



**Workshop on
Implementing the United Nations Framework
Classification for Resources (UNFC) in Southeast
Europe**

Minerals Case Studies

**Belgrade, Republic of Serbia
4 – 5 July 2024**

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Introduction

- How can UNFC be applied in two ways
- Through Direct Application, where no resource estimation has been done previously, based on publicly available data (open source)
- Via Bridging, where the resource has been estimated with national or international reporting systems
- When applying UNFC directly, the approach needs to be three-fold, by arranging the data and information dictating the categories and sub-categories (in some cases) for each axis:
 - E axis: how the project is producing or will be produce from the environmental, social, and economic perspectives
 - F axis: what can be done or what is being done to produce, market the resource with what exists in technical terms
 - G axis: How sure is the project of the resource quantity and quality before it is turned into a product
- A Bridging document explain “the relationship between UNFC and another classification system, including instructions on how to classify estimates generated by the application of that system using the UNFC Numerical Codes”



Several UNFC Case Studies, approved by EGRM, on mineral resources have been developed in the EU

<https://unece.org/mineral-case-studies>

Piampaludo Titanium Exploration Project



Piampaludo Titanium Exploration Project

Scope of Study

- The application of UNFC to the Piampaludo titanium exploration project in Liguria, Italy.
- The Piampaludo titanium deposit is reported to be one of the largest titanium deposits in Europe, yet the project remains bounded by social and environmental constraints.
- This case aimed to:

1- Introduce UNFC to Italy:

- Italy has no formal national or regional classification or reporting system for raw materials
- Italy has significant amounts of mineral occurrences & deposits, many of which are CRMs

2- Classify the Piampaludo project in UNFC:

- Sustainable decision-making
- Ligurian mineral inventory

3- Provide a new approach for UNFC:

- UNFC classification based only on publicly available / historic data



Titanium and Sustainable Development

- Titanium Metal: Listed as both Critical and Strategic Raw Material for the EU on March 2023
- Economic Titanium resources are only found in 3 EU Countries.
- Titanium is directly linked with Sustainable Development by supporting renewable energy and energy efficiency, through:
 - Buildings & Construction Materials
 - Advancements in Renewables
 - Battery Innovation
 - Medical Technology

	Contained TiO ₂ by primary ore mineral (million Mt)
Italy	9
Norway	297
Ukraine	~ 14.5



Piampaludo Titanium Deposit

Location

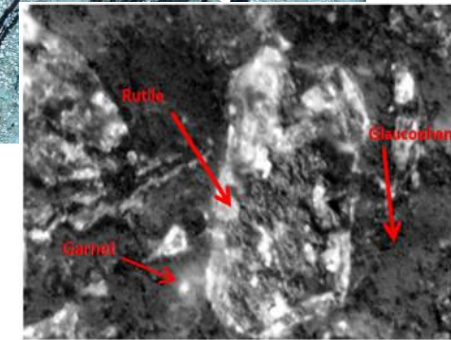
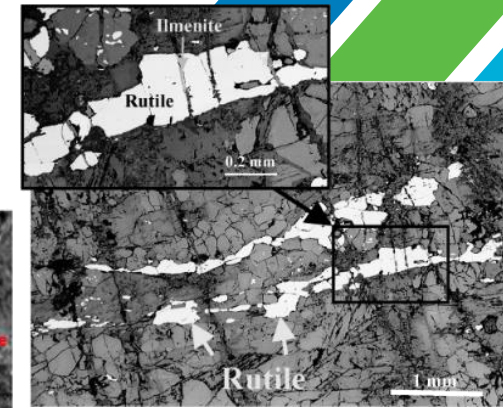
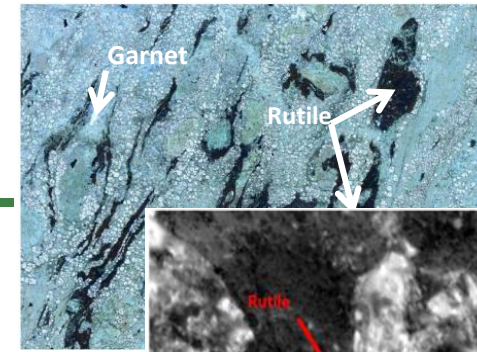


Piampaludo Titanium Deposit

Geological Data

Publically Accessible Information

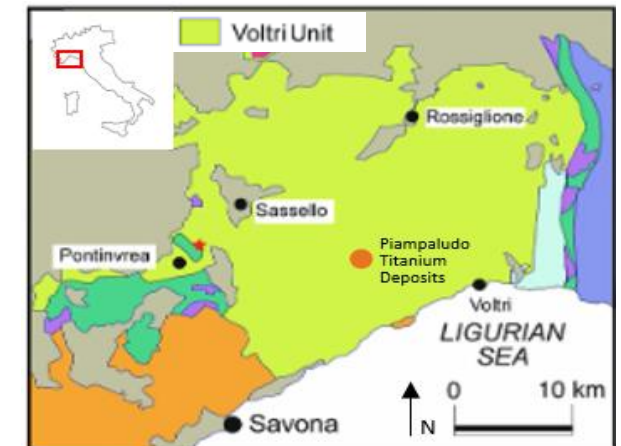
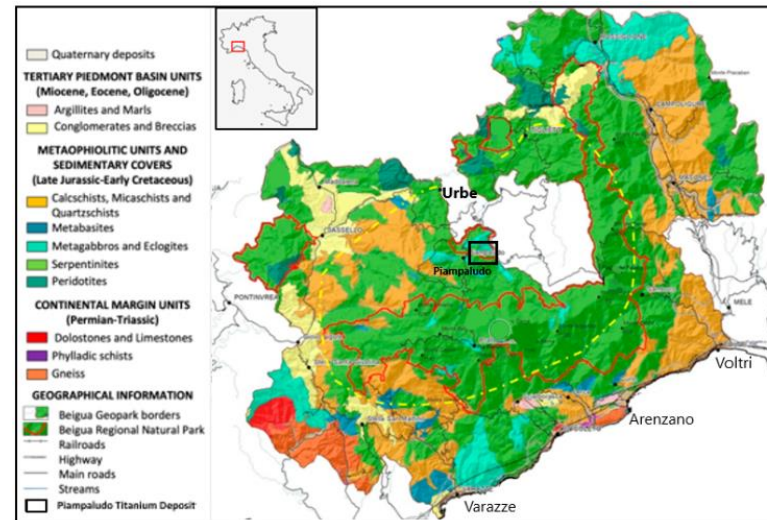
- **Academic and Scientific Research**
 - Geological mapping
 - Geophysical & geochemical studies
- **Laboratory Analysis**
 - Chemical and Mineralogical testing
 - X-ray diffractometer Eclogites & rutile
- **Field Sampling**
 - Boreholes up to 115 meters deep
 - Surface sampling
- **Exploration project**
 - Surface developments
- **Online Publications**
 - Court cases



Eclogites of Piampaludo under Microscope (Petrographic and Transmitted Polarized Light)

% Oxides	1	2	3	4	5	6	x	□
SiO ₂	0.10	0.18	0.19	0.13	0.18	0.21	0.16	0.04
TiO ₂	98.35	98.05	98.51	98.19	98.34	97.80	98.21	0.25
Al ₂ O ₃	0.13	0.11	0.17	0.37	0.10	0.18	0.18	0.10
FeO	0.41	0.22	0.32	0.48	0.41	0.26	0.35	0.10
V ₂ O ₅	-	-	-	0.54	-	0.06	0.07	0.03
MgO	0.05	0.10	0.11	0.04	-	0.06	0.07	0.03
CaO	0.06	0.12	0.08	-	0.11	0.07	0.09	0.03
Na ₂ O	0.12	0.23	0.17	0.17	-	0.13	0.16	0.04
Total	99.22	99.01	99.55	99.92	99.77	99.13	99.47	0.37

Chemical analysis of rutile from Piampaludo eclogites



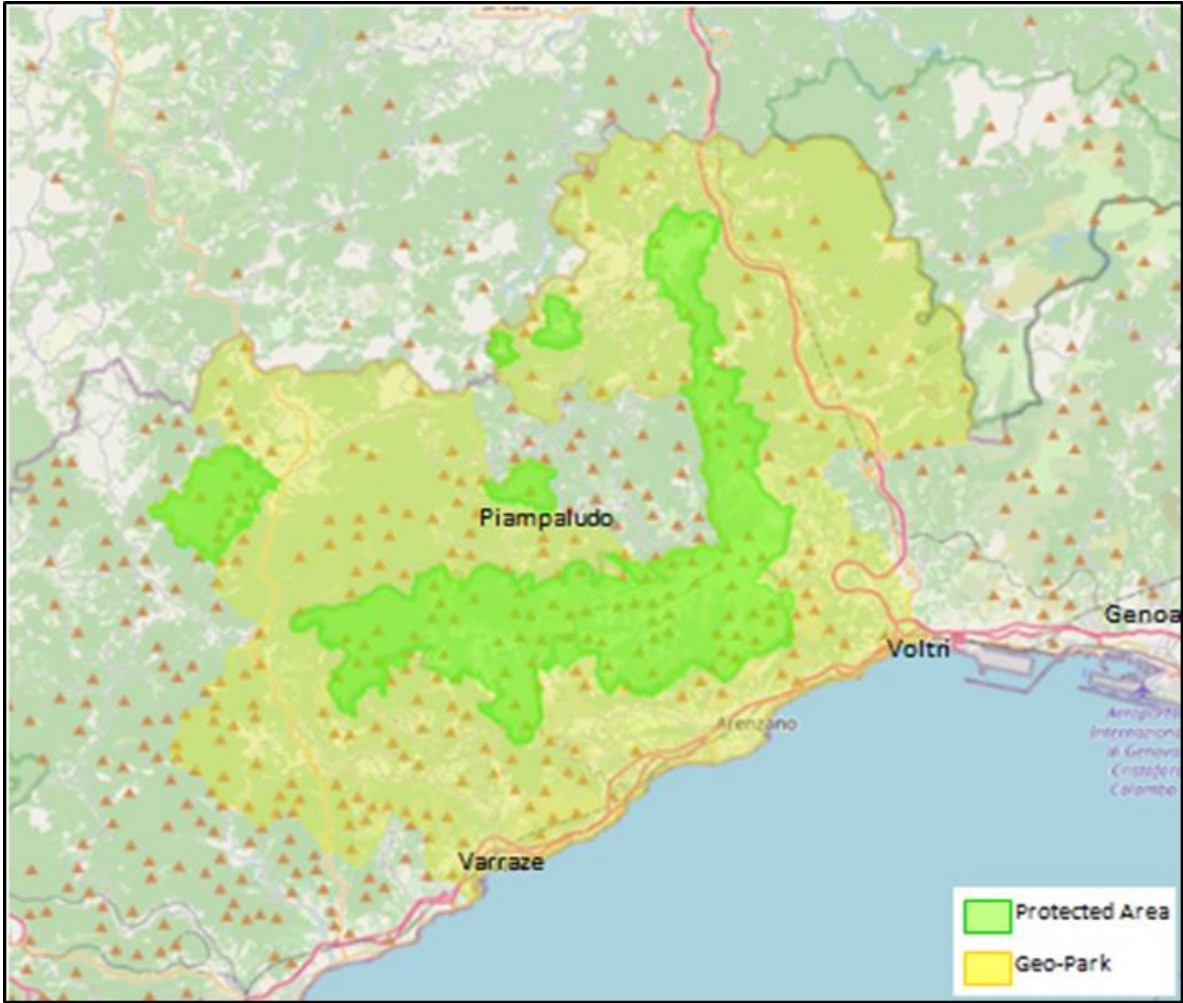
CET Mining Plan – Rutile Mining

- Compagnia Europea per il Titanio (CET)
- Mining Concession in 1985
- Prefeasibility Study
- Technical and geologic investigation
 - Surface developments
 - Coring and surface sampling
- Geophysical and Chemical analyses
- CET Mining Plan
 - Rutile recovery
 - Garnet as by-product

CET Proposed Mining Plan as part of the Piampaludo Prospect Project	
Type of Mining	Surface
Mining Method	Open Pit
Mining Technique	Drill & Blast
Surface Area	90 Hectares
Maximum Pit Slope	60 °
Operating Days per Year	265
Operating Shifts per Day	2 shifts of 8 hours each
Production	10,000 t/d
Production Unit Cost	1.37 \$/t ore*
Waste Rock	48.4 %
Ore Mining Features	
Ore Hardness	Hard Rocks (Eclogites)
Length	~ 1,800 m
Width	500 m
Thickness	300 m
Wall-Rock Alteration	None
Ore Control	Fracturing
Latest Ore Record	1991

*Subject to conversion into today's market price

Social and Environmental Contingencies



E3.2 Classification – Env.-Socio-Econ. Viability

- Classification based on court rulings, permit, social and environmental opposition, and economics.
- Exploration permit until 2024 by Liguria Regional Council
- CET has full exclusivity for exploration in this area
- Exploration granted on the deposit in areas outside the Natural park
- Under Italian law, exploration permit allows to carry out EIA and SEA
- The deposit is valued at a minimum of 120 B€
- Garnet as potential by-product
- No social consent
- E3.2 Classification

Category	Definition
E3	Development and operation are not expected to become environmentally-socially-economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socioeconomic viability.
Sub-Category	Definition
E3.2	On the basis of realistic assumptions of future conditions, it is currently considered that there are not reasonable prospects for environmental-socio-economic viability in the foreseeable future

F2.2 Classification – Technical Feasibility

- Based on CET’s preliminary mining plan, early developments, and research
- Prefeasibility plan indicates potential development
- Clear resource definition (more data acquisition is needed)
- Early developments (trenches, adits, shaft)
- Advancement still pending due to ongoing environmental and social impediments
- Technical feasibility is still at preliminary stages
- Considered highly prospective for Titanium
- F2.2 Classification

Category	Definition
F2	Technical feasibility of a development project is subject to further evaluation.
Sub-Category	Definition
F2.2	Project activities are on hold and/or where justification as a development may be subject to significant delay.

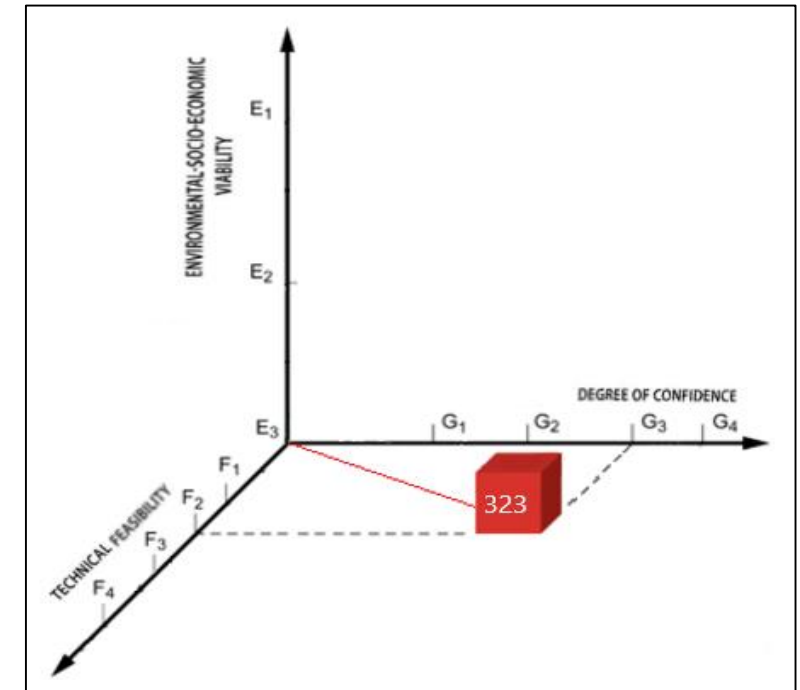
G3 + G4 Classification – Degree of Confidence

- Geologic knowledge is based on Scientific Research
 - Lab and field tests
 - Regional geology and ore mineralogy
- Subject of many researches
- No reporting publicly disclosed on resource estimates
- Estimates from studies between 1979-1998
- Moderate to low levels of confidence
- G3 + G4 Classification

Category	Definition
G3	Product quantity associated with a project that can be estimated with a low level of confidence.
G4	Product quantity associated with a Prospective Project, estimated primarily on indirect evidence

Conclusion and Challenges

- Piampaludo's titanium deposit is one of the largest eclogite-hosted deposits in EU
- Lower titanium supply risks in Italy and across Europe.
- Piampaludo project into a hiatus from Social and environmental concerns
- E3.2F2.2G3+G4 based on the available public information.
- No Garnet classification as by-product
- Case Study shows how to deal with a deposit when you only have second-hand information
- Liguria's Mineral Inventory, national database for resource management
- The study provides valuable insights into the resource for decision-making purposes
- If additional information becomes available, the conclusions drawn will need to be revised



Gorno Project



Introduction to Gorno Project

- The Gorno project is currently in advanced exploration stages, with the aim to mine Zinc, Lead, and Silver. Currently owned by Altamin Ltd. and Appian
- Extensive drilling and geological studies since 2015 has confirmed a JORC-compliant Mineral Resource estimate of 7.8Mt @ 6.8% Zn, 1.8% Pb and 32g/t Ag.
- Scoping study done in 2021 confirmed Gorno's potential commercial viability
- Estimation signed off by Competent Person
- Inferred and Indicated Resources

Gorno Mineral Resource Estimate								
Domain	JORC Classification	Tonnes Kt	Zinc Total		Lead Total		Silver	
			%	kt	%	kt	g/t	koz
Sulphide	Indicated	5,000	6.7	335	17	86	33	5,380
	Inferred	2,060	7.2	149	1.8	38	31	2,040
	Subtotal	7,060	6.9	484	1.8	124	33	7,420
Oxide	Indicated	670	6.0	40	1.8	12	26	560
	Inferred	70	7.0	5	1.8	1	26	60
	Subtotal	730	6.1	45	1.8	13	26	620
Total	Indicated	5,660	6.6	375	1.7	98	33	5,940
	Inferred	2,130	7.2	153	1.8	39	31	2,100
	Total	7,790	6.8	528	1.8	137	32	8,040



Gorno Classified in UNFC



- E2; F2; G2 -> Indicated Resources

- E2; F2; G3 -> Inferred Resources

- The project is Potentially Viable

1- Showcase how a bridging document is used:

- From JORC (CRIRSCO Family) to UNFC.

2- Classify the Gorno project in UNFC:

- Lombardian mineral inventory, but also national and EU scales
- Faster application for Strategic Project label, in case there is interest

CRIRSCO Template			Corresponding UNFC Category ^f			UNFC Class
Public Report and Study Types ^a	Standard Definitions					
Feasibility Study or Life of Mine Plan ^b (for an operating mine)	Mineral Reserves	Proved	E1	F1	G1	Viable Projects
		Probable			G2	
Pre-feasibility Study ^d	Mineral Reserves	Proved	E2	F2	G1	<u>Potentially Viable Projects</u>
		Probable			G2	
Feasibility Study, Life of Mine Plan ^b (for an operating mine) or Pre-feasibility Study ^e	Mineral Resources (exclusive of Mineral Reserves)	Measured	E2	F2	G1	
		Indicated			G2	
		Inferred			G3	
Scoping Study report or other Public Report on a Mineral Resource estimate ^f	Mineral Resources	Measured	E2	F2	G1	
		Indicated			G2	
		Inferred			G3	
Public Report on exploration stage projects	Exploration Target	E3	F3	G4	Prospective Projects	
	Exploration Results	Estimates not published				
Not applicable ^g	Estimates obtained from historical reports ^h				Non-viable Projects	

Commodity(ies)	Reserves (t)	Resource (t)	Grade (%)	Classification Method	Category	Total (t)	Date	UNFC Code	UNFC Class
Zinc		375,000	6.6	JORC	Measured & Indicated	528,000	5/11/2021	222	Potentiall Viable
		153,000	7.2	JORC	Inferred			223	Potentiall Viable
Lead		98,000	1.7	JORC	Measured & Indicated	137,000		222	Potentiall Viable
		39,000	1.8	JORC	Inferred			223	Potentiall Viable
Silver		5940000 (Oz)	33 (g/t)	JORC	Measured & Indicated	8,040,000 (Oz)		222	Potentiall Viable
		2100000 (Oz)	31 (g/t)	JORC	Inferred			223	Potentiall Viable



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Thank you!

**THE VIEWS EXPRESSED ARE
THOSE OF THE AUTHOR AND
DO NOT NECESSARILY
REFLECT THE VIEWS OF THE
UNITED NATIONS**

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