Sequence of sands. Quartz, parti-coloured sands; sandstone interbeds and lenses (upper part), in the lower part - interbeds of grey-coloured clays, coaliferous in places (5-15 m)

Poltavska Series

N_1*np* — Novopetrivska Suite. Quartz, light-grey, snow-white, micro- and fine-grained sands. Interbeds and lenses of clays and sandstones (upper part), clays and sands, dark-grey, in places coaliferous (lower part) (7-32 m)

OLEKSANDRIYSKO-APOSTOLIVSKA LTZ

Kharkivska Series

Mezhygirska Suite. Grey, greenish-grey, glauconite-quartz sands with sandstone lenses; glauconite clay interbeds (0-14 m)

₽$_3$*mž*, ₽$_2$*ob*, ₽$_{2-3}$*hr* — Obukhivska Suite. Glauconite clays and sands (0-12 m)

Undivided rocks: glauconite-quartz sands, glauconite clays (0-15 m)

₽$_2$*kv* — Kyivska Suite. Greenish-grey, rarely white clays; glauconite-quartz, fine-grained, in places clayey and calcareous sands and sandstones, rarely marl lenses (2-35 m)

₽$_2$*bč* — Buchatska Series. Coaliferous clays and sands, in places brown coal. Quartz sands, diverse-grained in the lower part, with coaliferous admixtures; interbeds and lenses of secondary kaolines, rarely bauxite-like rocks (0-2 m)

P-T (α, τα, β) — Sub-volcanic rocks. Andesites (α), trachy-andesites (τα), basalts (β)

INGULO-INGULETSKIY AREA

PR_3 (β, νβ, ν) — Dyke Complex. Diabases (β), gabbro-diabases (νβ), gabbro (ν)

PR_1*kg* (mt, ξ, iργ, $γ_2$m, $γ_1$m, γδ,m, Д,m) — Kirovogradskiy Complex. Microcline-albite metasomatites (mt), syenites (ξ), aplite-pegmatoid granites (iργ), porphyry-blastic granites and migmatites ($γ_2$m), banded and shadow granites and migmatites ($γ_1$m), granodiorites and migmatites of granodiorite composition (γδ,m), diorites and migmatites of diorite composition (δ,m)

PR_1*nu* (mt, $γ_2$, $γ_1$, č, γδ, μ, νμ, amν, amЛЬ) — Novoukrainskiy Complex. Microcline-albite metasomatites (mt), biotite and pyroxene porphyry-blastic granites ($γ_2$), biotite-hornblende contaminated granites ($γ_1$), charnockites (č), granodiorites (γδ), monzonites (μ), gabbro-monzonites (νμ), gabbro-amphibolites (amν), hornblendites (amσ)

KIROVOGRADSKA LTZ

Ingulo-Inguletska Series

PR_1*čč* — Checheliivska Suite. Biotite and garnet-biotite gneisses with interbeds of biotite-pyroxene and biotite-amphibole gneisses, meta-aleurolitic schists and meta-aleurolites (1500 m)

PR_1*sp* — Spasivska Suite. Two-pyroxene, pyroxene and biotite-pyroxene gneisses and mafic gneisses (1500 m)

PR_1*rd* — Rodionivska Suite. Pyroxene-bearing quartzites, graphite, graphite-pyroxene-biotite, graphite-amphibole-biotite gneisses and mafic gneisses, marbles, calciphyres and diopsidites (200-1200 m)

INGULETSKO-KRYVORIZKA LTZ

Ingulo-Inguletska Series

PR_1*gl* — Gleyuvatska Suite. Polymictic conglomerates, oligomictic meta-sandstones, meta-aleurolitic schists and meta-aleurolites, biotite, amphibole-biotite, garnet-biotite, pyroxene-amphibole-biotite schists and gneisses (800-3000 m)

Rodionivska Suite (PR_1*rd*: PR_1*rd*$_2$, PR_1*rd*$_1$):

PR_1*rd*$_2$ — Upper Sub-Suite. Marbles, graphite-mica, graphite-actinolite-biotite schists (in amphibolite facies - calciphyres, graphite, graphite-amphibole-biotite gneisses and mafic gneisses), skarnoids, silicate-magnetite quartzites (400-1300 m)

PR_1*rd*$_1$ — Lower Sub-Suite. Quartzites and quartzite-sandstones, silicate-magnetite quartzites, amphibole-biotite, graphite-biotite schists and gneisses (260-1200 m)

Undivided rocks. Mono-mineral and silicate-magnetite quartzites, graphite-amphibole-biotite, graphite-biotite, biotite schists and gneisses, marbles and calciphyres (500-2000 m)

PR_1*ar* — Artemivska Suite. Silicate-magnetite quartzites, amphibole-biotite and biotite gneisses and mafic gneisses (0-200 m)

Zelenorichenska Suite (PR_1*zr*: PR_1*zr*$_2$, PR_1*zr*$_1$):

PR_1*zr*$_2$ — Upper Sub-Suite. Sillimanite-biotite and garnet-biotite mafic gneisses, talc-carbonate schists, meta-sandstones (0-80 m)

PR_1*zr*$_1$ — Lower Sub-Suite. Amphibole gneisses, amphibolites. At the base - mica quartzites (0-100 m)

Undivided rocks. Amphibole, biotite-amphibole gneisses and mafic gneisses, amphibolites, quartzites with sillimanite, sillimanite-biotite, garnet-biotite schists, calciphyres, meta-sandstones (0-150 m)

MIDDLE-DNIPREAN AREA

βPR_3 — Dyke Complex. Diabases (β)

PR_1*kg* (iργ, $γ_1$m) — Kirovogradskiy Complex. Aplite-pegmatoid granites (iργ), banded and shadow granites and migmatites ($γ_1$m)

KRYVORIZKO-KREMENCHUTSKA LTZ

PR_1*gl* — Gleyuvatska Suite. Biotite, garnet-biotite, actinolite-biotite schists, in places with graphite; interbeds of meta-aleurolites, meta-sandstones and meta-conglomerates (0-700 m)

Kryvorizka Series

Gdantsivska Suite (PR_1*gd*: PR_1*gd*$_2$, PR_1*gd*$_1$):

PR_1*gd*$_2$ — Upper Sub-Suite. Graphite-mica, graphite-actinolite-biotite schists; dolomite marbles; interbeds of ferruginous quartzites and mica-chlorite schists (400-1000 m)

PR_1*gd*$_1$ — Lower Sub-Suite. Meta-sandstones, mono-mineral quartzite and ferruginous chlorite-mica, chlorite-magnetite schists, high-grade iron ores (200-800 m)

Undivided rocks. Mono-mineral and ferruginous quartzites, graphite-mica, graphite-actinolite-biotite, chlorite-mica, chlorite-magnetite schists, marbles, high-grade iron ores (370-1550 m)

Saksaganska Suite (PR_1*sx*: PR_1*sx*$_3$, PR_1*sx*$_2$, PR_1*sx*$_1$):

PR_1*sx*$_3$ — Upper Sub-Suite. Ferruginous quartzites, high-grade iron ores, hematite-chlorite, sericite-chlorite, chlorite-biotite, biotite-amphibole schists (640 m)

PR_1*sx*$_2$ — Middle Sub-Suite. Sericite-biotite, chlorite-actinolite schists, ferruginous quartzites (260 m)

PR_1*sx*$_1$ — Lower Sub-Suite. Ferruginous quartzites, sericite, chlorite, actinolite schists (40-300 m)

Undivided rocks. Ferruginous quartzites, biotite, amphibole, chlorite schists, high-grade iron ores - magnetite, martite, hematite (450-1260 m)

PR_1*sk* — Skelyuvatska Suite. Meta-sandstones, quartzites, meta-conglomerates, sericite, chlorite-sericite, talc, talc-carbonate schists with meta-sandstone interbeds (50-520 m)

PR_1*nk* — Novokryvorizka Suite. Chlorite-actinolite schists intercalating with meta-basalts. At the base - mica quartzites with andalusite (50-400 m)

ARCHEAN

βAR_3 — Dyke Complex. Diabases (β)

AR_3 (β, νβ) — Dyke Complex. Diabases (β), gabbro-diabases (νβ)

AR_3*dv* (νσ, σ, sr) — Devladivskiy Complex. Gabbro-peridotites (νσ), peridotites (σ), serpentinites (sr)

AR_3*tk* (mt, ξ, iργ, $γ_2$, $γ_1$, $γ^к$,m, γ-γ$δ^к$, δ,m) — Tokivskiy Complex (2760 Ma). Metasomatites (mt); syenites (ξ), aplite-pegmatoid granites (iργ); two-feldspar, uniform-grained, leucocratic granites ($γ_2$); two-feldspar porphyry-blastic meso- and melanocratic granites ($γ_1$); contaminated granites and migmatites ($γ^к$,m); contaminated granites and granodiorites (γ-γ$δ^к$); diorites and migmatites of diorite composition (δ,m)

AR_3*dm* (mt, iργ, $γ_2$m, $γ_1$m, γδ,m) — Demurinskiy Complex. Microcline-albite metasomatites (mt); aplite-pegmatoid granites (iργ); two-feldspar, gneiss-like, leucocratic granites and migmatites ($γ_2$m); two-feldspar, porphyry-blastic, meso- and melanocratic granites and migmatites ($γ_1$m); biotite-amphibole granodiorites and migmatites of granodiorite composition (γδ,m)

AR_3*sk* (iργ, γ,m, pγ, pγ,m, γδ,m, δ,m) — Saksaganskiy Complex (2971 Ma). Aplite-pegmatoid granites (iργ); microcline-plagioclase granites and migmatites (γ,m), plagiogranites (pγ); plagiogranites and plagiomigmatites (pγ,m); granodiorites and migmatites of granodiorite composition (γδ,m); diorites and migmatites of diorite composition (δ,m)

AR_3*in* (iργ, γ,m, pγ,m, γδ,m) — Inguletskiy Complex. Aplite-pegmatoid granites (iργ), microcline-plagioclase granites and migmatites (γ,m), biotite and amphibole-biotite plagiogranites and plagiomigmatites (pγ,m), granodiorites and migmatites of granodiorite composition (γδ,m)

AR_3*sr* (pγ, γδ, δ) — Surskiy Complex. Biotite-amphibole plagiogranites (pγ), granodiorites (γδ), diorites (δ)

Konkska Series

AR_3*kn* — Undivided rocks. Amphibolites, amphibole, biotite, pyroxene gneisses and mafic gneisses; silicate-magnetite quartzites (70-850 m)

VERKHIVTSIVSKO-CHORTOMLYTSKA LTZ

Konkska Series

AR_3*sl* — Solenivska Suite. Meta-andesite-dacites, meta-dacites, meta-rhyodacites (200 m)

AR_3*af* — Alferivska Suite. Actinolitites and tremolitites with meta-sandstone and quartzite interbeds (140-360 m)

AR_3*čr* — Chortomlytska Suite. Meta-andesite-basalts, meta-andesites (240 m)

AR_3*sr* — Surska Suite. Meta-basalts, meta-dolerite-basalts, meta-andesite-basalts, actinolite, chlorite-actinolite, chlorite-mica schists (in amphibolite facies - amphiblites and amphibole, amphibole-biotite gneisses), interbeds of komatiite meta-basalts (actinolitites, tremolitites, serpentinites), meta-sandstones, barren and silicate-magnetite quartzites (200-3200 m)

AR_3*vr* (sr, ac, tr, tc, ν, amν, ν, σ) — Verkhivtsivskiy Complex. Serpentinites (sr), actinolitites (ac), tremolitites (tr), talc and talc-carbonate rocks (tc), gabbro (ν), gabbro-amphibolites (amν), pyroxenites (ν), peridotites (σ)

pγ,mAR_2*dn* — Dnipropetrovskiy Complex. Amphibole-biotite and biotite plagiogranites and plagiomigmatites

AR_2bz — Bazavlutska Sequence. Amphibolites with interbeds of amphibole, biotite-amphibole, biotite gneisses and mafic gneisses and silicate-magnetite quartzite lenses (250-2800 m)

AR_2*ok* (ac, tr, amδ) — Oleksandrivskiy Complex. Actinolitites (ac), tremolitites (tr), hornblendites (amδ)

Sedimentary rocks

- Pebble conglomerate
- Diverse- and coarse-grained sands (a), fine-grained sands (b), clayey sands (c)
- Sandstones (a), flinted sandstones (b)
- Aleurites
- Clays (a), clays: sandy (b), marleous (c), aleuritic (d), calcareous (e), kaolineous (f); secondary kaolines (g)
- Marls (a), limestones (b); limestones: oolite (c), shelly (d)
- Baxite-like rocks (a), silica-clay-like rocks (b), tripoli (c)
- Brown coal (a), manganese ores (b)
- Rocks with glauconite (a), gypsum (b), coaliferous admixtures (c)

Metamorphic and metamorphosed rocks

- Meta-conglomerates (a), meta-sandstones (b), meta-aleurolites (c)
- Schists: sericite (a), chlorite (b), chlorite-actinolite (c), biotite-graphite (d), graphite-actinolite (e), talc (f)
- Mafic gneisses: pyroxene (a), two-pyroxene (b)
- Gneisses: biotite (a), garnet-biotite (b), amphibole and biotite-amphibole (c), pyroxene, biotite-pyroxene (d), two-pyroxene (e), amphibole-pyroxene (f), graphite and biotite-graphite (g), pyroxene-graphite (h)
- Amphibolites (a), gabbro-amphibolites (b)
- Dolomite marbles (a), calciphyres (b)
- Quartzites: mono-mineral (a), ferruginous (b)
- Rock intercalation: quartzites, calciphyres and graphite gneisses (a), meta-sandstones and sericite-biotite schists (b)
- Meta-andesite-basalts (a), meta-basalts (b)

Ultra-metamorphic and intrusive rocks

- Gabbro (a), amphibole diorites (b)
- Biotite-amphibole granodiorites and migmatites (a), charnockites (b)
- Plagiogranites and plagiomigmatites: biotite (a), biotite-amphibole (b); two-feldspar granites and migmatites: biotite (c), porphyry-blastic biotite (d); diverse-grained granites and migmatites: biotite (e), amphibole-biotite (f); porphyry-balstic (g), biotite plagiogranites (h); granites: biotite (k), biotite-amphibole (l), porphyry-blastic granites: biotite (m), pyroxene (n); syenites (o), albitites (p)

Altered rocks

- Migmatized rocks
- Metasomatically-altered rocks: greisenized (a), silicified (b), microclinized (c)

Tectonites

- Cataclasites and milonites (a), blasto-cataclasites, blasto-milonites (b)

Geological boundaries

- Boundaries of stratified and non-stratified age-different subdivisions: proven (a), inferred (b); boundaries of buried sediments: Borysfenska Suite (c), Buchatska Series and sequence of coaliferous clays and sands (d), Kodymska Suite (e); facial boundaries (f); distribution contour of red-brown clays (g); unit relationships in the legend and columns only: stratigraphic discontinuities, erosions (h), angular unconformities (k), undivided relationships (l), stratigraphic interruptions (m), conformable geological boundaries (n)

Faults

- Kryvorizko-Kremenchutskiy deep-seated fault (thrust-underthrust) (a); major faults: proven (b), inferred (c); minor faults: proven (d), inferred (e), revealed from satellite and airborne image interpretation (f); morphological varieties: normal faults (g)

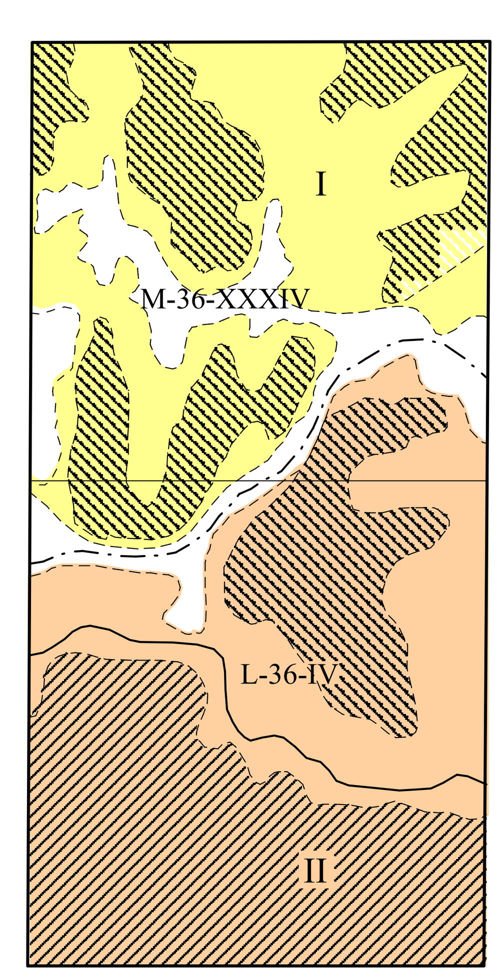
Other indications

- Organic remnant finding sites: mollusk (a), foraminifera (b), brachyopoda (c)
- A_1 A_2 A_3 — Geological cross-section line
- Drill-holes and their numbers: in the map (a), in the cross-section (b) (21490)

N_1*gl*	25	480
₽$_2$*kv*	41	
₽$_2$*bč*	54	

In the map next to the drill-hole symbol, the indexes of intersected stratigraphic subdivisions, the numbers - their depth in meters

SCHEME OF PALEOGENE AND MIOCENE LITHO-TECTONIC ZONES



Miocene litho-tectonic zones
- Vilnogirska
- Shyrokivska

Paleogene litho-tectonic zones
- Oleksandriysko-Apostolivska
- Vysokopilska

Boundaries of the Central (I) and Southern (II) areas of Ukrainian Shield
- in Miocene
- in Paleogene