



Institute of Geology & Mineral Exploration



GIS-BASED DATASETS OF MINERAL DEPOSITS AND MAN-MADE RESOURCES AS VALUABLE EXPLORATION TOOLS FOR DISCOVERING POTENTIAL ORE DEPOSITS IN GREECE



7th EUREGEO 12th -15th June, Bologna, Italy, 2012





Structure

- ∅ ProMine project
 - ∅ Structure of the databases (Mineral Database & Anthropogenic Concentration Database)
 - ∅ Greek Mineral Database
 - ∅ Mineral Commodities & Critical Raw Materials
 - ∅ Metallogenetic districts based on PROMINE classification
 - ∅ “Hot” metallic commodities for Greece
 - ∅ Greek Anthropogenic Concentration Database
 - ∅ Mining waste deposits in Greece upon PROMINE classification





The ProMine project

Nano-particle products from new mineral resources in Europe

Total budget: 17 M €
Requested EU contribution 11 M €
28 partners*
11 EU countries
2009-2013

*Sound and objective driven INDUSTRIAL project with huge exploitation potential
THE FLAGSHIP project of the European mineral industry in the area of mineral supply for the high added value products*

***Greek partners involved: IGME, Hellas Gold, Grecian Magnesite**





PROMINE project

Objectives

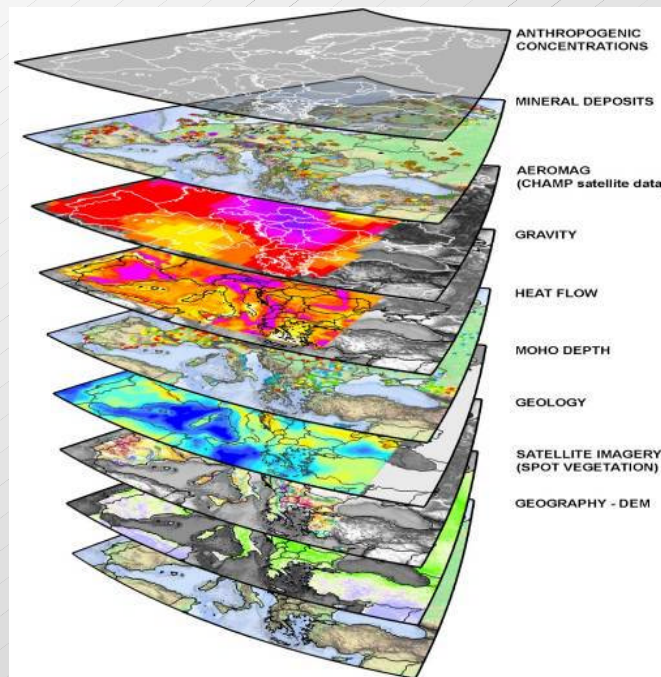
- **develop a Pan-EU GIS data management and visualization system for mineral resources**
- **develop the first ever 3D/ 4D mineral exploration geomodels in Fennoscandian shield (Sweden), Forsudetic belt (Poland-Germany), Iberian pyrite belt (Portugal and Spain), Hellenic belt (Greece)**
- **calculate the volumes of potentially strategic metals**
- **develop five new, high value, mineral-based (nano) products**
- **develop modern eco-efficient mineral processing and metal recovery methods**



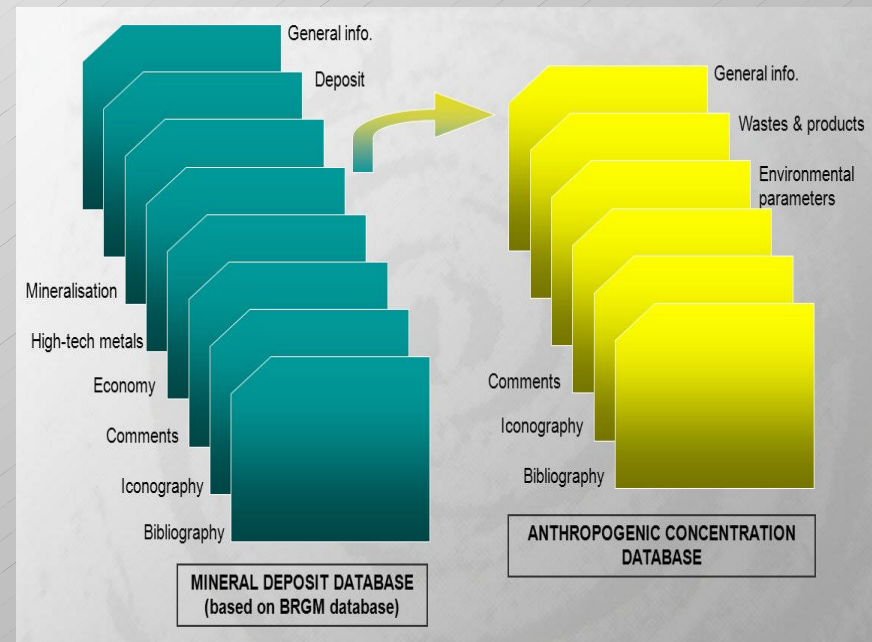


Methodology

Using existing and new data of Greece territory, a multi-layer Geographical Information System was created. The system includes databases on mineral deposits, and anthropogenic / mining and metallurgical residues along with relevant geological, structural, geochemical, geophysical layers and other information from a diverse range of sources.



The GIS multi-layer information system.



Interconnecting evaluation of MD and AC databases.





Mineral Database

Id GRC-00733 Name Perama Hill Commodity Au Identifier Name

Identifier

Mining company

District

Status

Longitude Controlled coordinates

Latitude

Author

Creation date

Controller

Checking date

Country(ies)

Ore-deposit names

Comment

URL

Source

Database name

Identifier in the database

[Back to the main menu](#)

[Preview for this deposit](#)

[Add a new deposit](#)

[Duplicate this deposit](#)

[Delete this deposit](#)

General Information

Id GRC-00733 Name Perama Hill Commodity Au Identifier Name

DEPOSIT

Deposit type

Main morphology

Azimuth Dip

Length (m) Width (m) Down dip (m)

Secondary morphologies

Deposit





Mineral Database

Id GRC-00733 Name Perama Hill Commodity Au Identifier Name

MINERALISATION

Age Sup.(Ma) Absolute age Error Unit

Inf.(Ma) Method

USGS age

Ore mineralogy Gangue mineralogy Hydrothermal alteration

M436	Gold
M490	Pyrite
M848	Telluride
M585	Tetrahedrite
M210	Energite
M099	Bornite
M558	Stannite
M247	Galena
M366	Luzonite

M499	Quartz
M332	Kaolinite
M316	Illite
M021	Alunite
M137	Chlorite
M213	Epidote

A10	Acide = Altération argileuse "avancée"
N10	Silicification
M	Oxydes de Fe, Mn
A40	Propylitisation

HOST ROCK

Age Sup.(Ma) Tert Tertiary 1.806 Absolute age Error Unit

Inf.(Ma) Method

USGS age

Host-rock formation names Host-rock lithology

Petrola graben

EPI431	volcaniclastic sandstone
PYR12	Hyaloclastite

Mineralization / Rocks

Ore Ore of indeterminate nature

Production unit t (1000 kg) Grade unit ppm

Total Former production 0 Avg. grade of prod. 0 Years 0 to 0

Reserve 11,000,000 Avg. grade of rese. 8.5 Year 0 Classification code used

Type of reserve Ref. Reserve

Resource 0 Avg grade of resou. 0 Year 0

Type of resource Ref. Resource

Former production Reserves Resources

Potential #Ovoq: Class Calculation

Commodity Au Gold (metal) GRC-00733

Ore Ore of indeterminate nature

Production unit t (1000 kg) Grade unit ppm

Total Former production 0 Avg. grade of prod. 0 Years 0 to 0

Reserve 11,000,000 Avg. grade of rese. 3.8 Year 0 Classification code used

Type of reserve Ref. Reserve

Resource 0 Avg grade of resou. 0 Year 0

Type of resource Ref. Resource

Economy





Mineral Database

Id GRC-00733 Name Perama Hill Commodity Au Identifier Name

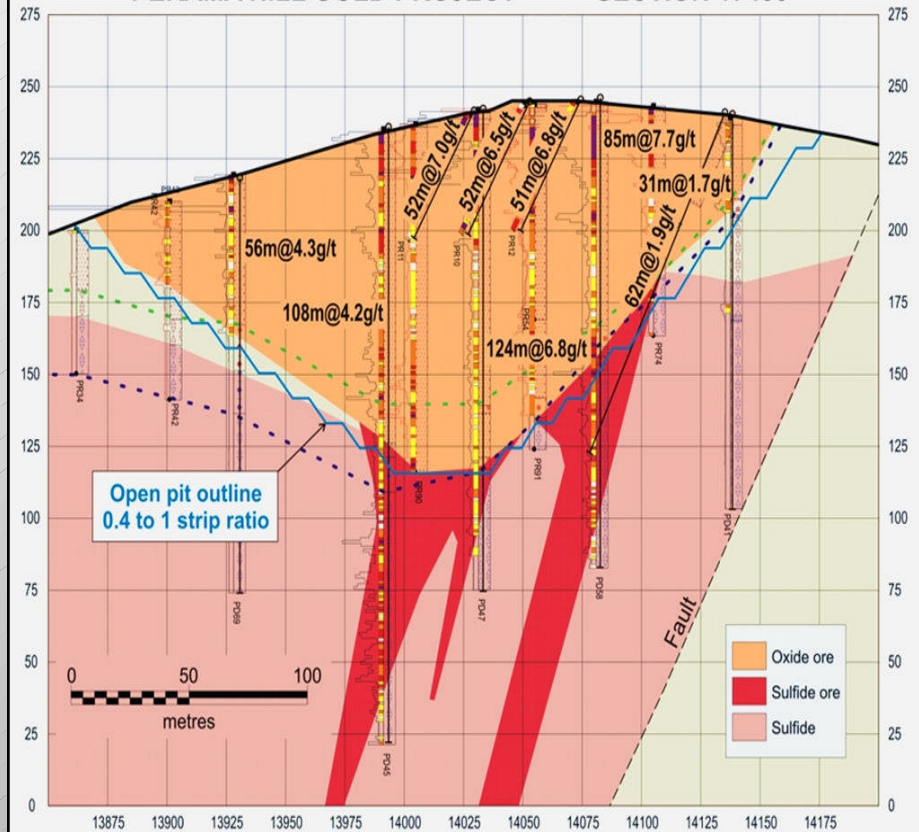
Details about geology (free text)

Perama Hill is a high sulphidation deposit hosted by tertiary sandstones (Lescuyer J.L. et al. 2003) and is located on the east margin of Petrota graben. Perama gold mineralisation is related to the late Eocene-Oligocene volcanism in the Rhodope massif. Gold mineralisation is associated with a series of wide (>1.5m) to narrow (few cm) milky quartz-barite veins and stockwork veining in the vuggy silica block. Gold in micro-sized was also found disseminated in the surrounding altered (oxide mineralisation) epiclastic sandstones (Lescuyer J.L. et al. 2003).
 After Michael C. 2004 Perama gold deposit occurs at the intersection of NS and NW trending epithermal zones. These structures represent the higher grade "feeder" system. After Lescuyer J.L. et al. 2003 the Perama Hill deposit is "mushroom shaped" oxide ore with 700m length (N-S) and up to 120m depth sandstone-filled depression. Beneath the oxide ore the deposit contains sulphide mineralisation by pyritised andesite breccia.

Details about economy (free text)

Comments

PERAMA HILL GOLD PROJECT SECTION 17450



Iconography





Mineral Database

Layout View

GIS Europe - Ore deposit database

Perama Hill

Perama Hill

General data

Deposit name(s): Perama Hill Identifier: GRC-00733

Main commodity: Au Main morphology: Surficial orebody of secondary origin

Status: Deposit under development - project

Commodities:	Ag	11,000,000	1 (1000)	Class	A
	As	11,000,000	1 (1000)	Class	A
	Au	11,000,000	1 (1000)	Class	A
	Be	11,000,000	1 (1000)	Class	A
	Cu	11,000,000	1 (1000)	Class	A
	Li	11,000,000	1 (1000)	Class	A
	Mn	11,000,000	1 (1000)	Class	A
	Nb	11,000,000	1 (1000)	Class	A
	Ni	11,000,000	1 (1000)	Class	A
	Pb	11,000,000	1 (1000)	Class	A
	Sc	11,000,000	1 (1000)	Class	A
	Se	11,000,000	1 (1000)	Class	A
	V	11,000,000	1 (1000)	Class	A
	W	11,000,000	1 (1000)	Class	A
	Y	11,000,000	1 (1000)	Class	A
	Zn	11,000,000	1 (1000)	Class	A
	Zr	11,000,000	1 (1000)	Class	A
	Cr	11,000,000	1 (1000)	Class	B
	Mg	11,000,000	1 (1000)	Class	B
	Mn	11,000,000	1 (1000)	Class	B
	Ti	11,000,000	1 (1000)	Class	B
	Fe	11,000,000	1 (1000)	Class	C

Company:

Longitude: 25.635 Latitude: 40.808 District: Thrace-Evros

Geology

Ore deposit type (geology):
High-sulfidation (acid-sulphate) epithermal deposit

Ore deposit shape:
Discordant lode or vein (thickness > 50 cm), in clusters or isolated

Mineralization Age span:

Ore mineralogy	Host rock mineralogy	Hydrothermal alteration
Gold	Quartz	High sulfidation = Acid-sulfate /
Pyrite	Kaolinite	advanced argillic alteration
Telluride	Illite	Silicification
Tetrahedrite	Alunite	Fe, Mn oxide alteration
Enargite	Chlorite	Propylitization
Bornite	Epidote	
Stannite		
Galena		
Luzonite		

Host rocks Age span: Tertiary

Hostrock formation names
Petrola graben

Host rock lithology
volcaniclastic sandstone
hyaloclastite

Economy

Exploitation type
Unworked

BRGM Report 07 September 2010 Page 1 / 4

GIS Europe - Ore deposit database

Perama Hill

Perama Hill

Perma Hill

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.013 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.002 %
- t (1000)	Average grade:	- %

208)

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	5 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.0008 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.071 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	9 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	39.4 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.09 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.003 %
- t (1000)	Average grade:	- %

BRGM Report 07 September 2010 Page 3 / 4

Perama Hill

Perama Hill

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.039 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	8.5 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	3.8 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.002 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	2 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.008 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	7 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	1.09 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	20 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.008 %
- t (1000)	Average grade:	- %

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GIS Europe - Ore deposit database

Perama Hill

Perama Hill

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.002 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	2 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.008 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- ppm
11000000 t (1000)	Average grade:	7 ppm
- t (1000)	Average grade:	- ppm

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.008 %
- t (1000)	Average grade:	- %

epithemate nature

- t (1000)	Average grade:	- %
11000000 t (1000)	Average grade:	0.008 %
- t (1000)	Average grade:	- %

BRGM Report 07 September 2010 Page 4 / 4

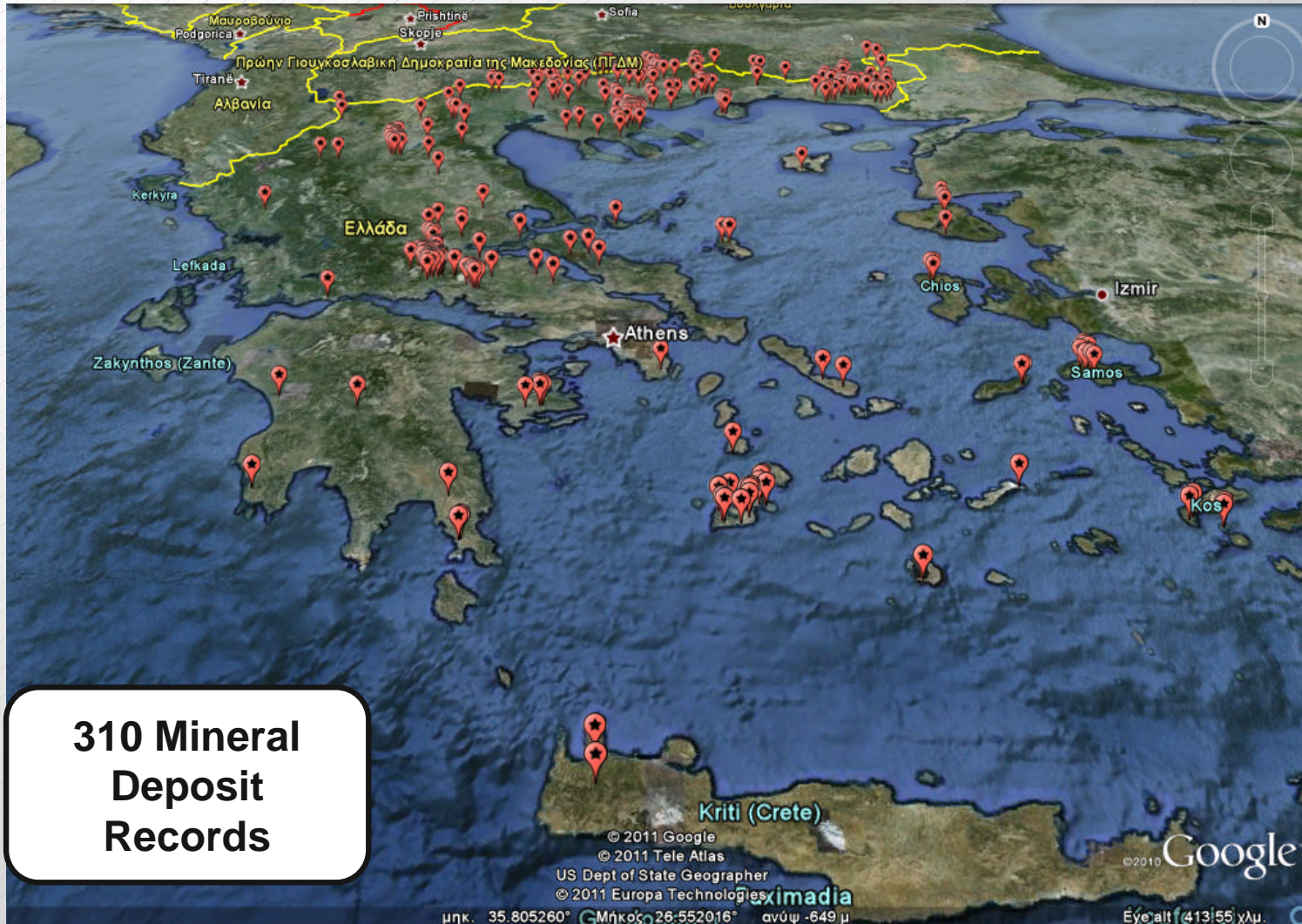
Goldstones (Lescuyer, J. L. et al. 2003) and is located on the east margin of Evros-Oligocene volcanism in the Thracian coastal Goldstone (few cm) milky quartz-barite veins and stockwork veining in the field in the surrounding altered (oxide mineralization) epithermal section of NS and NW trending epithermal zones. These structures are room shaped" oxide ore with 700m length (N-S) and up to 120m depth contain sulphide mineralisation by pyritised andesite breccia.

"Thrace gold mines"



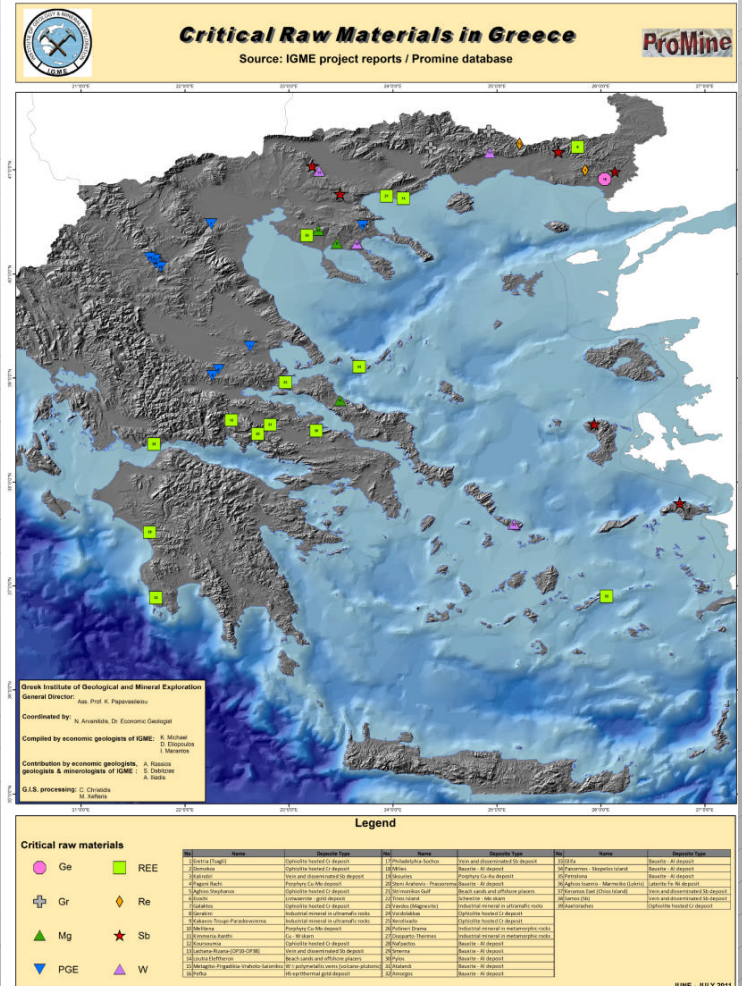
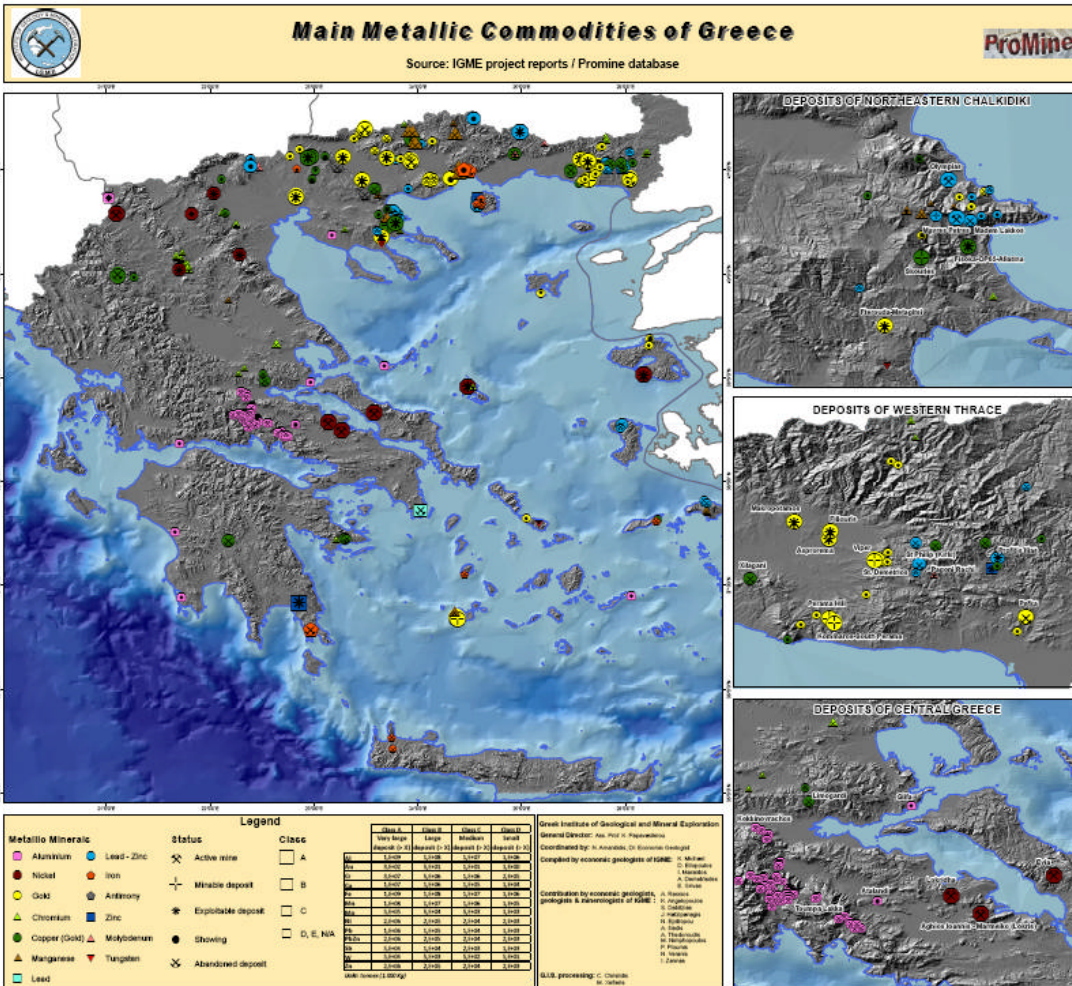


Total database inputs



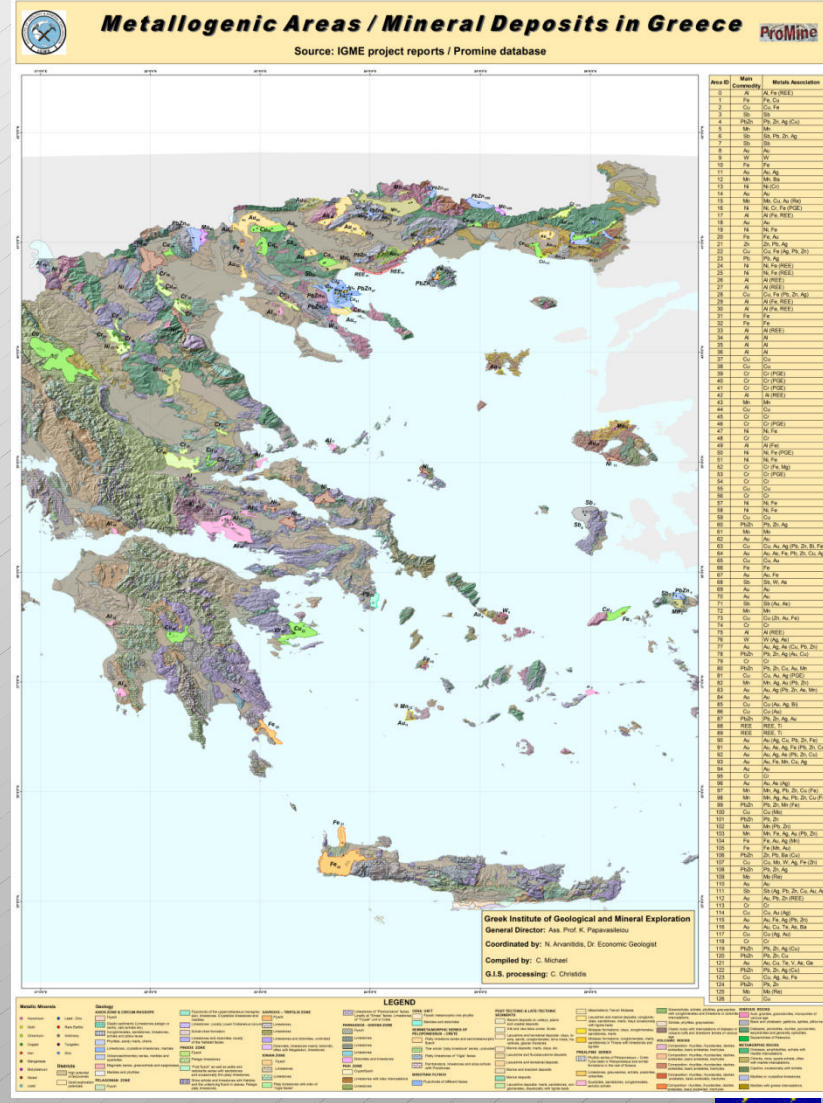
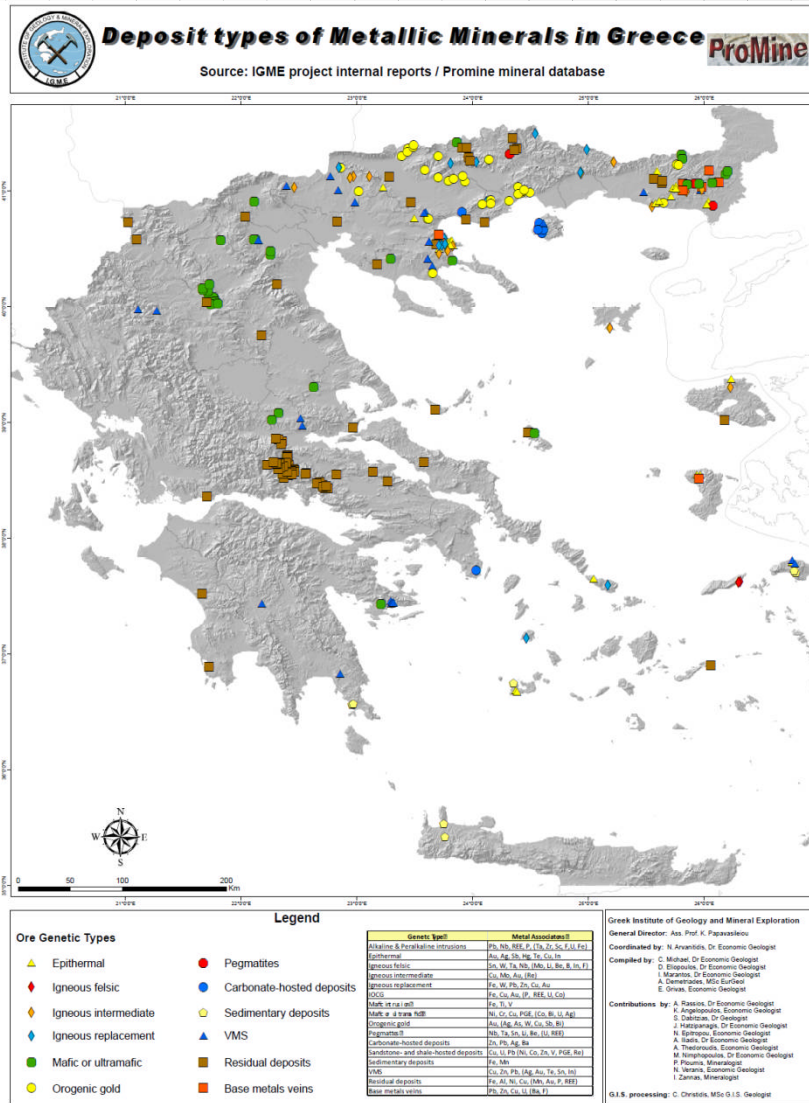


Mineral Commodities & Critical Raw Materials



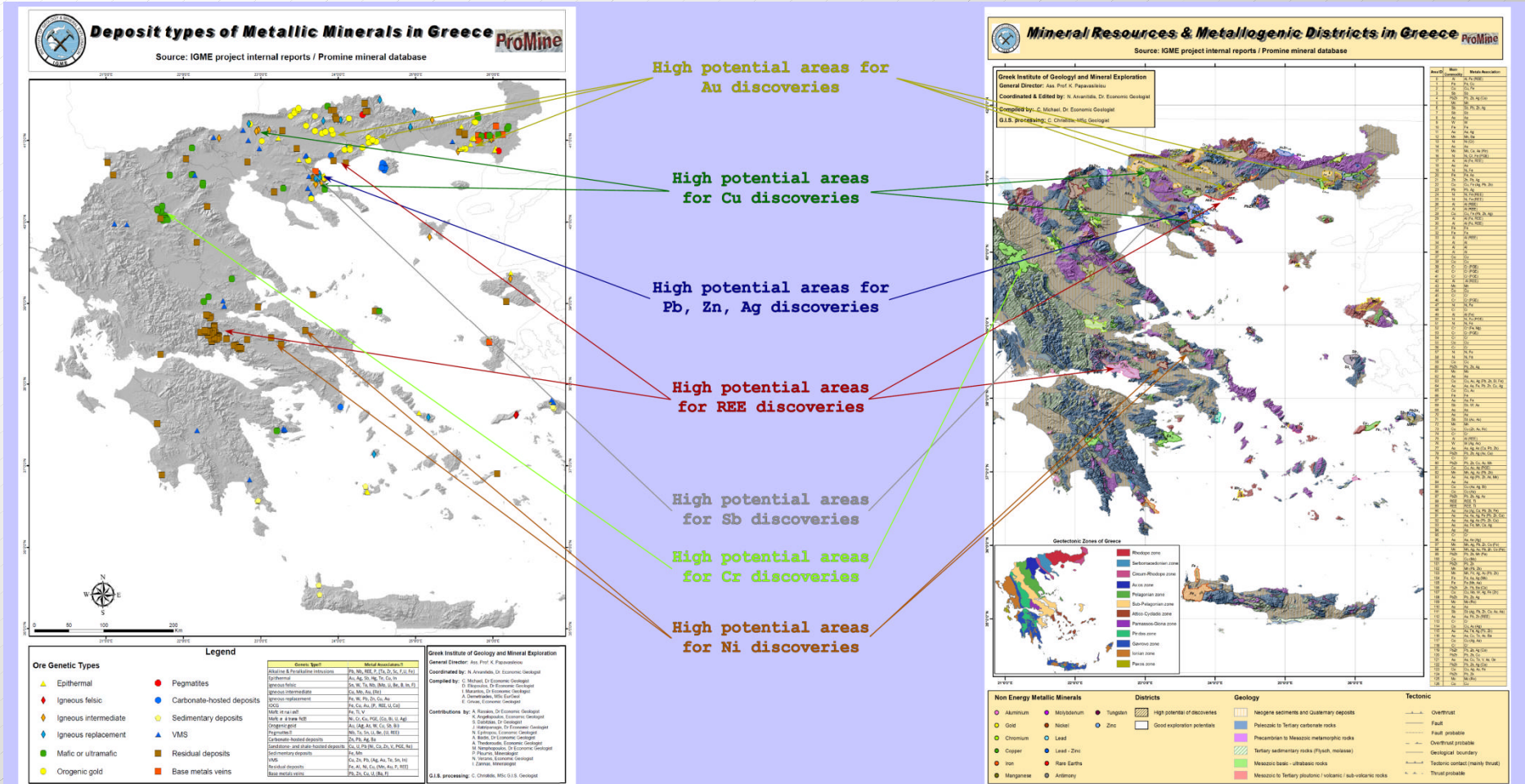


Metallogenetic districts based on PROMINE classification





“Hot” metallic commodities for Greece





Anthropogenic Database

Anthropogenic concentration database

Αρχείο Επεξεργασία Εισαγωγή Εγγραφές Παράθυρο Βοήθεια Adobe PDF Πληκτρολογήστε ερώτηση

description of the site

Id GRC-A00015 Name St Phillip (Kirki)

General information Wastes and products Comments Iconography Bibliography

Identifier GRC-A00015

Owner(s)

District/province Evros-Thrace

Status Inactive Plant

Country GREECE (Hellenic republic)

Longitude 25.81944 25 49 10

Latitude 41.01766 41 1 4

Controlled coordinates

Author IGME

Creation date 18/11/2010

Controller

Checking date

Come from deposit St Phillip (Kirki) Full ore processing & selling concentrates

Implemented processin(s) Comminution (crushing-grinding-pulverising) Flotation

Site names St Phillip (Kirki)

URL Source

Database name Identifier in the database

Εγγραφή: 13 από 15

Εγγραφή: 1 από 2

Εγγραφή: 1 από 1

General report

Back to the main menu

Preview for this site

Add a new site

Duplicate this site

Delete this site



Anthropogenic Database

Anthropogenic concentration database

Αρχείο Επεξεργασία Εισαγωγή Εγγραφές Παράθυρο Βοήθεια Adobe PDF Πληκτρολογήστε ερώτηση

Id **GRC-A00015** Name **St Phillip (Kirki)** Id Name

General information **Wastes and products** Comments Iconography Bibliography

SITE

Volume (m3) Surface (m²) Tonnage (t) Density

Type of storage Surface storage 90.000,00 m3 0,00 m² 0,00 t

Type of waste Mine products and waste Classe

Waste mineralogy	Commodity	Min.	Max.	Ave.	Unit	Date	Accuracy	Potential
M490 Pyrite	Pb Lead (metal)	505,000	31.100,000	4.672,890	ppm	19/11/2010	100,00%	0,0 t
M133 Chalcopyrite	As Arsenic (metal)	105,000	550,000	243,600	ppm	19/11/2010	100,00%	0,0 t
M554 Sphalerite	Cd Cadmium (metal)	5,000	165,000	34,600	ppm	19/11/2010	100,00%	0,0 t
M640 Wurtzite	Mn Manganese (metal)	675,000	18.650,000	4.242,100	ppm	19/11/2010	100,00%	0,0 t
M247 Galena	Zn Zinc (metal)	785,000	21.150,000	4.168,700	ppm	19/11/2010	100,00%	0,0 t
M061 Arsenopyrite	Cu Copper (metal)	75,000	17.100,000	1.215,300	ppm	19/11/2010	100,00%	0,0 t
M1014 Iron Oxides(unspecified)	Ni Nickel (metal)	25,000	100,000	55,800	ppm	19/11/2010	100,00%	0,0 t
M265 Goethite								
M292 Hematite								
M531 Scorodite								
M809 Jacobsite								
M4145 Vernadite								

Εγγραφή: 1 από 11

Impacts

Impact

Erosion

Surface (km²)

Volume of water affected(m3)

Impact

AMD (Acid Mine Drainage)

Surface (km²)

Volume of water affected(m3)

Εγγραφή: 1 από 2

Comment

Εγγραφή: 1 από 1

WARNING: An estimated accuracy has to be entered [0-100%] for each input data

Εγγραφή: 13 από 15



Anthropogenic Database

Anthropogenic concentration database

Αρχείο Επεξεργασία Εισαγωγή Εγγραφές Παράθυρο Βοήθεια Adobe PDF Πληκτρολογήστε ερώτηση

Tahoma 8 B I U

Impacts

Pathway	Treatment
A Surface water	
B Groundwater	
C Soil	
*	

Εγγραφή: 1

Receptor	Restoration
A10 Soil	
A70 Flora	
B32 Agriculture, forestry and fishery	
*	

Εγγραφή: 1

St Phillip (Kirki)

GRC-A00015

Impacts

Erosion

Cl

Waste

Type of storage: Surface storage
Type of waste: Mine products and waste

Volume (m3)	Surface (m ²)	Tonnage
90.000,00 m3	0,00 m ²	0,0

Affected

Surface	Water
0,0 km ²	0 m3

Volume of water affected(m3) 0
Εγγραφή: 1 από 2

ανό 1

estimated accuracy has to be entered [0-100%] for each input data

Refresh



Anthropogenic Database

Anthropogenic concentrations database

Layout View



Anthropogenic concentrations database

St Phillip (Kirk) - GRC-A00015
District/province
Evros-Thrace

Status
Inactive Plant

names
St Phillip (Kirk)

titles

level(s)

storage

jobs and waste

Tonnage 0
Density

Class

max.	avg.	unit	date	accuracy	potential
100,000	4 672,800	ppm	19/11/2010	100,00%	0
550,000	243,800	ppm	19/11/2010	100,00%	0
165,000	34,800	ppm	19/11/2010	100,00%	0
650,000	4 242,100	ppm	19/11/2010	100,00%	0
150,000	4 198,700	ppm	19/11/2010	100,00%	0
100,000	1 215,300	ppm	19/11/2010	100,00%	0
100,000	55,800	ppm	19/11/2010	100,00%	0
18,000	8,300	ppm	19/11/2010	100,00%	0
190,000	136,700	ppm	19/11/2010	100,00%	0
19,000	7,500	ppm	19/11/2010	100,00%	0
1,420	0,800	%	19/11/2010	100,00%	0

Chalcocopyrite
Galena
Goethite
Jacobinite

Sphalerite
Arsenopyrite
Hemattite
Vermadite

Anthropogenic concentrations database

Hollandite
Wulfenite
Bismutodiborite
Mica
Montmorillonite
Anhydrite

Jarosite
Anglesite
Quartz
Kaolinite
Pyrophyllite
Alunite

affected Surface Volume
0,00 km² 0 m³

Receptor
Soil
Flora
Agriculture, forestry and
fishery

0,00 km² 0 m³

Receptor
Surface water
Groundwater
Soil
Flora
Agriculture, forestry and
fishery

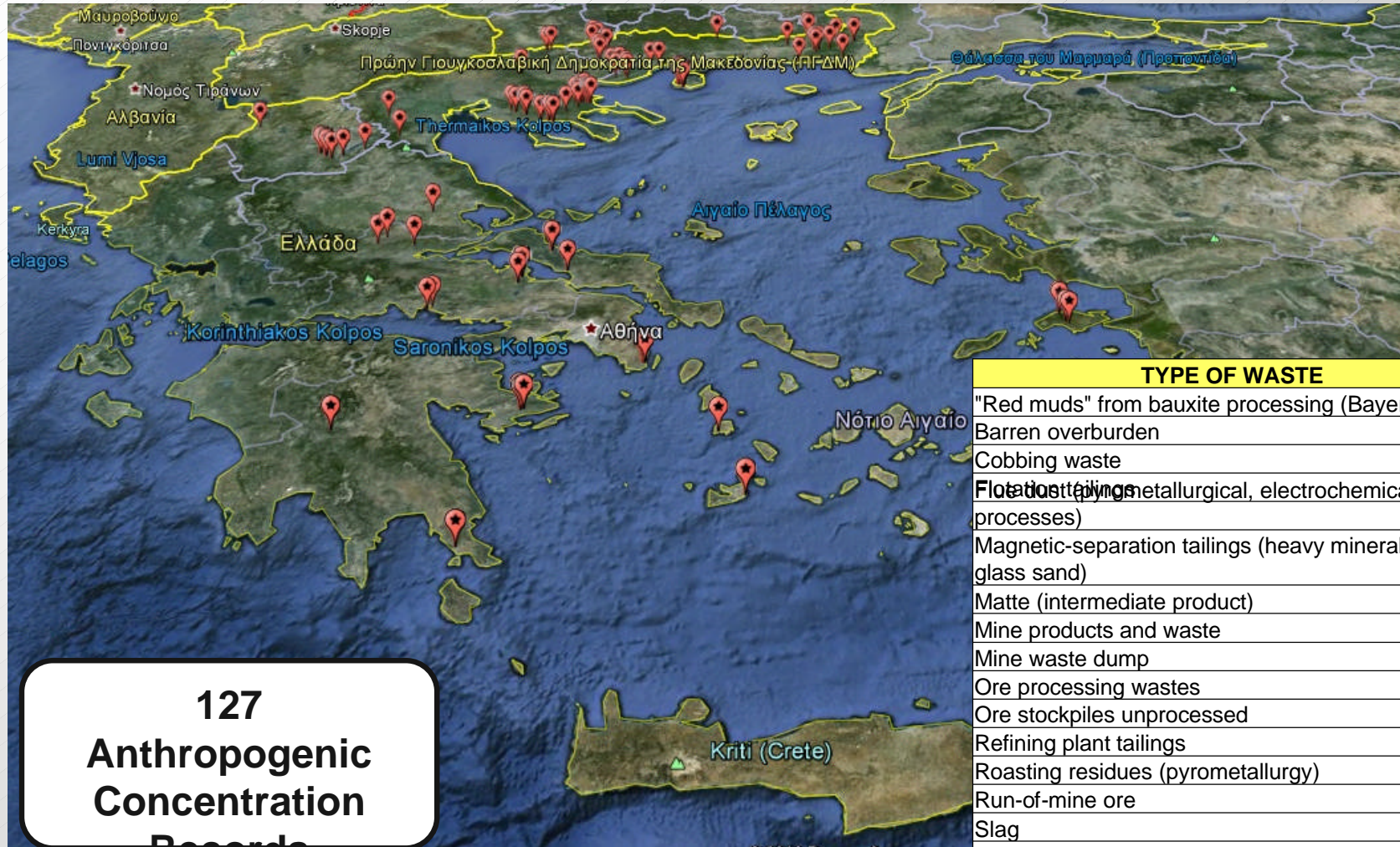
WEB sources

Controller
Checking date





Total AC database inputs



127
Anthropogenic
Concentration
Records

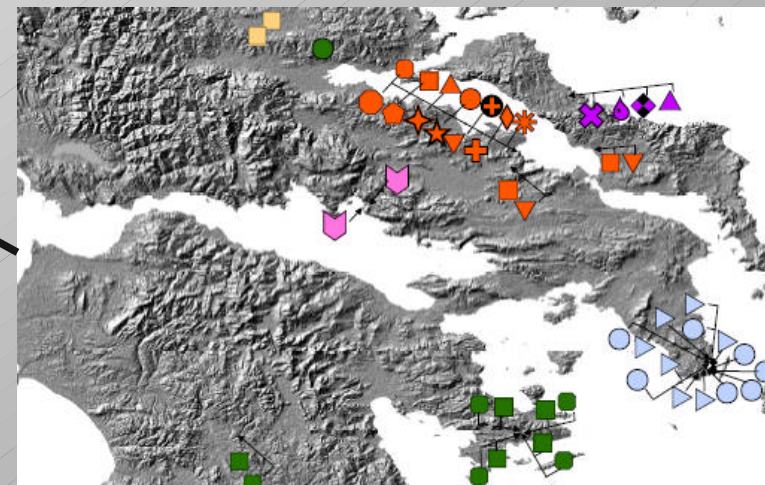
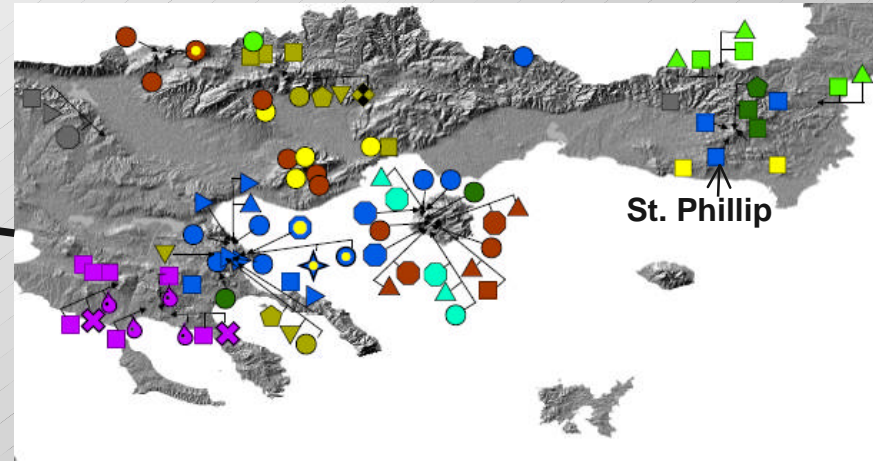
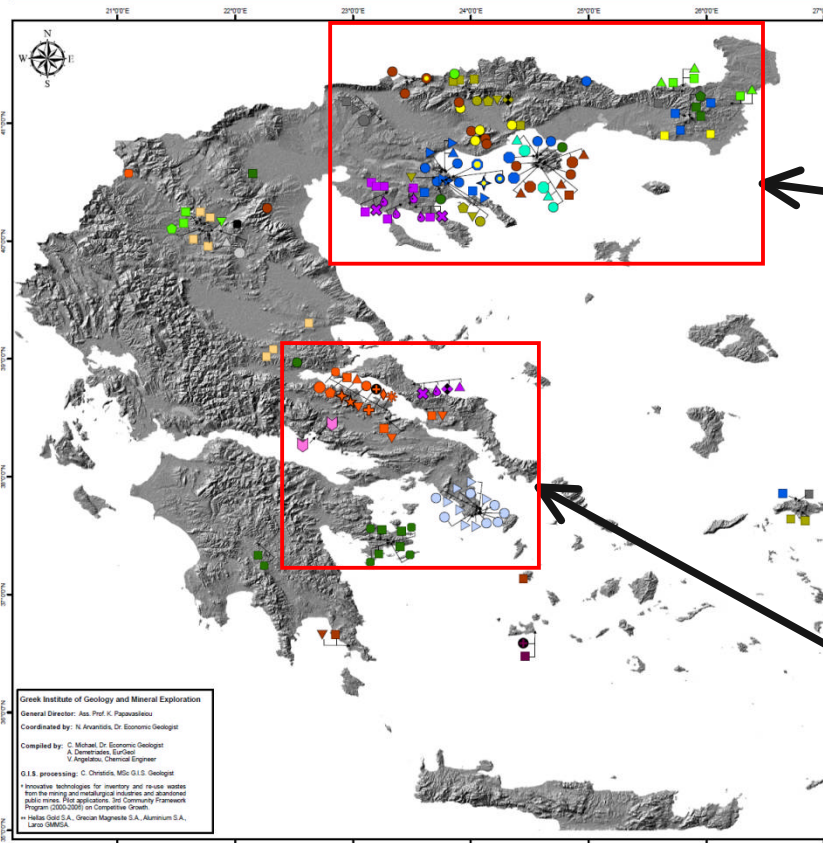
TYPE OF WASTE	NUMBE R
"Red muds" from bauxite processing (Bayer)	2
Barren overburden	12
Cobbing waste	1
Flotation tailings (metallurgical, electrochemical processes)	15
Magnetic-separation tailings (heavy minerals from glass sand)	1
Matte (intermediate product)	2
Mine products and waste	3
Mine waste dump	10
Ore processing wastes	57
Ore stockpiles unprocessed	8
Refining plant tailings	5
Roasting residues (pyrometallurgy)	1
Run-of-mine ore	2
Slag	8
Smelter waste (metallurgical residues & slags, etc.)	38
Wash tailings	1
Total	173





Mining waste deposits in Greece upon PROMINE classification

Mining Waste Deposits in Greece ProMine
 Source: IGME project internal reports* & Promine Anthropogenic Concentration Database**



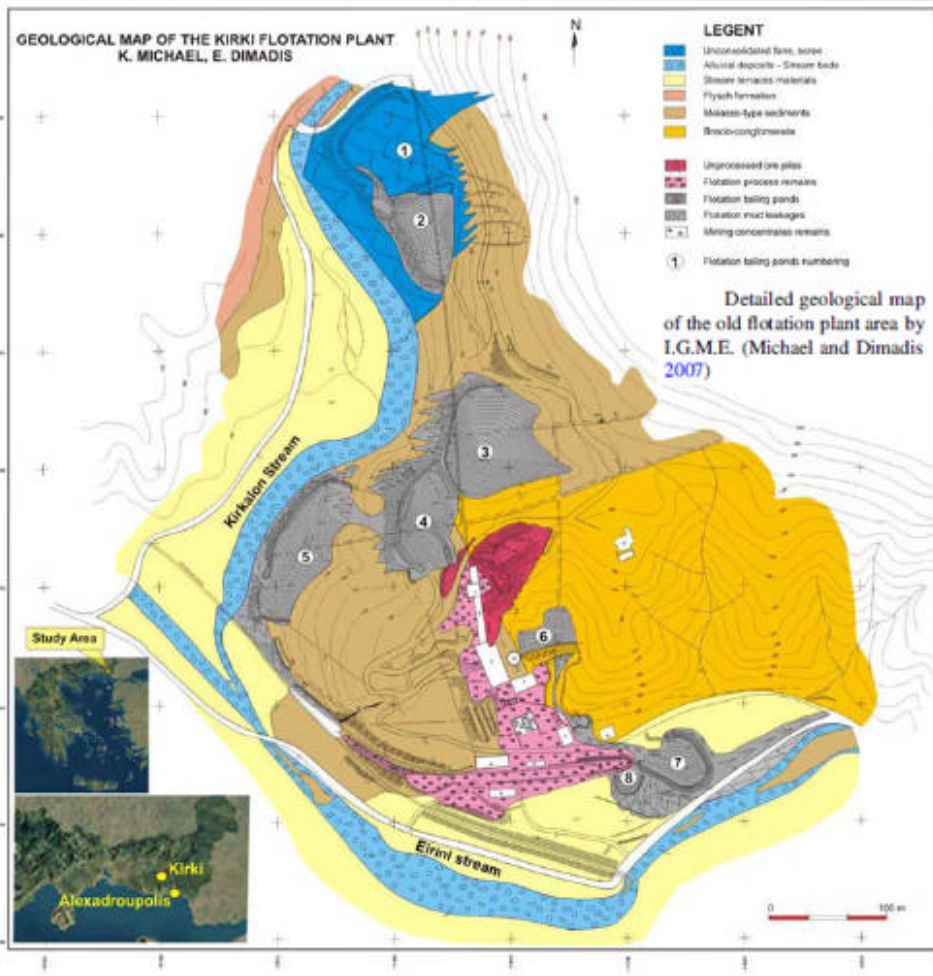
Greek Institute of Geology and Mineral Exploration
 General Director: Asst. Prof. K. Papavasiliou
 Coordinated by: N. Avramidis, Dr. Economic Geologist
 Compiled by: C. Michael, Dr. Economic Geologist
 A. Demetriades, Engineer
 V. Angelatos, Chemical Engineer
 GIS processing: C. Christaki, MSc. GIS Geologist
 Innovative technologies for inventory and remote sensing from the mining and metallurgical industries and abandoned public mines. Post applications, 3rd Community Framework Program (2000-2006) on Competitive Growth.
 *Hellenic Gold S.A., Greece Magnesia S.A., Aluminium S.A., Larco GIMESA.

Mining / processing / metallurgical wastes and by-products			Potential commodities		
☐ "Red muds" from bauxite processing	☒ Flue dust	⚡ Roasting residues	🟡 Al (REE)	🟢 Cu	🟠 Pb
⚡ Barren overburden	⚡ Magnetic-separation tailings	⚡ Run-of-mine ore	🟡 Asbestos	🟢 Fe	🟠 Pb, Zn, Ag
⚡ Matte (intermediate product)	☐ Mine waste dump	○ Slag	🟡 Au	🟢 Fe, Au	🟠 Pb, Zn, Au, Ag
○ Mine products and waste	▽ Ore processing wastes	⚡ Smelter waste	⚡ C	🟡 Mg	🟠 S
◇ Cobbing waste	☐ Ore stockpiles unprocessed	⚡ Treatment waste	🟡 Cr	🟢 Mn	🟠 Sb
⚡ Flotation tailings	☆ Refining plant tailings	💧 Wash tailings	🟡 Cr (PGE)	🟢 Ni, Fe	🟠 Zn





AD – St. Phillip

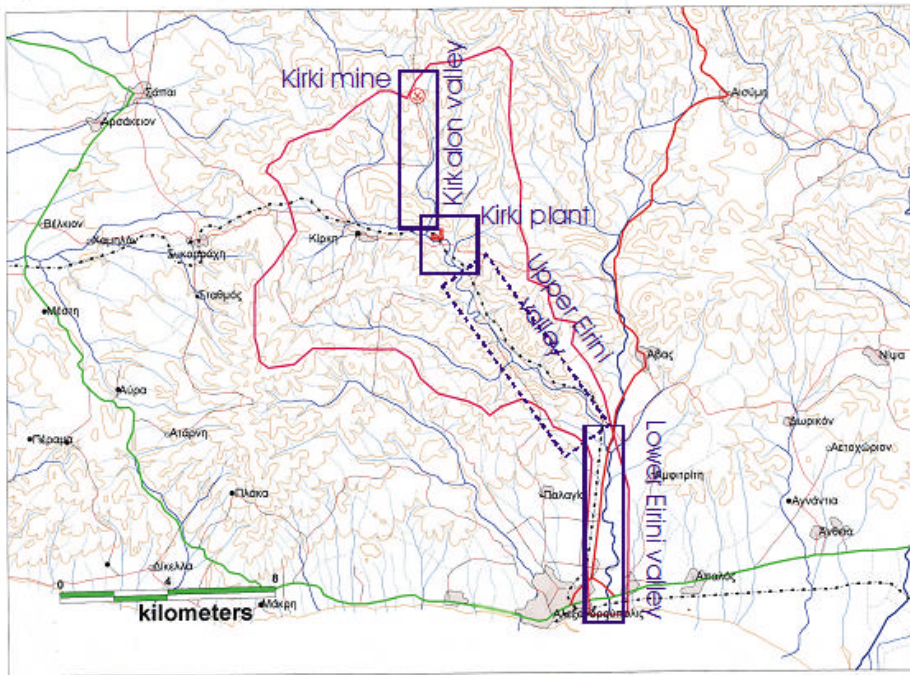


Mud overflowing from tailings pond extending to pond





AC database – St. Phillip



Map of the studied area.



St. Phillip mining area showing the location of open pit



Mining waste pile dumped downstream



PROMINE Portal



ProMine Portal

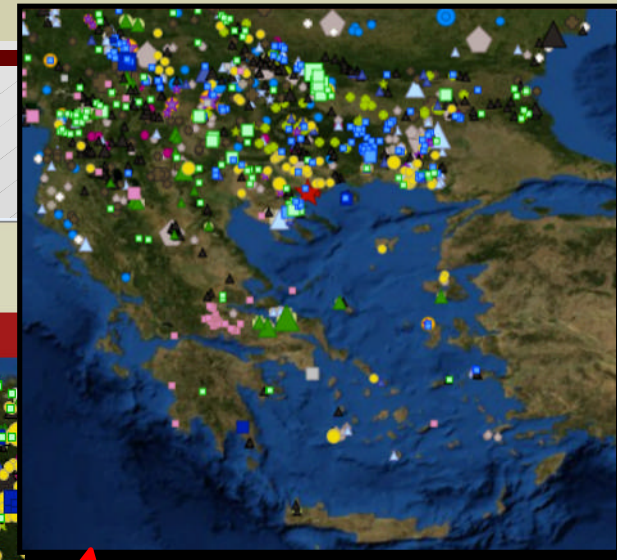
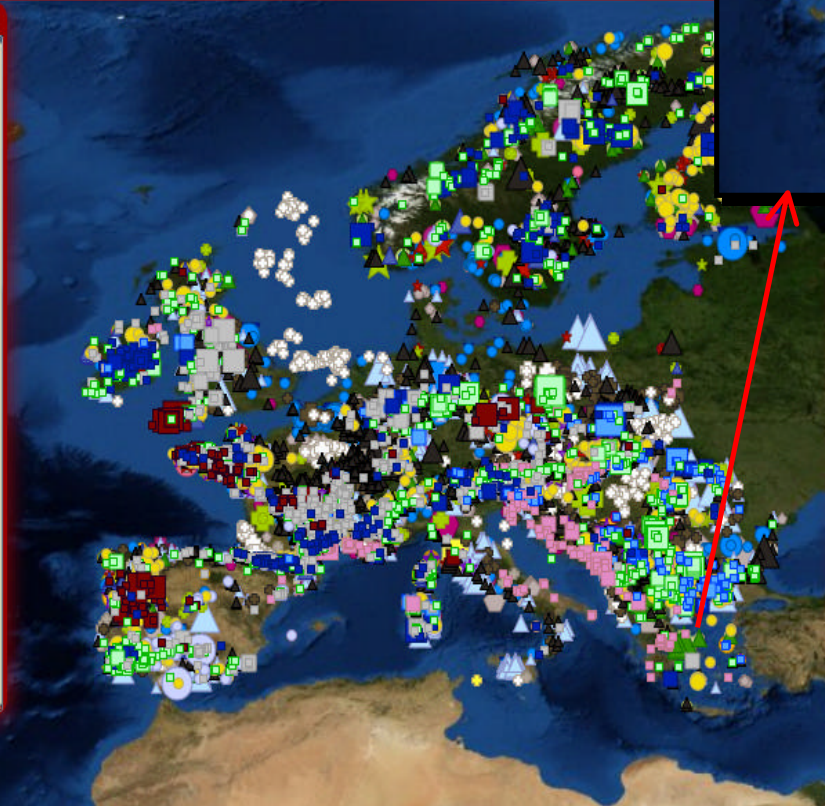


Table of Contents

- ProMine - Mineral deposit layers
 - Base metals
 - Precious metals
 - Iron and ferro-alloy metals
 - Speciality and rare metals
 - Energy commodities
 - Precious and semi-precious stones
 - Minerals for chemical use
 - Ceramic and refractory minerals
 - Fertilizer minerals
 - Building raw materials
 - Speciality and other industrial rocks and minerals
 - Critical mineral raw materials
- ProMine - WP2 (Demo)
- ProMine - Geological layers
- ProMine - Geographic layers
- ProMine - Geophysical layers



Legend

Base metals

- Lead+Zinc;
- Copper;
- Tin;
- Zinc only;
- Lead;
- Aluminium (bauxite ore).

DEPOSIT SIZE:

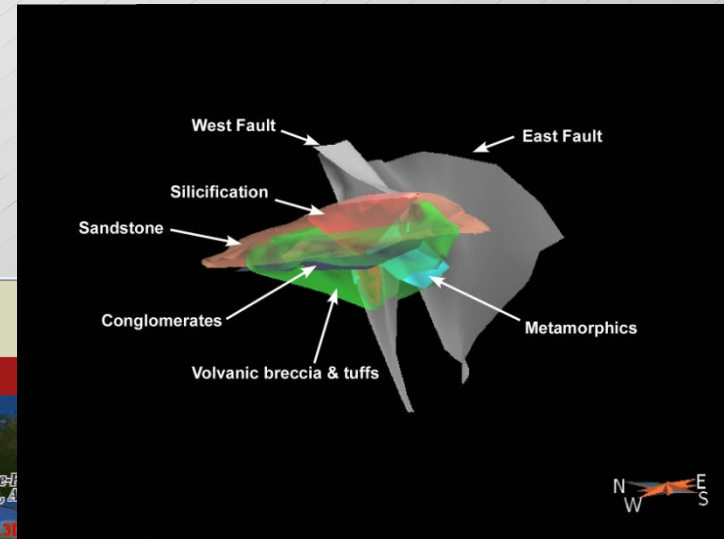
- Very large
- Large
- Medium
- Small

Screen Coords: X = 1231, Y = 107
Map Coords: X = 47.466, Y = 63.616





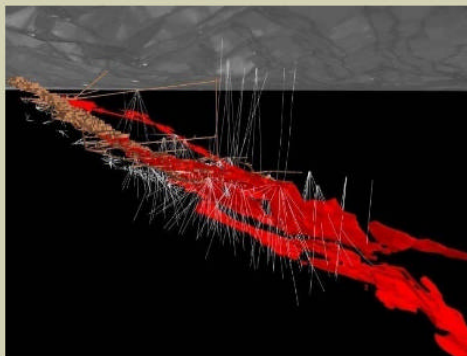
PROMINE Portal



ProMine Portal

GetFeatureInfo results

Southeastern Europe – The Balkans



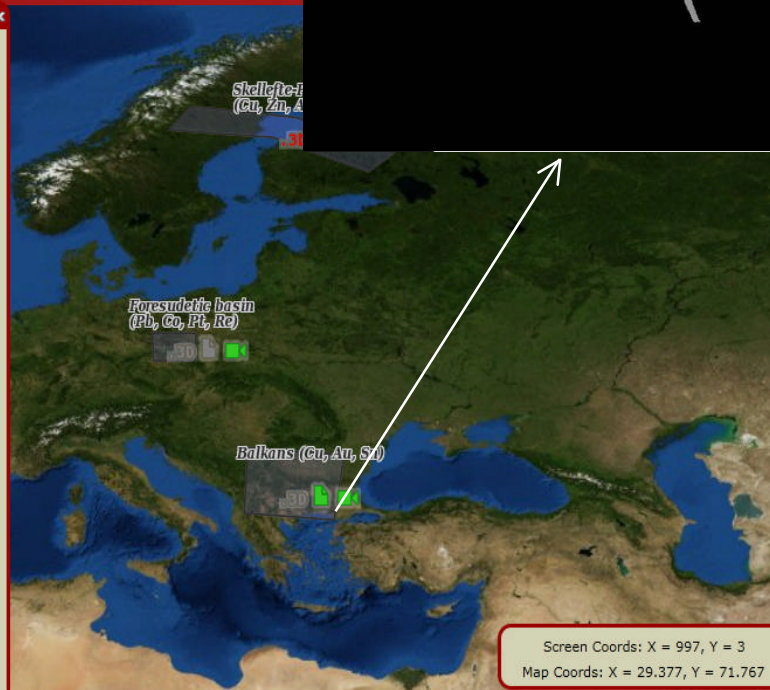
Place a text here to briefly present the belt/district, its general geological description, mining activity and history.

A short description of the work done within the framework of ProMine, should be presented, with list of available 3D/4D models and some basic information on each of them.

Data download

[Link to public access data](#)

[Link to restricted access data \(login and password required\)](#)





Thank you for
your attention

<http://thes.igme.gr>
www.igme.gr

