MINISTRY OF ENVIRONMENT PROTECTION OF UKRAINE
STATE GEOLOGICAL SURVEY

STATE GEOLOGICAL MAP OF UKRAINE

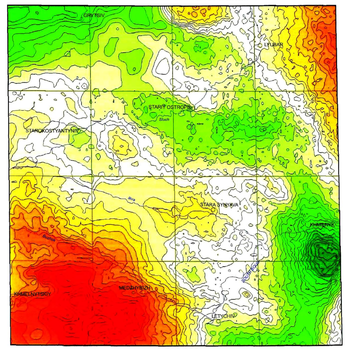
Scale 1:200 000

GEOLOGICAL MAP AND MAP OF MINERAL RESOURCES OF CRYSTALLINE BASEMENT

Central-Ukrainian Series

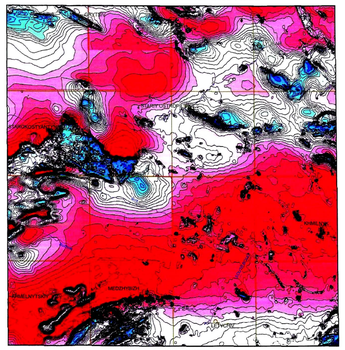
M-35-XXII (Starokostyantyniv)

SCHEME OF GRAVITY ANOMALIES



1:500 000
5 kilometres in 1 centimetre

MAP OF ANOMALOUS MAGNETIC FIELD



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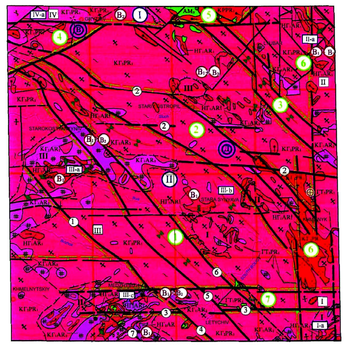
5 kilometres in 1 centimetre

TECTONIC SKETCH OF CRYSTALLINE BASEMENT



1:500 000
5 kilometres in 1 centimetre

LEGEND

TECTONIC ZONATION

MEGA-BLOCKS
- Volynskiy
- Dnistersko-Buzkiy

I-ORDER BLOCKS
- Novograd-Volynskiy
- Podilskiy

II-ORDER BLOCKS
- Vinnytskiy
- Berdychivskiy
- Khmelnytskiy
- Shepetivskiy

III-ORDER BLOCKS
- Lityns kiy
- Ivanopilskiy
- Veselivskiy
- Starosynyavskiy
- Medzhybizkiy
- Grytsivskiy

TECTONIC ZONES
1 – Letychivska
2 – Khmilnytska south-western
3 – Khmilnytska north-eastern
4 – Teterivska
5 – Andrushivska
6 – Bilokorovytska
7 – Khmelnytska

FOLD AXES
- antiform
- synform

ENDERBITE-CHARNOCKITE DOMES
- I - Lityns kiy
- II - Medzhybizkiy
- III - Starokostyantyniv skiy

GRANITE DOMES
- I - Starosynyavskiy
- II - Papiynetskiy
- III - Sluchanksiy

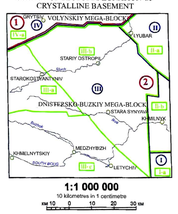
Formation boundaries

METAMORPHIC FACIES
- Granulite
- Amphibolite
- Granulite facies rocks retrograde metamorphosed under amphibolite facies conditions

OTHER FAULTS
1 – Starokostyantyniv skiy
2 – Ostropilskiy
3 – Golosk iv ko-Verbkivskiy
4 – Rudnyanskiy
5 – Letychivskiy
6 – Romanivskiy
7 – Kopachivskiy

Geodynamic settings			Podiliska LTZ										Volynska LTZ				
			Primary lithosphere consolidation					Collision: Early collision	Collision: Late collision	Collision: Final stage of late collision	Plate inner parts		Plate inner parts	Active continental margin	Collision: Early collision	Collision: Late collision
Litho-tectonic complexes	Litho-tectonic paleozones		Enderbite-granulite (protocontinental)					Deep compression zones			Hot spots and lincs		Continental rifts	Magmatic arcs	Deep compression zones	
Litho-tectonic complexes	Geological formations		Granulite-basite	Kinzigite	Migmatite-enderbite	Charnockite	Kinzigite-granite	Leucogranite	Alkaline-gabbroid	Pyroxenite-peridotite	Dyke	Terrigenous-volcanogenic	Gabbro-monzonite-granite	Plagiogranite-migmatite	Granite-migmatite
Litho-tectonic complexes	Indexes of litho-tectonic complexes		HF₁		HF₂	KF₁	KF₂	KF₃	ΓT₁	ΓT₂	ΓT₃	KP	AM₄	KF₁	KF₂
Eon	Era	Index													
Proterozoic	Paleo-Proterozoic	PR₁													
Archean	Neo-Archean	AR₃													
Archean	Meso-Archean	AR₂													
Archean	Paleo-Archean	AR₁													

SKETCH OF TECTONIC ZONATION OF CRYSTALLINE BASEMENT

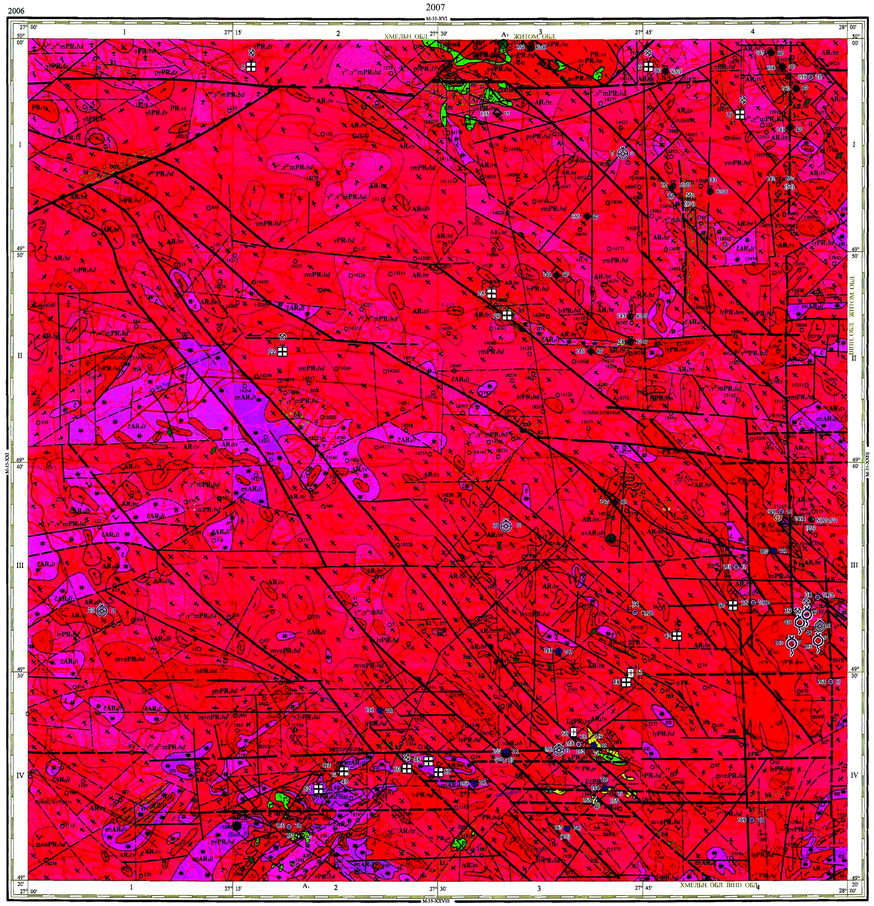


1:1 000 000
10 kilometres in 1 centimetre

LEGEND

- Mega-block boundaries
- I-ORDER BLOCKS
  - 1 Novograd-Volynskiy
  - 2 Podilskiy
- II-order block boundaries
- II-ORDER BLOCKS
  - I Vinnytskiy
  - II Berdychivskiy
  - III Khmelnytskiy
  - IV Shepetivskiy
- III-order block boundaries
- III-ORDER BLOCKS
  - I-a Lityns kiy
  - II-a Ivanopilskiy
  - II-b Ulanivskiy
  - III-a Veselivskiy
  - III-b Starosynyavskiy
  - III-c Medzhybizkiy
  - IV-a Grytsivskiy

2006



1:200 000
2 kilometres in 1 centimetre
Solid horizontals are put through 40 metres

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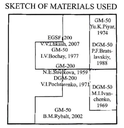
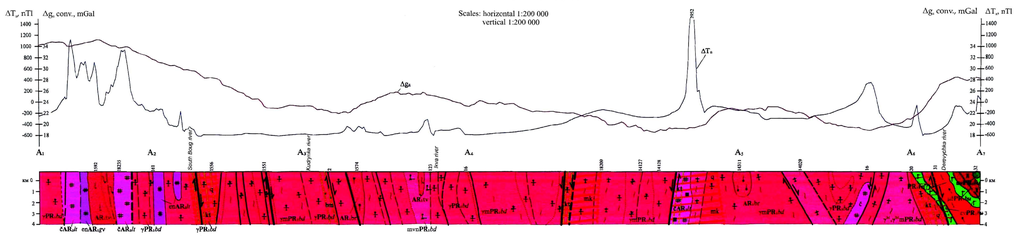
LOCATION SKETCH OF CENTRAL-UKRAINIAN SERIES MAP SHEETS

SKETCH OF MATERIALS USED



CROSS-SECTION BY LINE A_1 - A_5

Scales: horizontal 1:200 000
vertical 1:200 000



L E G E N D

INTERNATIONAL GEOCHRONOLOGICAL SCALE: EON	ERA	AGE LIMITS, Ma	REGIONAL STRATIGRAPHIC SUBDIVISIONS	AGE SCALE, Ma	LOCAL STRATIGRAPHIC SUBDIVISIONS
PROTEROZOIC	MESO-PROTEROZOIC	1600	OVRUCHIV	1400–1600	
	PALEO-PROTEROZOIC		KLESOVIV	1600–2000	
			KRYVORIZHIV	2000–2500	
ARCHEAN	NEO-ARCHEAN	2800	POBUZHIV	2500–2800	
	MESO-ARCHEAN	3200	DNIPROVIV	2800–3200	
	PALEO-ARCHEAN		AZOVO-DNISTROVIV	3200–3500	

LOCAL STRATIGRAPHIC SUBDIVISIONS

ULTRAMETAMORPHIC, INTRUSIVE AND METASOMATIC ROCKS

AUTOCHTONOUS AND PARAAUTOCHTONOUS ULTRAMETAMORPHIC

DNISTERSKO-BUZKIY MEGA-BLOCK
PODILSKA LTZ

BERDYCHIVSKIY COMPLEX
Aplite-pegmatoid ($\gamma\tau^{PR}$), leucocratic ($\delta\gamma$) granites; biotite granites (γ^{PR}) and migmatites ($\gamma^{PR}m$), garnet-biotite granites (γ), migmatites (γm), often with cordierite, plagiogranites ($p\gamma$); plagiomigmatites ($p\gamma m$); garnet-biotite with hypersthene migmatites - vinnytsites (mvn)

PR₁bd — $\delta\gamma$, γ^{PR}, $\gamma^{PR}m$, γ_1m, $p\gamma$, $p\gamma m$, mvn

VOLYNSKIY MEGA-BLOCK
NOVOGRAD-VOLYNSKA LTZ

PR₁zt — γ

ZHYTOMYRSKIY COMPLEX
Biotite and two-mica granites (γ)

VOLYNSKIY MEGA-BLOCK
NOVOGRAD-VOLYNSKA LTZ

PR₁gr — $\gamma\tau$, γm

TETERIVSKA SERIES
Vasylivska Suite (?)
Biotite, often garnet- and sillimanite-bearing, amphibole-biotite gneisses, amphibolites

PR₁sh — $p\gamma$, $p\gamma m$, $\gamma\delta$

SHEREMETIVSKIY COMPLEX
Biotite plagiogranites ($p\gamma$); plagio-migmatites ($p\gamma m$), amphibole-biotite plagiogranites of granodiorite composition, kenalites ($\gamma\delta$)

ARₓlv — en, ξ

LITYNSKIY COMPLEX
Massive enderbites (en), charnockites (ξ)

ARₓgv — $\xi\delta$

GAYVORONSKIY COMPLEX
Banded enderbites (en)

DNISTERSKO-BUZKIY MEGA-BLOCK
PODILSKA LTZ

ARₓ₁ₙ — UNDIVIDED ROCKS. Pyroxene, amphibole-pyroxene, often with garnet, retrograde-altered gneisses and mafic gneisses

ARₓ₁bv — BEREZNYNSKA SEQUENCE. Garnet-biotite, often with cordierite, in places with graphite gneisses, biotite-pyroxene mafic gneisses

ARₓ₁tv — TYVRIVSKA SEQUENCE. Hypersthene, two-pyroxene, amphibole-pyroxene gneisses and mafic gneisses, in places calcilphyres

INTRUSIVE AND METASOMATIC

DNISTERSKO-BUZKIY MEGA-BLOCK
PODILSKA LTZ

βPR₁ — DYKE COMPLEX
Diabases (β), gabbro-diabases (v)

ZHIDANIVSKA ASSOCIATION OF ULTRAMAFIC ROCKS (?)
PR₁δ(ЕГ) — Serpentinized peridotites ($\omega\gamma$); pyroxenites (ν)

¹PR₁gr — EL, EL, ev, v

²PR₁ism — ν, ν

1. PROSKURIVSKIY COMPLEX
Phenites, syenites, nepheline syenites (EL); malhegites, alkaline pyroxenites, jakupirangites (EL); essexites, sub-alkaline gabbro (ev), gabbro-norites (v)
2. KHMELNYTSKIY COMPLEX
Aplite-pegmatoid granites and pegmatites undivided (γ^{PR}), leucocratic granites ($\delta\gamma$)

VOLYNSKIY MEGA-BLOCK
NOVOGRAD-VOLYNSKA LTZ

PR₁sbu — $\gamma\nu$, $\gamma\nu$, pl, ex

BUKYNSKIY COMPLEX
Amphibolized gabbro (av), monzonites ($\mu\delta$), gabbro-monzonites (ev)

ARₓ₁ₙ — SABARIVSKIY COMPLEX
Pyroxenites (v), amphibolized gabbro (av)

R O C K C O M P O S I T I O N

Gneisses: biotite (1), amphibole-biotite (2), garnet-biotite (3), garnet-biotite-cordierite (4), biotite-orthopyroxene (5), pyroxene undivided (6), two-pyroxene (7), amphibole (8)

1 – aplite-pegmatoid granites, 2 – leucocratic granites, 3 – biotite granites (a) and migmatites (b), 4 garnet-biotitic granites (a) and migmatites (b), 5 - garnet-biotite with cordierite granites (a) and migmatites (b), 6 - amphibole-biotite granites (a) and migmatites (b), 7 – biotite plagiogranites (a) and plagio-migmatites (b), 8 – enderbites, 9 – charnockites (a), in places with magnetite (b), 10 – vinnytsites, 11 – tonalites, 12 – diorites, 13 – gabbro, 14 – gabbro-monzonites, 15 – monzonites, 16 – syenites, nepheline syenites, 17 – sub-alkaline gabbro (essexites), 18 – melteigites

Mafic gneisses: biotite-amphibole (1), garnet-biotite with pyroxene (2), garnet-pyroxene (3), biotite-pyroxene (4), pyroxene undivided (5), two-pyroxene (6)

Out of scale ultramafic bodies:
1 – amphibolized gabbro, 2 – pyroxenites, 3 – serpentinized peridotites and pyroxenites

ALTERED ROCKS

Retrograde metamorphic: am - amphibolized, bi - biotitized

HYDROTHERMALLY-METASOMATIC ALTERED ROCKS

mk - microclinized, q - silicified, s - sulphidized, cl - chloritized, al - albitized
Out of scale sites of metasomatically-altered rocks

Tectonic alteration sites:
kt - cataclasis, bk - blastic cataclasis, bm - blastic milonitization

GEOLOGICAL BOUNDARIES

- Between age-different units: proven (1), possible (2)
- Between coeval units
- Metasomatically-altered rock limits
- Undefined relationships (in the legend)

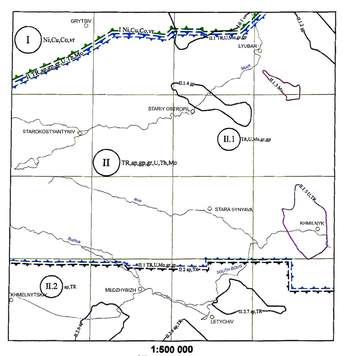
FAULTS

- Major: proven (1), possible (2)
- Minor: proven (1), possible (2)
- Local: proven (1), possible (2)
- Fault morphologic types: normal faults (1), strike-slips (2)
- Fold axes: antiform (1), synform (2)

OTHER SYMBOLS

- Isolines of crystalline basement surface
- Geological cross-section line
- Drill-holes and their numbers: in the map (a), in cross-sections (b)
- Radiological rock age in Ma, in denominator - determination method
- Rock dipping
- Curve of gravity anomalies in Bouguer reduction (Δg_B) (in cross-sections)
- Curve of magnetic field (ΔT_a) (in cross-sections)

METALLOGENIC ZONATION SKETCH



1:500 000
5 kilometres in 1 centimetre

LEGEND

Numbers and specialization of metallogenic fields:
- I – Ni_1Cu_1 Co_1,tr tectonic-metallogenic zones: I - Zhytomyrska, II - Podilska
- II.2 sp,TR metallogenic zones of Podilska TMZ: II.1 - Khmilnytska, II.2 - Khmelnytska

Boundaries of mineragenic objects:
- tectonic-metallogenic zones
- metallogenic zones
- ore fields (field number and mineraganic specialization in line break)

Tectonic-metallogenic zones	I - Zhytomyrska	II - Podilska
Metallogenic zones (number, specialization)		II.1 TR,U,Mo,gr,gp Khmilnytska II.2 sp,TR Khmelnytska
Ore-bearing fields (number, specialization)	I.0.1 vr Grytsivske	II.1.2 gp Veselkivske II.1.3 Mo Bratalivske II.1.4 gp Makhaynetske II.1.5 U,TR Khmilnytske II.2.6 ap Goloskivske II.2.7 sp,TR Antoninivske II.2.8 sp,TR Rudnyanske

MINERAL RESOURCES

Mineral type	Deposits	Occurrences	Genetic types
Metals			
Base metals			
Nickel, copper, cobalt (chromium)	Ni,Cu,Co (Cr)		Residual
Titanium	Ti		Hydrothermal-metasomatic
Rare metals			
Molybdenum	Mo		Hydrothermal-metasomatic
Rare-earth metals			
Rare earths	TR		Hydrothermal-metasomatic
Radioactive metals			
Uranium, thorium	U,Th		Metasomatic
Non-metals			
Ore-chemical raw materials			
Agrochemical raw materials			
Apatite	ap		Igneous
Non-metal ore raw materials			
Electric- and radio-technical raw materials			
Graphite	gp		Metamorphic
Adsorption raw materials			
Vermiculite	vr		Residual
Facing stones			
Granite, charnockite	Г-Ч		Ultrametamorphic
Glass and porcelain-faience raw materials			
Primary kaoline	KsrfI		Residual
Construction materials			
Aggregate raw materials			
Granite, migmatite			Ultrametamorphic
Waters			
Groundwater			
Mineral radon	P		Fractured
Fresh	П		Fractured

Commercial development of deposits
- In production
- Under conservation

Mineral type symbol
- genetic type
- 28 Mo — Left - number in the list of deposits and occurrences; right - symbol of mineral