

Eurolithos: Ornamental stone resources in Europe GeoEra 2018 – 2022

*Tom Heldal, Jorge Carvalhoi, Željko Dedić, Cyprien Habimana,
Konstantinos Laskaridis, Anne Liinamaa-Dehls*

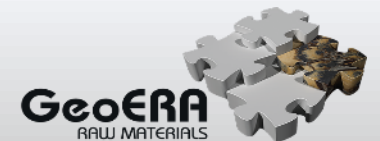


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

Why Eurolithos?



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“It’s cheap, light, quick, fireproof and has a tiny carbon footprint compared to concrete. No wonder the ‘great forgotten material of our time’ is staging a comeback”

“The miracle new sustainable product that's revolutionising architecture – stone!”

The Guardian, March 2020



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Ornamental stone is

- A **Durable** and **High Quality** Construction material
- Has **not run out of fashion for 5000 years**
- The **face** of our cultural and architectural heritage
- **Locally** or **regionally** available all over Europe
- A large amount of **jobs**
- **Less climate impact** than most other, non-organic construction materials



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Europe has

- A **large diversity** of stone materials
- A **large number of unique resources** with long history
- **Workforce and skills** to exploit the resources
- **Lack** of a harmonised information platform
- **Lack** of proper tools for value assessment beyond short-term economic

**EuroLithos answer: get these resources on the map
and provide tools for proper resource management
aid**



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Who are we?



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Project Lead



GEOLOGICAL
SURVEY OF
NORWAY

- NGU -

WP Leads



Partners



ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale



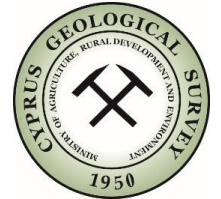
Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann



GeoZS
Geološki zavod
Slovenije



SGU
Sveriges geologiska undersökning
Geological Survey of Sweden



Service Géologique
du Luxembourg



Instituto Geológico
y Minero de España

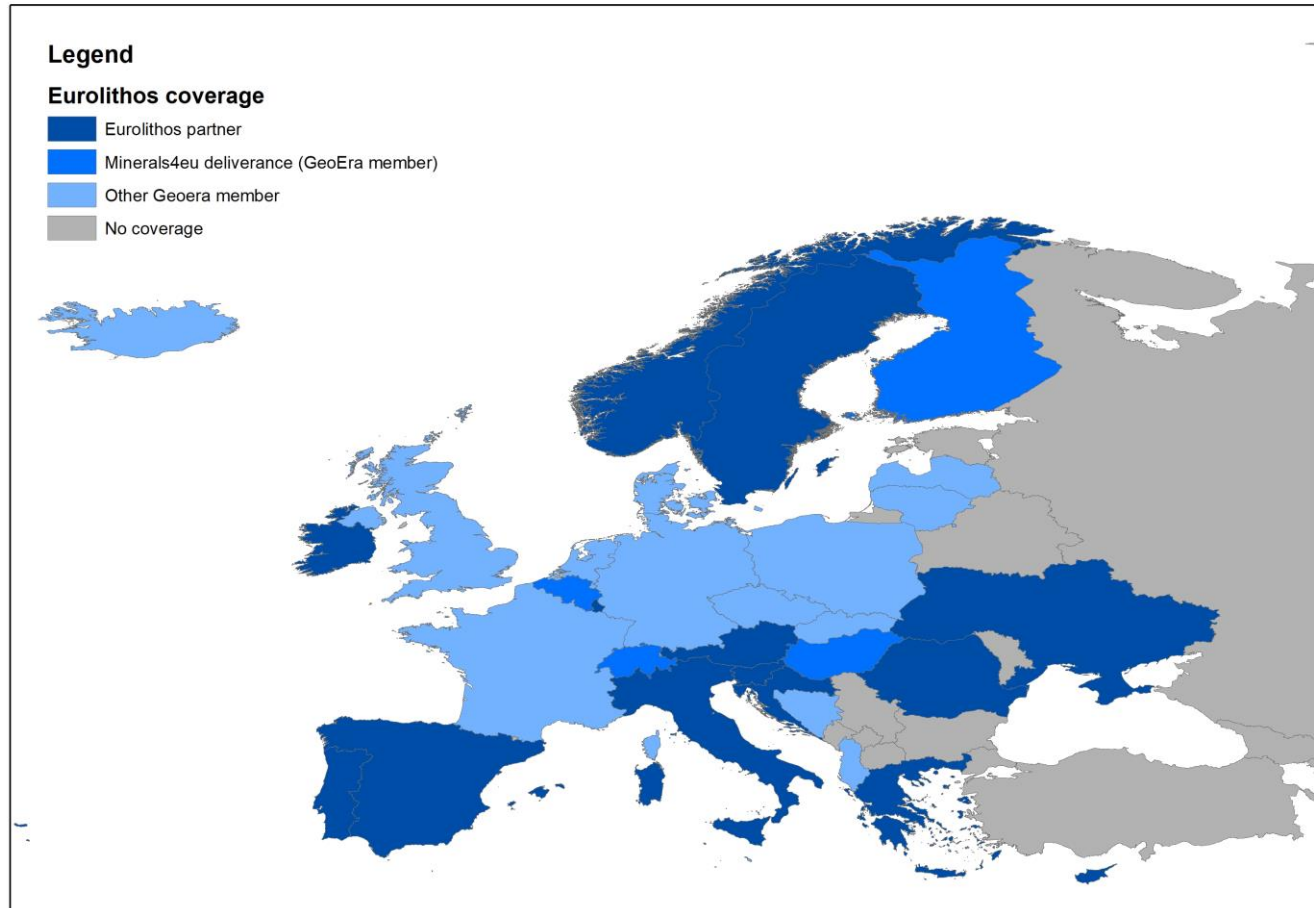
GBA



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Eurolithos coverage



Countries in Europe that are members of EuroLithos or other, connected projects



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What has Eurolithos made?

Maps and databases



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« Eurolithos ornamental stone types

EUROLITHOS European Ornamental Stone Resources

+ Base layers

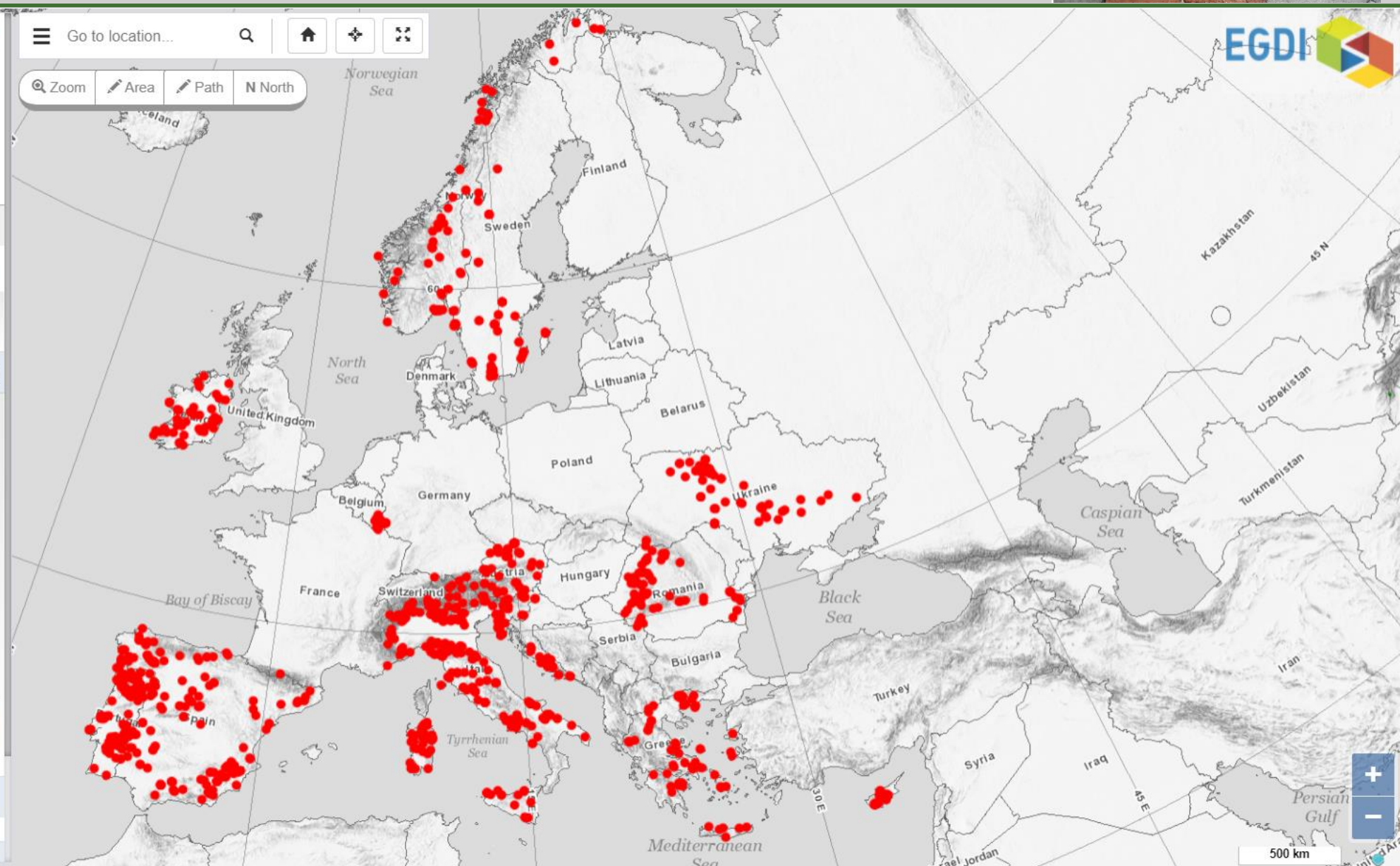
Layers

☐

– Ornamental stone 1

☒ ornamental_stones

+ Search ECDI metadata catalogue



POINT(5192311 385207942 1436305 121262162)

EPSG:3034 : 8459769, 3170936 EPSG:4326 : 67.4547, 38.5241



innovation programme under grant agreement No 731166

Eurolithos ornamental stone types



+ Base layers

Layers

Layer search...

☐

- Ornamental stone

☒ ornamental_stones

Download dataset

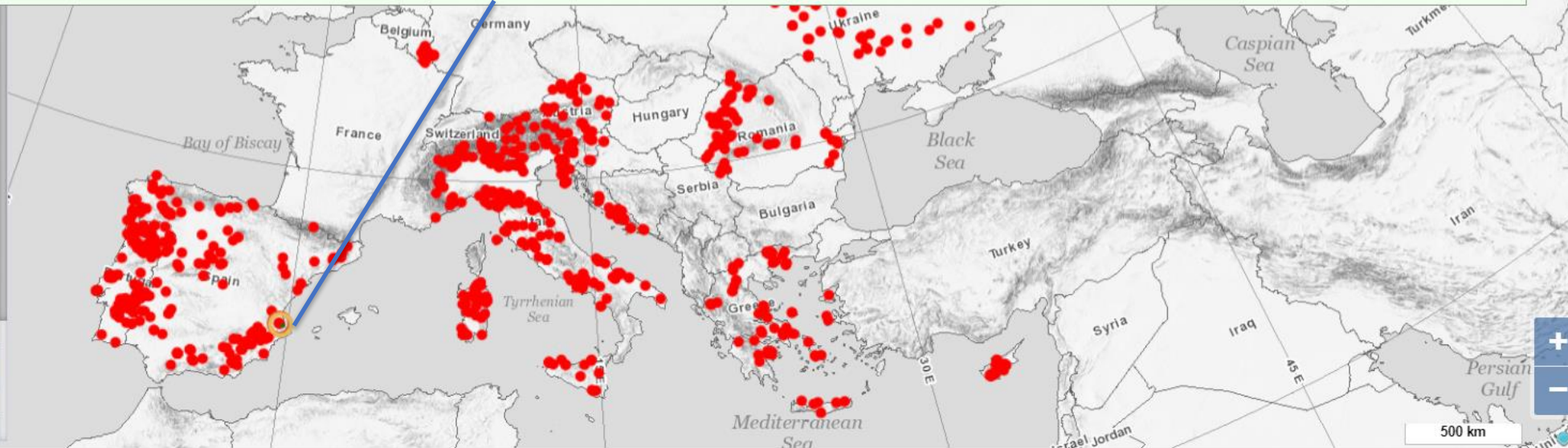
Details

Go to location...

Zoom Area Path N North

ornamental_stones New window

Go to	Fid	Stonename	Altname	Altname2	Commodity	Lithology	Colour	Placename	Municipali	Country	Egdilink	Point X	Point Y	F14	F15
	ES69	Crema Valencia			commercial limestone	biosparite limestone	beige	Barcheta	Barcheta (V)	Spain	Link...	-0.385956	39.028563		
	ES82	Rosa Valencia			commercial limestone	sparitic limestone	pink	Barcheta	Barcheta (V)	Spain	Link...	-0.358615	39.006879		
	ES118	Rosa Buixcarro			commercial marble	biosesparite limestone	pink	Cuatretonda	Cuatretonda (V)	Spain	Link...	-0.358615	39.006879		



POINT(3114724.6376998336 1462771.4645630638)

EPSG:3034 : 3127957, 1456155 EPSG:4326 : -0.2517, 38.9939

« Eurolithos ornamental stone types

EUROLITHOS

European Ornamental Stone Resources

+ Base layers

Layers

Layer search...

Ornamental stone

ornamental_stones

Download dataset

Details

ornamental_stones

Go to

Fid

Stonename

Altname

Altname2

Com

ES69

Crema Valencia

comr

ES82

Rosa Valencia

comr

ES118

Rosa Buixcarro

comr

POINT(3114724.6376998336 1462771.4645630638)

EUROLITHOS

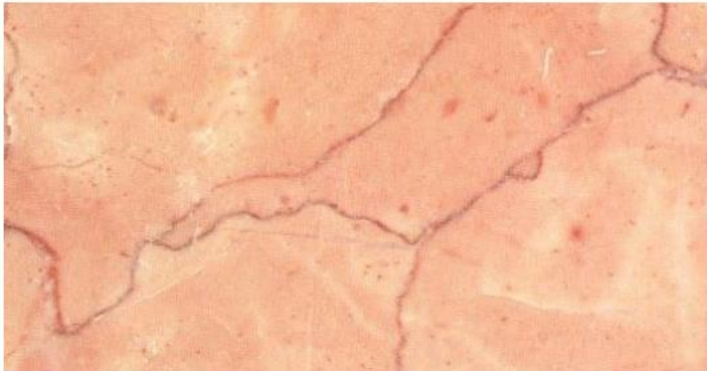
European Ornamental Stone Resources

GeoERA

RAW MATERIALS

Rosa Valencia

Rosa Buixcarró



5 cm

Image source: http://marmolnacional.blogspot.com/

Short description:

Cream- to orange-coloured limestone without any recognisable depositional structure. Frequent orange stylolites characterize this building rock.

Commodity (vocabulary)	Lithology (vocabulary)	Typical colour (code list)	Place of origin			
			Country	County / District / Province	Municipality / Community	Place/town / Village
limestone	biosparite limestone	pink	Spain	Valencia	Barcheta	Barcheta

Country

Egdilink

Point X

Point Y

F14

F15

Link...

-0.385956

39.028563

Link...

-0.358615

39.006879

Link...

-0.358615

39.006879

500 km

POINT(3114724.6376998336 1462771.4645630638)

EPSG:3034 : 3127957, 1456155 EPSG:4326 : -0.2517, 38.9939



innovation programme under grant agreement No 731166

Until now: 1220 Unique stone types, 350 of
them with detailed reports

Will continue after project end



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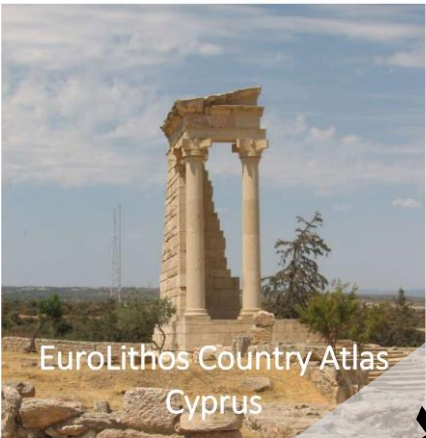


EUROLITHOS European Ornamental Stone Resources



EuroLithosCountry Atlas
Greece

EUROLITHOS European Ornamental Stone Resources



EuroLithos Country Atlas
Cyprus

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EuroLithos Atlas

Ornamental stone resources in Croatia



Ornamental Stone Resources in Croatia as a basic building material in the old architecture of Brač



EUROLITHOS European Ornamental Stone Resources



1 2

EuroLithos Country Atlas
Emilia-Romagna Region, Italy



EUROLITHOS European Ornamental Stone Resources



EuroLithos Country Atlas
Portugal

EUROLITHOS European Ornamental Stone Resources



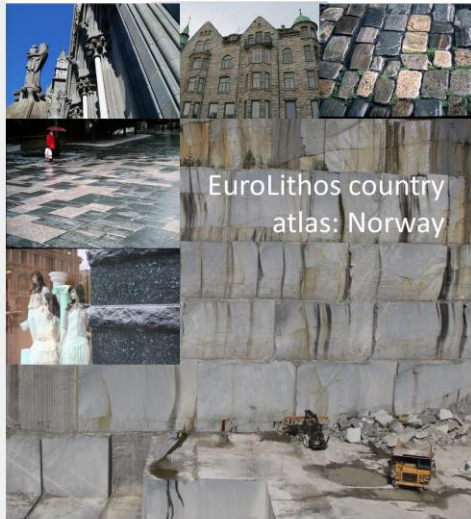
EuroLithos Country Atlas
SLOVENIA

EUROLITHOS European Ornamental Stone Resources



EuroLithos Country Atlas
SLOVENIA

EUROLITHOS European Ornamental Stone Resources




EuroLithos country atlas: Norway

Country Atlases of
Ornamental stone

EUROLITHOS European Ornamental Stone Resources

Eurolithos case study


Heritage assessment of quarry landscapes: Quarries near Pučišća, the island of Brač, Croatia



EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

The Iddefjord granite quarry landscape



EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

Connecting stone in constructions with a digital resource: technical case study



EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

Magura Calanului - Heritage assessment of historical quarry



EUROLITHOS European Ornamental Stone Resources

Eurolithos case study


Sustainable exploitation of ornamental limestones in Maciço Calcário Estremenho, Portugal




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Eurolithos case study

Built heritage of Nicosia, Cyprus: the use of calcarenite as built stone from antiquity to recent times



Thematic focus: Stone and built heritage
Responsible partner: Geological Survey Department
Author: Christodoulos Hadjigeorgiou



EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

The Pučišća Stonemason's Guild




Thematic focus: Stone and intangible heritage
Responsible partner(s): HGJ-CGS
Author(s): Željko Đurić, Anđelina Hranjina


EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

The use of traditional craft in the production of the rock-christ in Central Norway




Thematic focus: Craft
Responsible partner(s): MØRØ, Høylandet
Author(s): Tom Høy, Høylandet
Year: 2021



EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

Best practices of natural stone valorisation for the preservation of stone-built heritage: the case of platy limestone as characteristic element of cultural landscape along the Eastern Adriatic coast



Thematic focuses: Ornamental stone resource value assessment, Stone and built heritage
Responsible partners: Geological Survey of Slovenia (GeoZS), Croatian Geological Survey (HGJ-CGS)
Authors: Matevž Novak (GeoZS), Snježana Miletić (GeoZS)

EUROLITHOS European Ornamental Stone Resources

Eurolithos case study

Ornamental stone production in Vitor Lisboa



Thematic focus: Ornamental stone production
Responsible partner: Vitor Lisboa



EUROLITHOS European Ornamental Stone Resources

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Euroolithos Newsletter No. 5 - Nov 2021

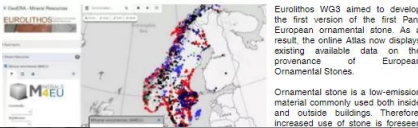
THE LEGACY OF EUROLITHOS

In the past year, Euroolithos partners have worked in close collaboration with the administrators of the GeoEra Information Platform to ensure that vast amounts of information regarding European ornamental stone is open and freely accessible to the public. As a result, Euroolithos has set up the framework for collecting the unique stone resources, already half the European countries have made a significant contribution. Although the project is near its end, partners are committed to adding more information to this platform and encouraging national geological agencies in neighbouring countries to upload information.



Visiting quarry in the Dnieper marble close to Athens, Greece

WORKING TOWARDS A COMPLETE PAN-EUROPEAN ORNAMENTAL STONE ATLAS



Euroolithos WG3 aimed to develop the first version of the first Pan-European ornamental stone. As a result, the online Atlas now displays existing available data on the provenance of European Ornamental Stones.

Ornamental stone is a low-emission material commonly used both inside and outside buildings. Therefore, increased use of stone is foreseen

EUROLITHOS European Ornamental Stone Resources



euroolithos.org

Newsletter No.4 (September 2021)

Contents

Dear partners: What's left to do?

Update of UNFC and for ornamental stones (D6.3)

Topic Working Group 5: Ornamental Stone Heritage

- Heritage assessment of a historical quarry (Magura Calanului, Romania)
- Heritage assessment of quarry landscapes (Pučiška, Brač, Croatia)
- Open data solutions for linking ornamental stone resources with buildings (Norway)
- Traditional crafts in modern stone production (Norway)
- Sustainable exploitation of ornamental limestones in Maciço Calcário Estremenho (Portugal)
- Best practices of natural stone valorisation for the preservation of stone-built heritage: the case of platy limestone as a characteristic element of cultural landscape along the Eastern Adriatic coast

Euroolithos partners: What's left to do?



"Smile, partners!" Tom Heidal and other Euroolithos consortium members met on 20 September to agree upon a time plan to complete the remaining actions before the project ends on 31 October. Some of the most important deliverables left are Euroolithos atlas (map services and country atlases (WPS)), uploading of the directory of ornamental stone resources (WP4), guidelines for assessing heritage values of ornamental stone resources (WPS) and functional harvesting system for national databases to the EGD platform (WP6).

The consortium also discussed the scientific volume to be published in early 2022 in the NOU Bulletin series.

European Ornamental Stone Resources Newsletter No. 4, September 2021

EUROLITHOS European Ornamental Stone Resources



Newsletter No.3: Special Update on Euroolithos Deliverable D.5 "Ornamental Stone Heritage" 12 Case Studies

Overview

This is an update on the progress on Euroolithos Deliverable 5 "Ornamental Stone Heritage." Early this year the Euroolithos partner, the Croatian Geological Survey, shared their case study overview (D5.1) which identified the 12 case studies that will be conducted under four themes: Ornamental stone resource value assessment, stone and built heritage, Stone and intangible heritage; and Sustainability. The task group involves of 8 Euroolithos partners:

- Geological Survey of Norway (NGU)
- Geological Survey of Slovenia (ZAG)
- Italian Institute for Environmental Protection and Research (ISPRA)
- Croatian Geological Survey (CGS)
- Cyprus Geological Survey Department (GSD)
- Geological Survey of Greece (GS)
- Norwegian Mineral Research Institute (NMR)
- Norwegian Geological Survey (LNEG)

The 12 case studies developed project concepts and methodologies that will be used to develop 12 case studies described in this report. Euroolithos WP5 aims to develop a policy that ensures improved of stone-built heritage, better protection for SME's and better protection of stone resources in land-use planning.

- Case studies on Ornamental Stone Heritage
- Heritage assessment of large quarry landscapes (Iddefjord granite quarry, Norway)
- Heritage assessment of historical quarry (Magura Calanului, Romania)
- Heritage assessment of quarry landscapes (Pučiška, Brač, Croatia)
- Open data solutions for linking ornamental stone resources with buildings (Trondheim, Norway)
- The use of calcarenite as built stone from antiquity to recent times (Nicosia, Cyprus)
- Linking natural stone from the island of Brač, with built heritage (Croatia)
- Stone and built heritage: the Carrara Marble (Alpi Apuane District)
- Traditional crafts in modern stone production (Norway)

European Ornamental Stone Resources Newsletter No. 3, March 2020 - Page 1

GeoERA research project on European Ornamental Stone Resources Euroolithos Newsletter No. 2, July 2019

EUROLITHOS European Ornamental Stone Resources



Contents at a glance

- Project Assembly meeting in Trondheim, Norway July 3-4
- It's a time for some case studies!
- The Oppdal schist: Designing the future using traditional knowledge
- Meet our new WP2 Leader
- New website and social media channels
- Are you a super-stakeholder?

Euroolithos project assembly in Trondheim, Norway July 3-4, 2019

Euroolithos project assembly meeting was held in Trondheim, July 3, 2019. Most of the Euroolithos partners were present. The main issues addressed at the meeting were Deliverable 1.1 (Summary of nature and type of available spatial data in each country partner and the framework for the Atlas), final structure of ornamental stone directory (WP4: technical properties) and the start-up of several studies in WP5. On July 4th, the consortium travelled south to the municipality of Oppdal to visit parties that produce schist.



The group before (left) and during fieldtrip - experiencing snow in July. Even from Norwegian standards, this is quite rare!

Euroolithos Newsletter No. 2, July 2019

EUROLITHOS European Ornamental Stone Resources



Newsletter No.1 Contents

- About the Euroolithos project
- Euroolithos Objectives
- About GeoERA
- United to make European geodata accessible
- Euroolithos News and Events
- Euroolithos workshop in Athens, March 20-21, 2019
- Heritage Stone, Salamanca
- EGU 2019, Vienna, 7-12 April
- Natural stone has an outstanding track record
- Call for items for July Euroolithos newsletter

About the Euroolithos project

Euroolithos is a GEOERA research project on European Ornamental Stone Resources. Although ornamental stone is today an important raw material produced all over Europe, its use locally and regionally is decreasing, along with related knowledge, traditions and skills.

Euroolithos was founded upon the premise that increased knowledge of the geological quality and historical use of natural stone in Europe can stimulate more sustainable use of its resource, which will in turn benefit enterprise, promote cultural heritage, and contribute to developing effective land-use practices.

Euroolithos Objectives

The objectives of the Euroolithos are the following: 1) establish a descriptive framework for natural stone resources in Europe, 2) create a directory database for stones and their properties, 3) make a natural stone atlas on a European and country level linked to atlases and directories, 4) identify heritage values and establish guidelines for assessing the heritage value of natural stone, and finally 5) communication and dissemination to relevant stakeholders.

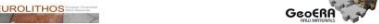
The Euroolithos consortium is composed of 16 partners from 14 countries, collectively forming a strong and innovative research group. In addition, Euroolithos will interact and collaborate with more than 150 different stakeholders that will ensure good integration of the project with relevant associates, authorities and industry partners.

For more information: <http://geoera.eu/projects/euroolithos/>

European Ornamental Stone Resources Newsletter No. 1, May 2019 - Page 1



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EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverable D5.2- D5.4
Guidelines for assessing non-economic values of ornamental stone resources

Authors and affiliation:
Tom Hoidal (NGU),
Željko Dedić (HGI-CGS)



E-mail of lead author:
tom.hoidal@ngu.no
zdedic@hgi-cgs.hr

Version: 25-10-2021

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 731166.

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverables D4.1 – D4.2
Working version of the directory containing information from selected countries and Guideline for using the Directory

Authors and Affiliation:
Konstantinos Laskaridis
H.S.G.M.E.

Tom Hoidal
NGU

E-mail of lead author:
laskaridis@igme.gr

Version: 13/12/2021

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Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverable D3.1
Summary on the nature and type of available spatial data in each country partner and framework for the Atlas.

Authors and affiliation:
Jorge M. F. Carvalho (LNEG)
Tom Hoidal (NGU)

E-mail of lead author:
jorge.carvalho@ineg.pt

Version: 28-07-2019

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 731166.

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverable D5.1
Eurolithos case study collection

Authors and affiliation:
Željko Dedić (HGI-CGS), Tom Hoidal (NGU), Jorge Carvalho (LNEG), Valentina Cetean (IGR), Christodoulos Hadjigeorgiou (GSD), Javier Martinez Martinez (IGME), Mauro Lucarini (ISPRA), Mirka Trajanova (GeoZS)

[Affiliation: PP acronym]

E-mail of lead author:
zdedic@hgi-cgs.hr

Version: 30-01-2020

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 731166.

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverable D3.3
Country-level atlases and a European Atlas of Ornamental Stones. Printed and digital versions

Authors and affiliation:
Jorge M. F. Carvalho
LNEG

Tom Hoidal
NGU

G. Hadjigeorgiou, C. Hadjigeorgiou
GSD

Maria Teresa de Nardo
SGSS

K. Laskaridis, A. Arapakou
HSGME

M. Lucarini, F. Fumanti
ISPRA

S. Miletic, M. Novak
GeoZS

E-mail of lead author:
jorge.carvalho@ineg.pt

Version: 29-10-2021

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 731166.

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverable D3.2
Country-level and European-level Atlas templates for input of harmonized data

Authors and affiliation:
Jorge M. F. Carvalho
LNEG

Tom Hoidal
NGU

E-mail of lead author:
jorge.carvalho@ineg.pt

Version: 14-10-2020

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under grant agreement number 731166.

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.171.017

Deliverable D6.1
Evaluation of IP prototypes

Authors and affiliation:
Tom Hoidal (NGU),
Kostas Laskaridis (IGME-Gr)

[Affiliation: PP acronym]

E-mail of lead author:
tom.hoidal@ngu.no

Version: 14-01-2019

EUROLITHOS European Ornamental Stone Resources
Project number GeoE.xxxx

Deliverable D6.1
Data and information structure for the knowledge platform on European ornamental stone resources

Authors and affiliation:
Tom Hoidal (NGU)
Jorge M. F. Carvalho (LNEG)
Kostas Laskaridis (IGME-Gr)

[Affiliation: PP acronym]

E-mail of lead author:
tom.hoidal@ngu.no

Version: 14-01-2019

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EUROLITHOS European Ornamental Stone Resources
Project number GeoE.xxxx

UNFC and ornamental stone resources – Larvikite case study

Tom Hoidal, Geological Survey of Norway
Helene Fromreide Nesheim, LUNDHS

Case study MinterHEU
Deliverable 6.3. Eurolithos
January 14, 2021

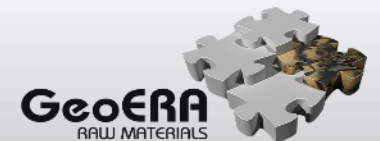
Deliverable Data			
Deliverable number	D6.2		
Dissemination level	Open		
Deliverable name	Evaluation of IP prototypes		
Work package	WPS ORNAMENTAL STONE HERITAGE		
Lead WP/Deliverable beneficiary	NGU		
Deliverable status			
Submitted (Author(s))	15-12-2021	x	
Verified (WP leader)	15-12-2021	x	
Approved (Coordinator)	15-12-2021	x	

Plus....

- Scientific publications - NGU Bulletin (Special Publication) – manuscript deadline January 14



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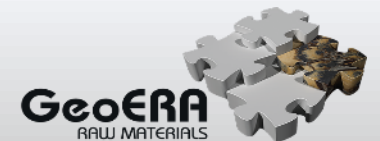




Where are we?



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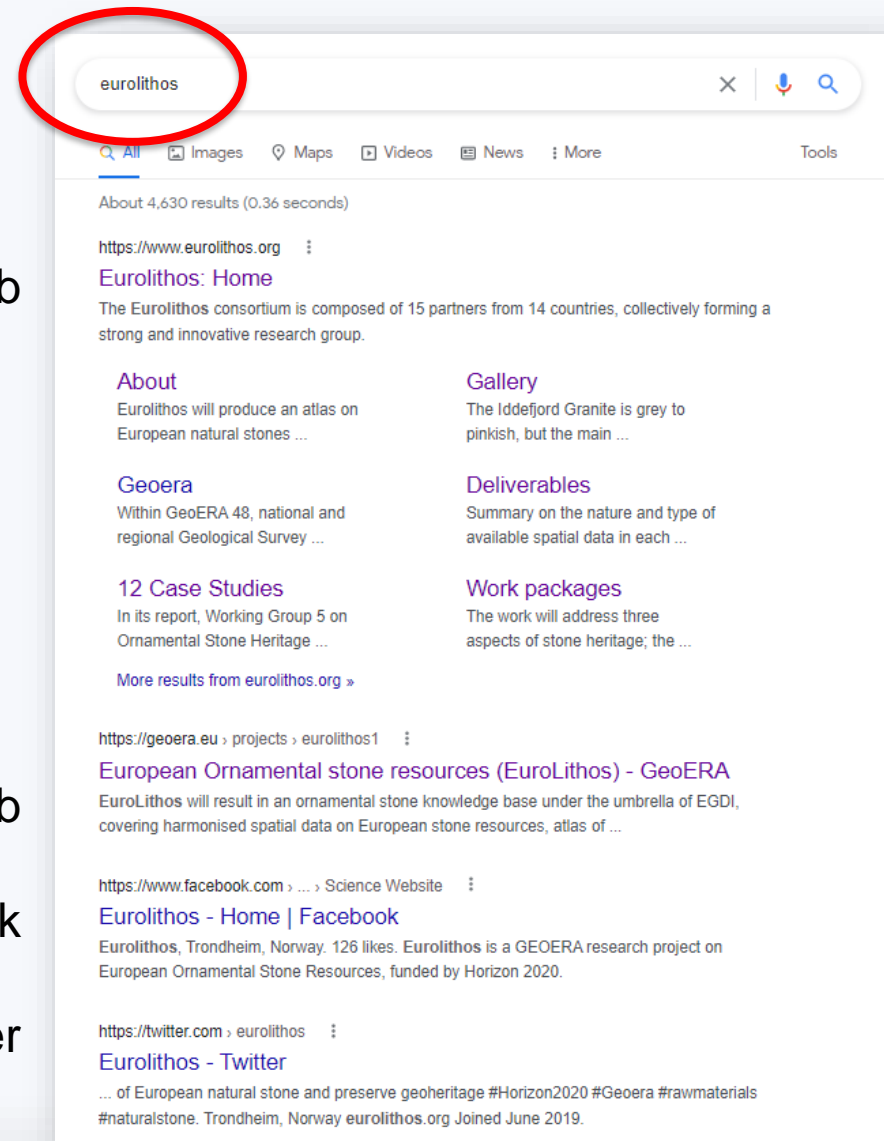
Google Eurolithos

Project web

GeoEra web

Facebook

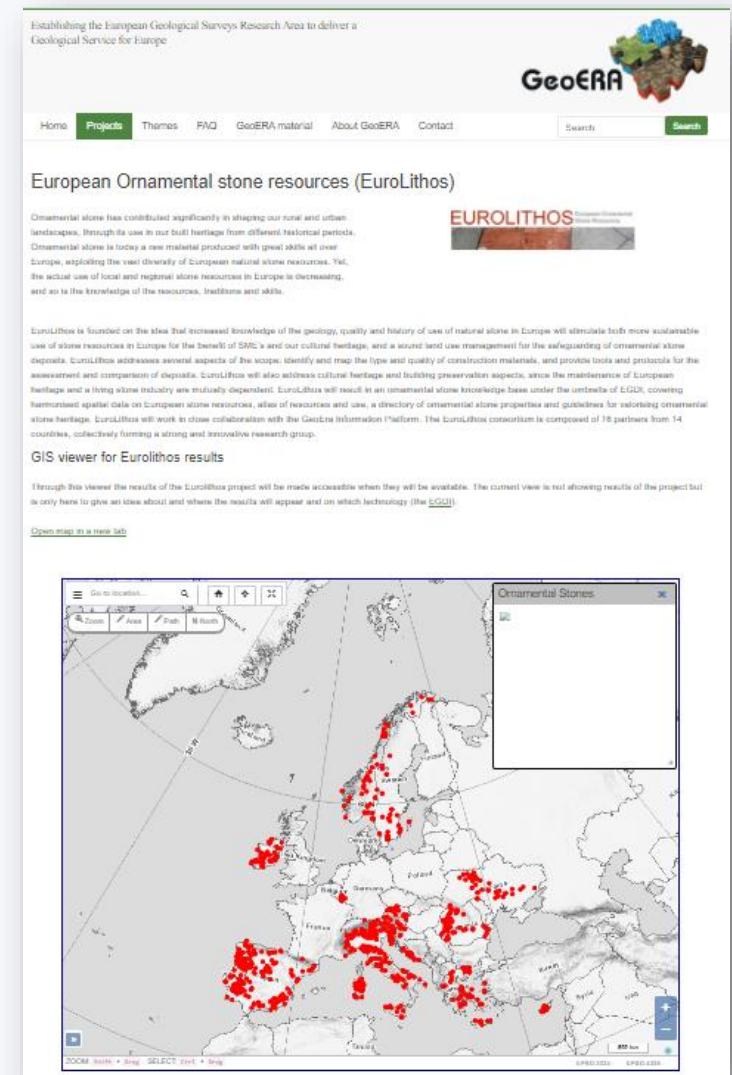
Twitter



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<https://www.eurolithos.org/>



<https://geoera.eu/projects/eurolithos1/>



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Eurolithos
Published by Anne Llinamaa · 21 October ·

In this Eurolithos case study, our partner the Geological Survey Department (GSD) Cyrus, has taken a closer look at the stone heritage of Nicosia and the calcarenite quarries that provide the building stone.

Calcarenite has been used as a building material since antiquity and authors suggest that organized quarrying in the surrounding area must have existed at least since medieval times. Based on surveys carried out by the GSD underground quarries are located in the areas of the city of Nicosia and especially in Aglantzia, Agia Paraskevi, Dasoupoli, Acropolis and west of Nicosia in Mammari and Gerolakkos villages.

Download Case Study:
<https://tinyurl.com/jztnntny>
The built heritage of Nicosia, Cyprus
Thematic focus: Stone and built heritage
Responsible partner: Geological Survey Department
Author: Christodoulos Hadjigeorgiou



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Eurolithos
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Eurolithos
@eurolithos

Aiming to increase the responsible use of European natural stone and preserve geoheritage [#Horizon2020](#) [#Geoera](#) [#rawmaterials](#) [#naturalstone](#)

Trondheim, Norway eurolithos.org Joined June 2019

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Eurolithos afterlife and continuation

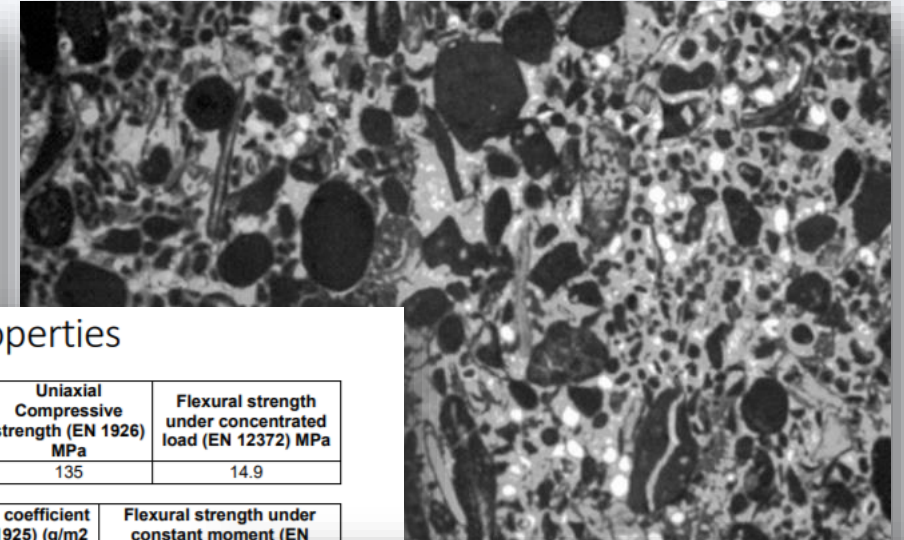
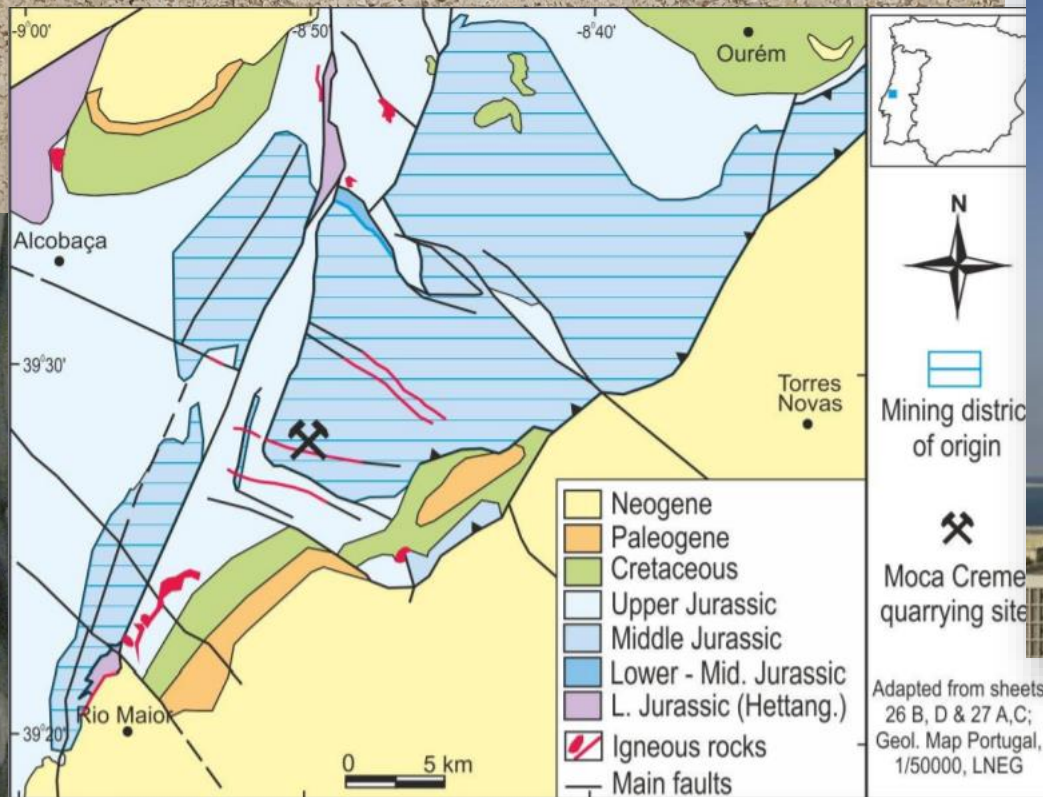
- Geological Survey of Norway (NGU) will provide **regular update services for map and directory** for 5 years
- NGU will **maintain website** and make project to «Eurolithos Community»
- Contribution of **new data and new countries** are all **welcome**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166



Moca Creme limestone, Portugal



Physical properties

Apparent density (EN 1936) kg/m3	Open porosity (EN 1936) % vol	Water absorption at atmospheric pressure (EN 13755) % wt	Uniaxial Compressive strength (EN 1926) MPa	Flexural strength under concentrated load (EN 12372) MPa
2480	6.9	3.1	135	14.9

Real density (EN 1936) kg/m3	Total porosity (EN 1936) % vol	Water absorption coefficient by capillary (EN 1925) (g/m2 x s0,5)	Flexural strength under constant moment (EN 12372) MPa
		17.4 (C2)	

Frost resistance (EN 12371) Technological Test (Test A)			
Flexural strength (EN 12372) after freeze-thaw cycling, MPa	Number of cycles	Uniaxial compressive strength (EN 1926) after freeze-thaw cycling, MPa	Number of cycles
12.4	48		


Resistance to ageing by thermal shock (EN 14066)			
Change in dynamic modulus of elasticity (increase: +; decrease: -) %	Change in open porosity (increase: +; decrease: -) %	Change in ultrasound pulse velocity (increase: +; decrease: -) %	Change in compressive strength (increase: +; decrease: -) %

Abrasion resistance (EN 14157)			Resistance to salt crystallisation (EN 12370)	Breaking load, N
Method A - Wide Wheel Abrasion Test, mm	Method B - Böhme Abrasion Test, mm³	Method C - Amsler Abrasion Test, mm	Change in mass (increase: +; decrease: -), %	Breaking load, N
20.5				2900

Slip resistance by means of the pendulum tester (EN 14231 / CEN/TS 16165)			Rupture energy (EN 14158), Joule	Thermal Conductivity (EN 1745), W/m-K
Tested surface finish	Slip Resistance Value — SRV			
	Dry test condition	Wet test condition		
matt polished	71	64	3	

Sources of more information

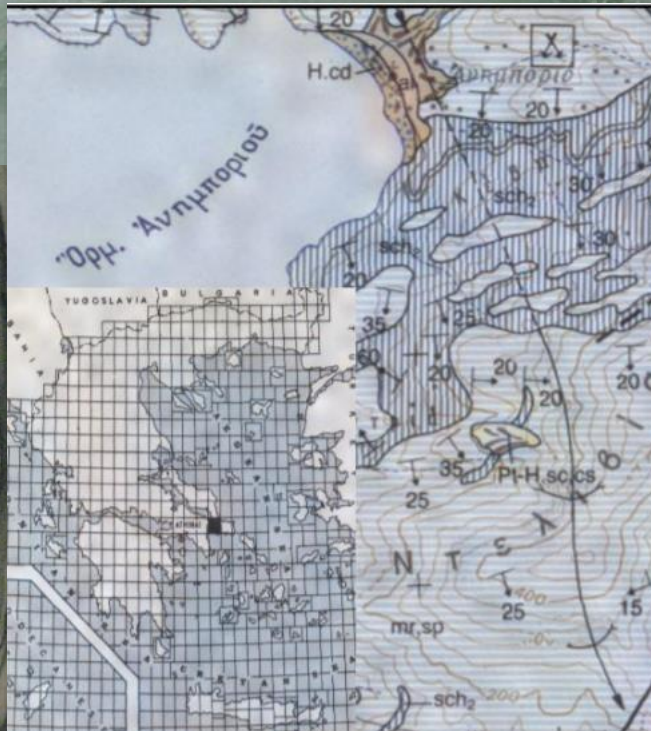
Type of information	Name of provider	URL
This data sheet:	Geological survey of Portugal (Laboratório Nacional de Energia e Geologia, IP)	www.lneg.pt https://rop.lneg.pt/rop/index_en.php
Non-commercial directory:	Primeira Pedra	http://www.primeirapedra.com/en/stones/moca-creme/
Commercial directory:		
Scientific publication:	Environmental Earth Sciences Environmental Earth Sciences Geol. Soc. London Spec. Publ.	https://doi.org/10.1007/s12665-018-7382-x https://doi.org/10.1007/s12665-018-7670-5 https://doi.org/10.1144/SP333.15
Other publication:		

Compiled by:	Geological survey of Portugal (Laboratório Nacional de Energia e Geologia, IP) www.lneg.pt	
Version / date:	V1 / 14/09/2021	



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Chemical properties

Main elements

SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	TiO ₂ (%)	MgO (%)	CaO (%)	Na ₂ O (%)	K ₂ O (%)	MnO (%)	P ₂ O ₅ (%)	SO ₃ (%)	LOI (%)
3,00	0,73	0,45	-	0,80	52,20	1,50	0,40	0,15	-	-	41,65

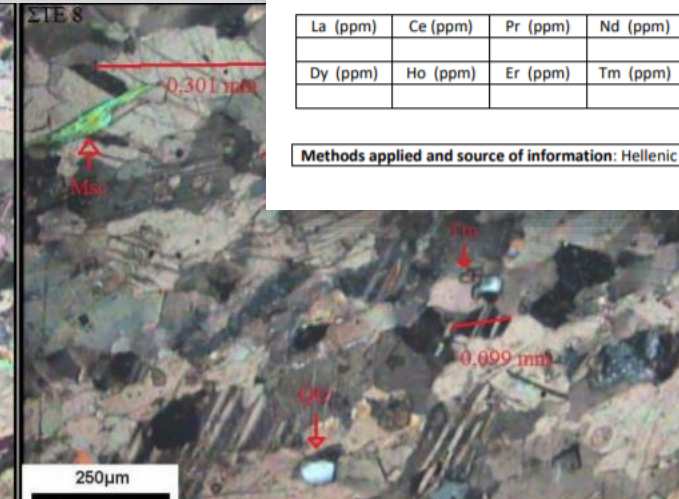
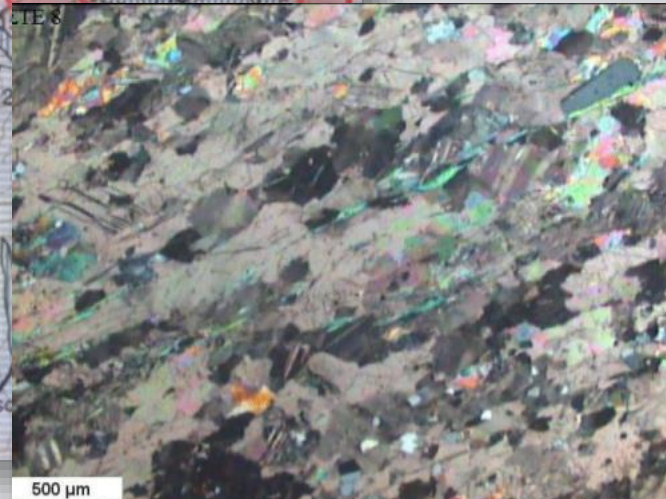
Trace elements

V (ppm)	Cr (ppm)	Mn (ppm)	Co (ppm)	Ni (ppm)	Cu (ppm)	Zn (ppm)	As (ppm)
10	26	950	4,0	25	104	22	2,0
Sr (ppm)	Cd (ppm)	Ba (ppm)	Pb (ppm)	Be (ppm)	Rb (ppm)	Bi (ppm)	U (ppm)
570	0,6	56	12,5	0,3	5,5	<0,1	1,4
Sc (ppm)	Y (ppm)	Th (ppm)	Sb (ppm)	Ta (ppm)	Nb (ppm)	Zr (ppm)	Sn (ppm)
31	3,3	1,4	1,7	0,4	0,6		
Ag (ppm)	B (ppm)	Mo (ppm)	W (ppm)	Ga (ppm)	Ge (ppm)	Se (ppm)	Cs (ppm)
Tl (ppm)							

REE

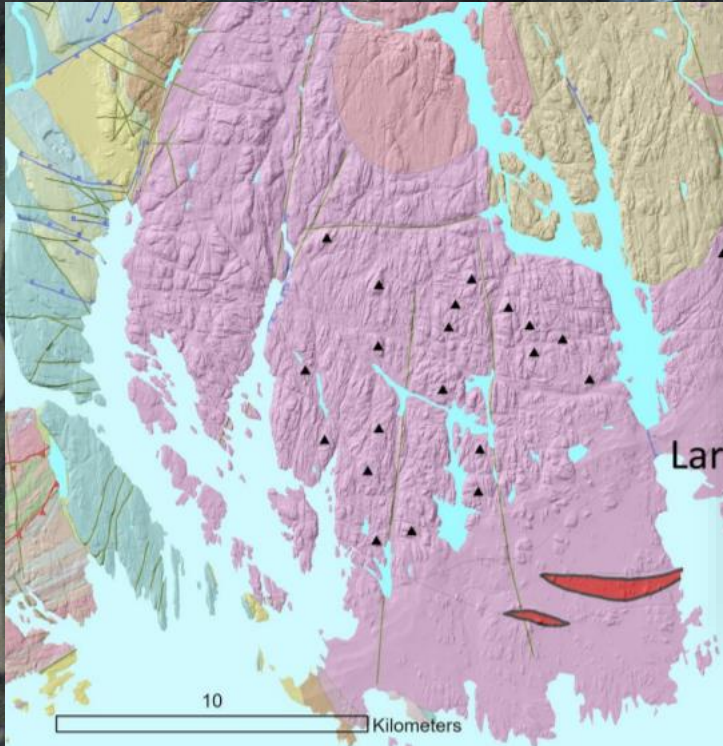
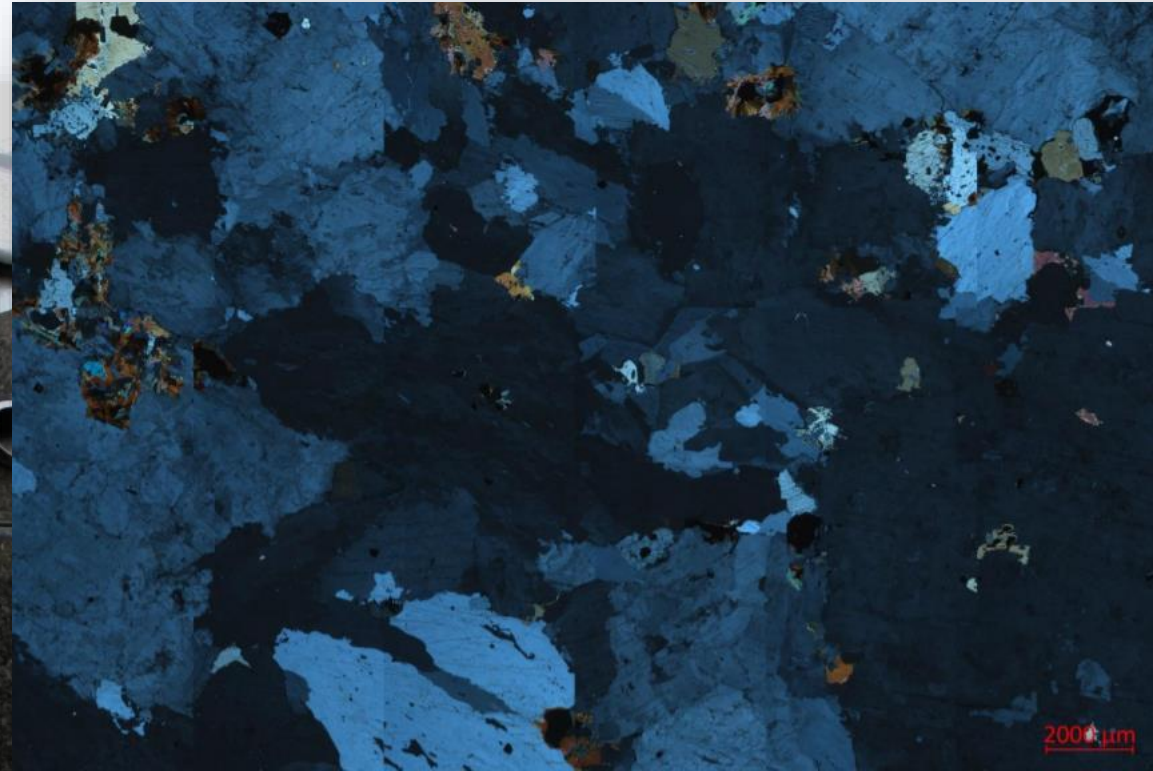
La (ppm)	Ce (ppm)	Pr (ppm)	Nd (ppm)	Sm (ppm)	Eu (ppm)	Gd (ppm)	Tb (ppm)
Dy (ppm)	Ho (ppm)	Er (ppm)	Tm (ppm)	Yb (ppm)	Lu (ppm)		

Methods applied and source of information: Hellenic Survey of Geology and Mineral Exploration



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731166

Dark larvikite, Norway



Mineral composition

If no accurate number, use MM=main minerals, SM = Subordinate minerals, AM=accessory minerals

Feldspars (%)	Pyroxene (%)	Amphiboles (%)	Olivine (%)	Biotite (%)	Apatite (%)	Opaques (%)
83,5	3,5	4,5	2,5	1,5	1	3

Source of information: [Lundhs](#)



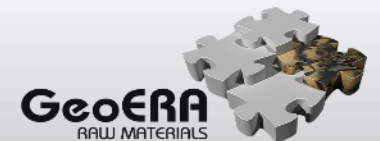
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Want to take part?

- Please contact: tom.heldal@ngu.no



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Spring meeting Greece



Thank you for
listening

Summer meeting Norway



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