



The International Quaternary Map of Europe and Adjacent Areas (IQUAME 2500): an European project with numerous facets



under construction

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IQUAME: new edition of the International Quaternary Map of Europe - Overview



- Umbrella** International Union of Quaternary Research (INQUA)
Commission of the Geological Map of the World (CGMW)
- 2011** Start at INQUA congress, Bern
- Coordination** Federal Institute for Geosciences and Natural Resources (BGR) Germany
- Cooperation** with international experts and advisory board
- Continuation** of the first edition on paper (14 sheets, BGR & UNESCO, 1967- 1995)
- Based** on the work of hundreds of mapping geologists in the last centuries
- Built digitally** as GIS to be available as web mapping application with selectable attributes



Aims:

- Compile and summarize the actual status quo of Quaternary mapping and linked research in Europe
- to renew the first edition on paper
- to work together in international cooperation across political borders
- to make these data usable and available for the Quaternary community, research, universities, planning authorities, exploration, the general public



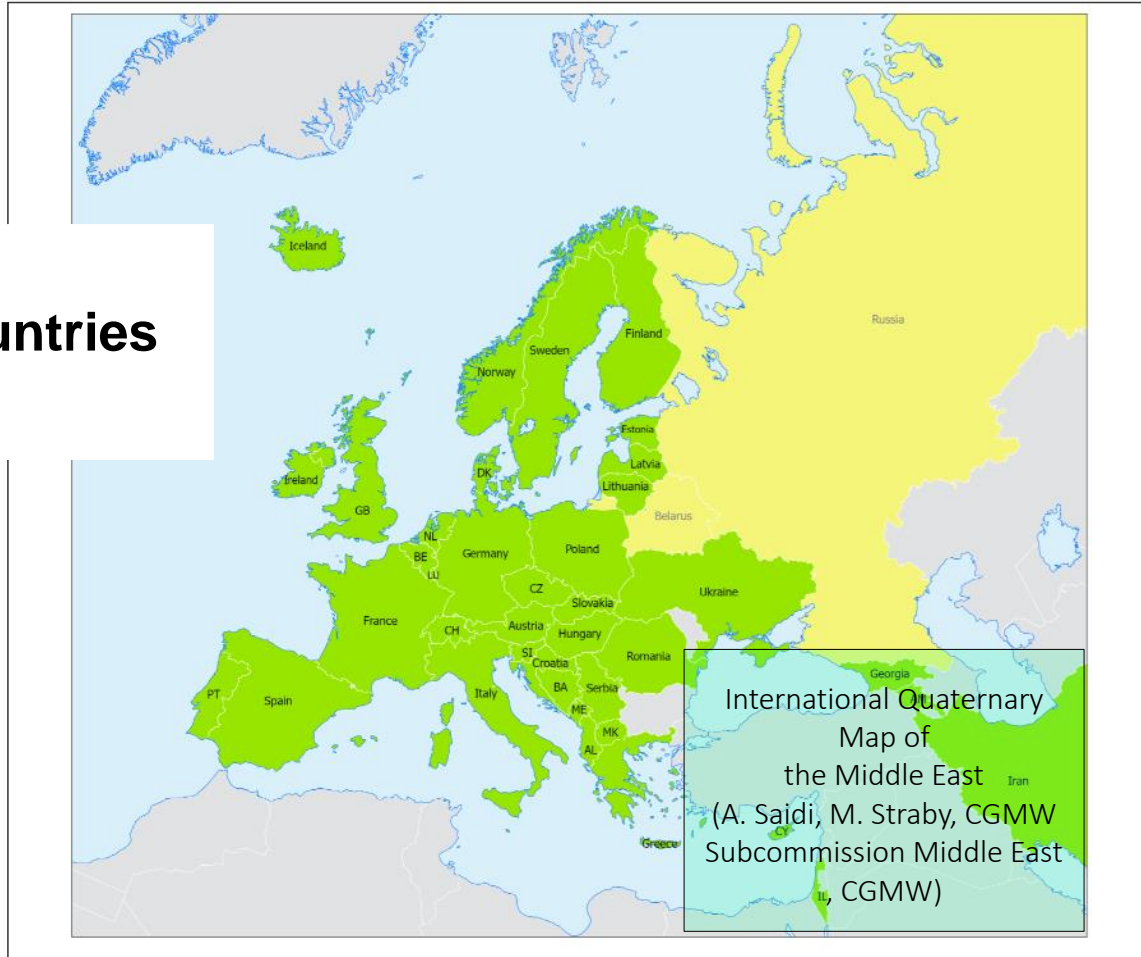


IQUAME cooperation and participation

Recently joined to the community: Czech Republic, Slovak Republic, Luxembourg, Hungary and Romania



Scientists from 36 countries involved



IQUAME 2500

participating countries

- participating countries
- part

National Geological Survey Organizations (contact points and contributing scientists)

- | | |
|---|---|
| <p>Albania: Albanian Geological Survey (gsa), Marku, S.
Austria: Geological Survey of Austria (GSA), Retner, J.
Belarus: The National Academy of Sciences of Belarus (NASB), Karabanov, A.
Belgium: Royal Belgian Institute of Natural Sciences (RBINS), Bogemans, F., Heyvaert, V.
Bosnia and Herzegovina: Federal Geological Survey of Bosnia and Herzegovina, Hrvatinović, H.
Croatia: Croatian Geological Survey (HG), Galović, L.
Cyprus: Cyprus Geological Survey (GSD), Zomeni, Z.
Czech Republic: Czech Geological Survey (CGS), Nyvit, D.
Denmark: Geological Survey of Denmark and Greenland (GEUS), Houmark-Nielsen, M.
Denmark: Geological Survey of Denmark and Greenland (GEUS), Jakobsen, P., Leif, J.
Estonia: Geological Survey of Estonia (EGK), Kalm, V., Ploom, K.
Faroe Islands: The Faroe Earth and Energy Directorate (FEED), Mortensen, L.
Finland: Geological Survey of Finland (GTK), Kotilainen, A., Palttu, J.
France: Bureau de Recherches Géologiques et Minières (BRGM), Pegnon, C., Tissot, H.
France: Commission for the geological Map of the World - Commission de la Carte Géologique du Monde (CGMW - CCGM), Cahet, J., Rossi, P.
France: School and Observatory of Earth Science (EOST), Meghraoui, M.
Georgia: Tbilisi State University (TSU), Gobejshvili, R., Sadradze, N.
Germany: Behörde für Stadtentwicklung und Umwelt (BSU), Ehlers, J.
Germany: Federal Institute for Geosciences and Natural Resources (BGR), Asch, K., Müller, A.
Germany: Free University of Berlin (FU), Böse, M.</p> | <p>Germany: Geo Dienst, Landesamt für Umwelt (LU), Wroner, E.
Germany: Lower Saxony Institute for Historical Coastal Research (NHK), Gagschneider, M.
Greece: Hellenic Centre for Marine Research (HCMR), Sakellariou, D.
Greece: Institute of Geology & Mineral Exploration (IGME), Fotiadis, A., Tsagkas, D., Zaganini, I.
Iceland: Iceland GeoSurvey (ISOR), Hjartson, A.
Iran: Geological Survey of Iran (GSI), Marzieh, E.
Iran: National Geosciences Database of Iran (NGDIR), Saidi, A.
Ireland: Geological Survey of Ireland (gsi), Pollock, K., Sheehy, M.
Italy: Institute for Environmental Protection and Research (ISPRA), Pantalon, M.
Italy: University of Ferrara (Unife), Ghezzi, E.
Lithuania: Lithuanian Geological Survey (LGT), Gyobyte, R., Satkunas, J.
Macedonia: Geological Survey of the Republic of Macedonia (gsm), Andov, I., Petrushev, D.
Malta: Ministry for Transport and Infrastructure (MTI), Caruana, A.
Montenegro: Geological Survey of Montenegro (GSM), Radisimovic, S.
Netherlands: TNO Geological Survey of the Netherlands (TNO), Schokker, J.
Netherlands: Utrecht University (UU), Cohen, K.
Norway: Geological Survey of Norway (NGU), Gislefoss, L., Lapinska-Viola, R., Lyså, A.
Poland: Polish Geological Institute (PGI), Marks, L., Pyschel, J., Józwiak, K.
Portugal: National Laboratory of Energy and Geology (LNEG), Ressurreição, R., Terreira, P.
Portugal: Portuguese Sea and Atmosphere Institute (ipma), Borralho, M., Pereira, A.
Romania: Geological Institute of Romania (IGR), Munteanu, M.</p> |
|---|---|

Cooperation:

CGMW Subcommission Middle East
(A. Saidi, M. Straby)

EMODnet Geology (H. Vallius et al.)

Scientific advisors and exoerts:

Dave Barell, Margot Böse, Kim Cohen, Jürgen Ehlers, Phil Gibbard, Marco Giardino Thijs van Kolfsochten, M. Meghraoui, Giovanni Monegato, Pierluigi Pieruccini, Christian Schlüchter, Bettina Schulz-Paulsson, Brigitte Urban, Stefan Wansa et al.

Coordinator and editor-in-chief

Kristine Asch (BGR)

GIS cartography:

Alexander Müller (BGR)

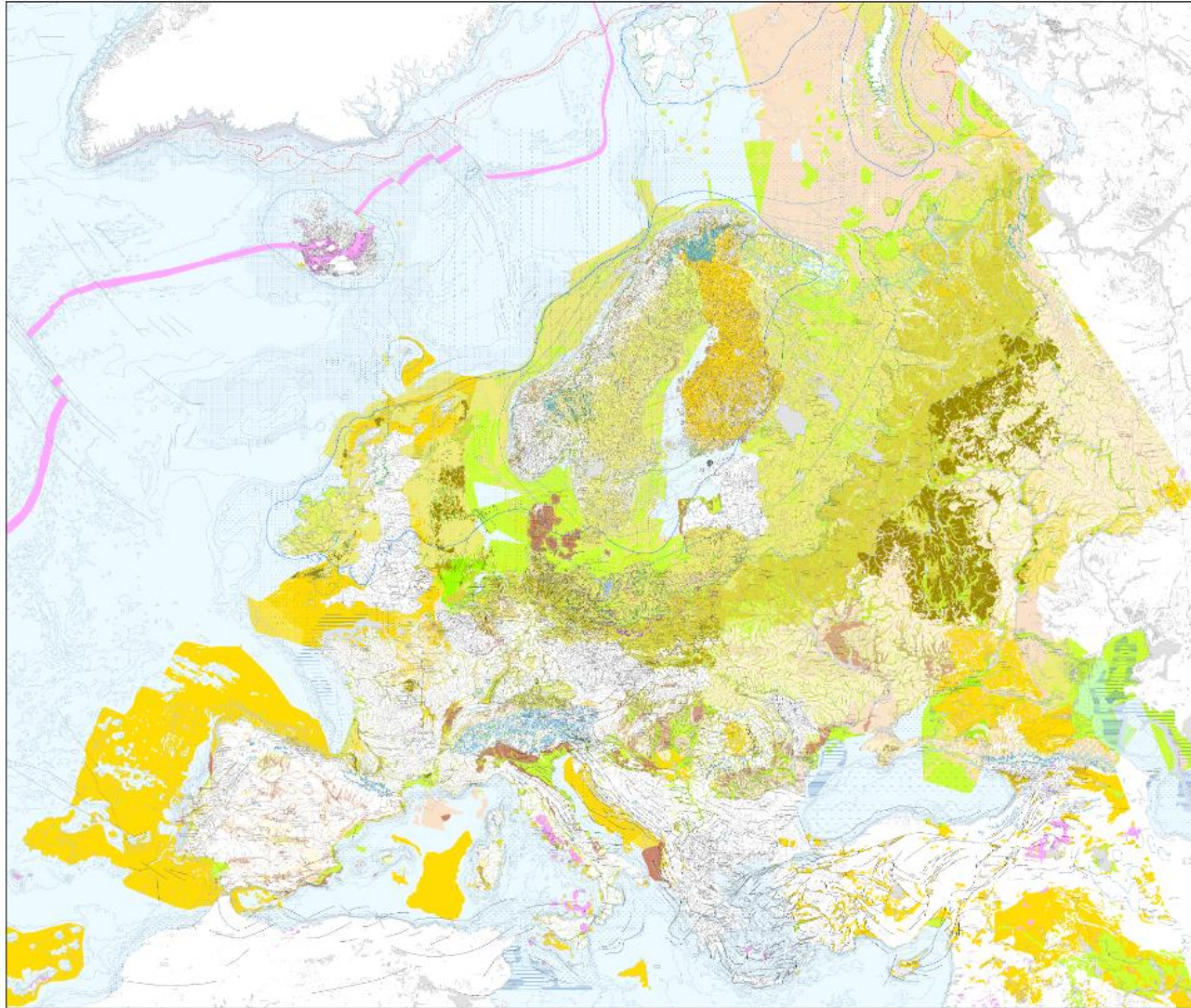




The International Quaternary Map of Europe and Adjacent Areas, scale 1:2,500,000 (IQUAME 2500) (reduced to the scale 1: 4 750 000)



DRAFT July 2023



Legend and metadata table with multiple columns detailing symbols, colors, and text for the map's features.

Actual Status of the IQUAME –



On- and offshore Quaternary geology

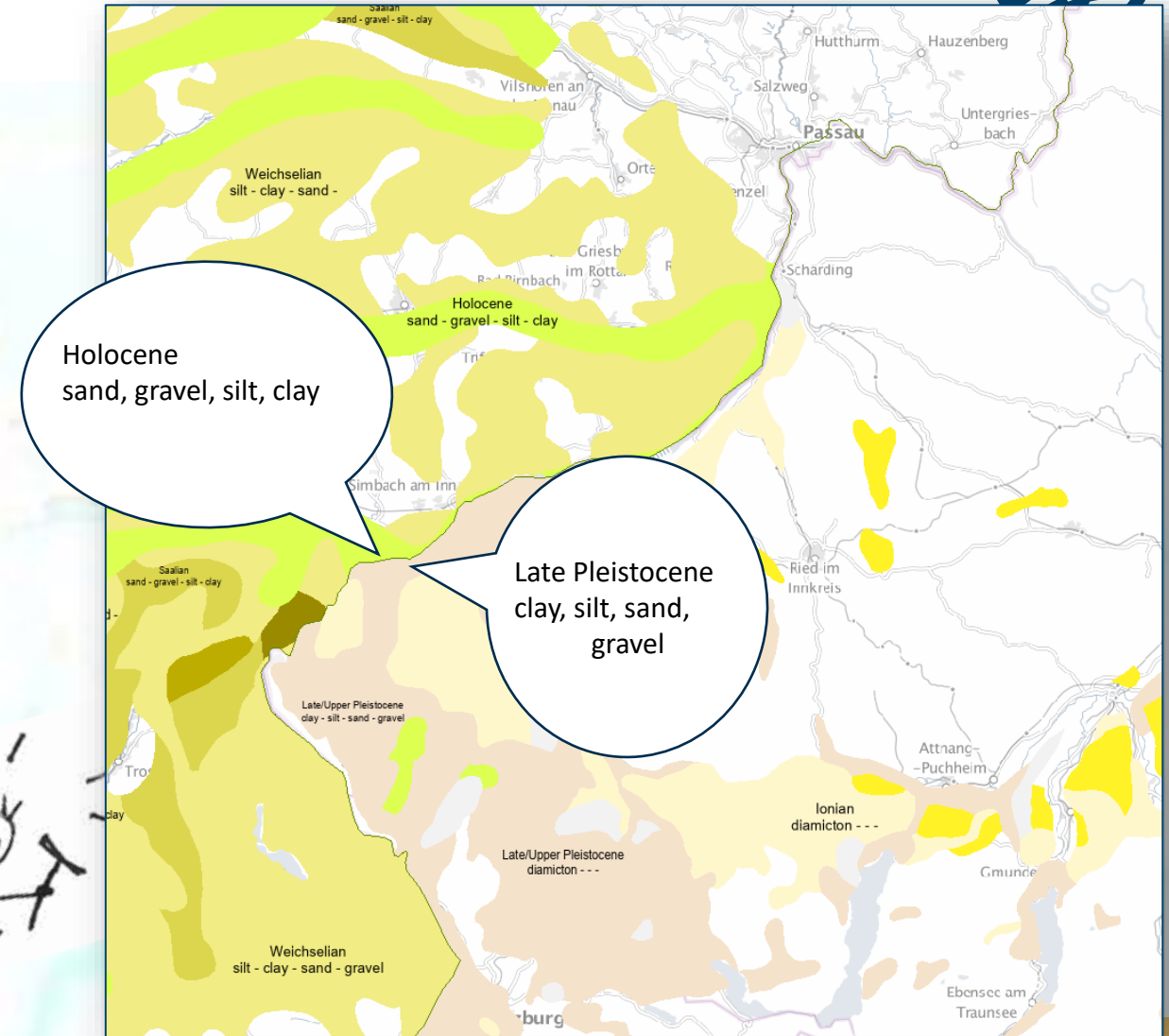
- lithology
- age
- genesis (environment, process)
- glaciogenic features
- active faults
- key locations incl. palaeolithic sites
- postglacial rebound
- last extent of glaciations
- direction of ice movement
- last maximum of permafrost
- Last extent of sea ice



differing:

- mapping scales
- age of mapping campaign
- mapping methods
- legends and classification systems*
- colours/symbols/portrayal rules

... and the typical geologist's individual fondness for a specific geological feature.

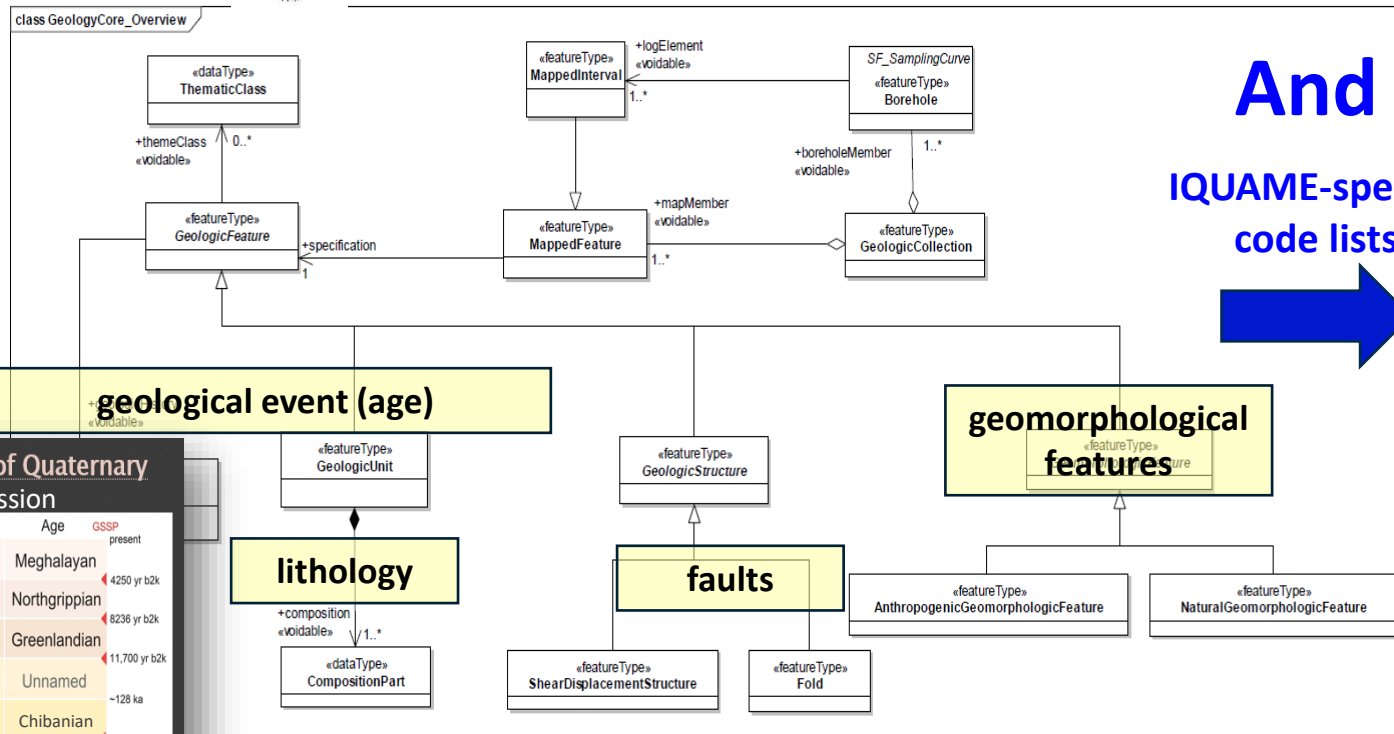


* EC Directive INSPIRE changed some of that.

Need for a common denominator: Project standards

adaptation of European EC INSPIRE Directive Implementation Rules:
data model and vocabularies

INSPIRE



And

IQAME-specific
code lists



Active faults

Glaciogenic features

Maximum extent of
glaciation

Direction of ice
movement

Maximum limit of
permafrost

Post glacial rebound

Key locations,
palaeolithic sites

Present formal subdivision of Quaternary IUGS Stratigraphic Commission

Eon	Era	Period	Epoch	Subepoch	Age	GSSP		
Phanerozoic (pars)	Cenozoic (pars)	Quaternary	Holocene	Late	Meghalayan	present		
				Middle	Northgrippian	4250 yr b2k		
				Early	Greenlandian	8236 yr b2k		
			Pleistocene	Late	Unnamed	11,700 yr b2k		
				Middle	Chibanian	~128 ka		
				Early	Calabrian	774 ka		
					Gelasian	1.80 Ma		
								2.58 Ma



IQUAME 2500: age description of the units: Stratigraphic correlation table



Agreed correlation table for the IQUAME age classification

Cohen, K.M. & Gibbard, P. (2011)	ISC age (IUGS; 2019)	INSPIRE value	Regional Stages (as defined during the Vienna (2012) IQUAME meeting)					Age	
			Northern Europe	Alps	East Europe 1	East Europe 2	British Stages	Older Boundary	Younger Boundary
Quaternary	Quaternary	Quaternary						2.588 Ma	0.0 Ma
Holocene	Holocene	Holocene						0.0117 Ma	0.0 Ma
	Meghalayan (2018)							0.0042 Ma	0.0 Ma
	Northgrippian (2018)							0.0082 Ma	0.0042 Ma
	Greenlandian (2018)							0.0117 Ma	0.0082 Ma
Pleistocene	Pleistocene	Pleistocene						2.588 Ma	0.0117 Ma
Late Pleistocene	Upper Pleistocene	Upper Pleistocene						0.126 Ma	0.0117 Ma
		Weichselian	Weichselian	Würm	Valdaian		Devensian		
		Eemian	Eemian		Mikulianian		Ipswichian		
Middle Pleistocene	Middle Pleistocene	Middle Pleistocene						0.781 Ma	0.126 Ma
		Ionian							
		Saalian	Saalian	Riss	Moscovian	Dnieper	Wolstonian		
		Holsteinian	Holsteinian		Likhvinian		Hoxnian		
		Elsterian	Elsterian	Mindel	Okian	Berezina	Anglian		
		"Cromerian complex"	Cromer C		Muchkapien				
			Cromer B	Günz	Donian				
Cromer A									
Early Pleistocene	Calabrian	Lower Pleistocene						1.806 Ma	0.781 Ma
		Calabrian							
		"Cromerian complex"	Cromer A						
		Bavelian	Bavelian						
		Gelasian	Gelasian						





IQUAME thematic layer under construction: glaciogenic features



- glacial features

incl. drumlins, eskers, nunatak fields,
tunnel valleys, moraine features

- periglacial features

incl. pingos, cover sands

- glacio-marine features

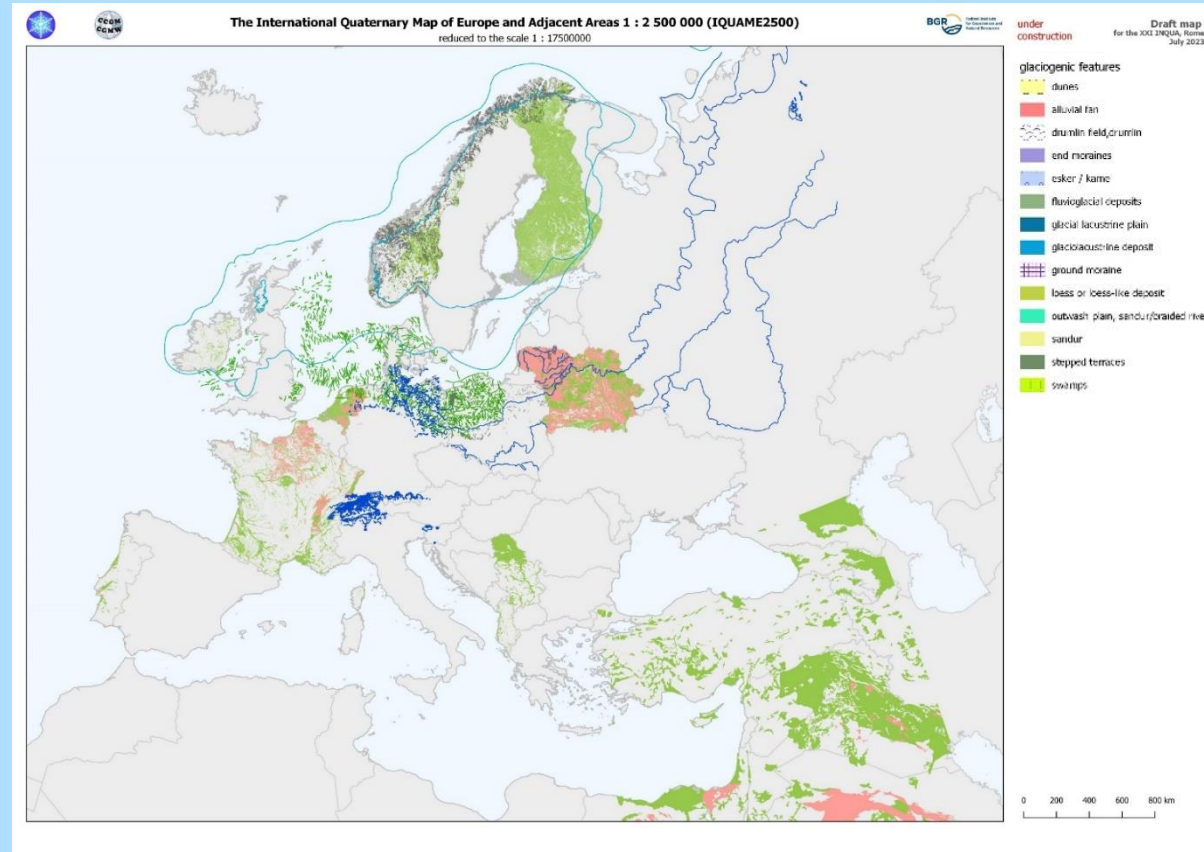
(partly from EMODnet project)



incl. tunnel valleys, glacial scouring marks,
ice-rafted debris fields

and

incl. e.g. loess/loess-like deposits,
alluvial fans, dunes/dunefields, etc.



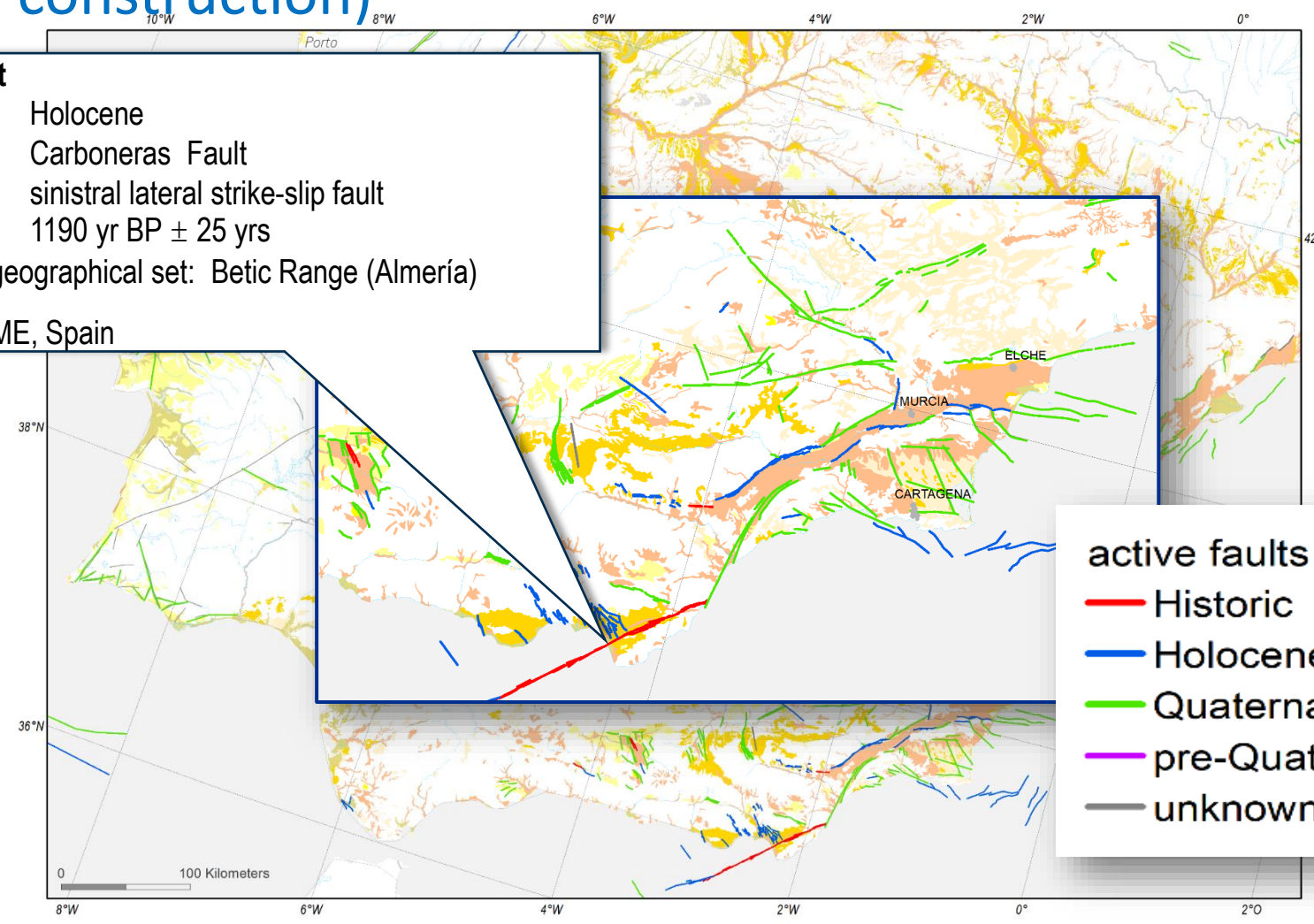


IQUAME thematic layer: active faults (under construction)



Active fault
 strat. age: Holocene
 fault name: Carboneras Fault
 fault type: sinistral lateral strike-slip fault
 age: 1190 yr BP ± 25 yrs
 geological/geographical set: Betic Range (Almería)
 Source: IGME, Spain

- Stratigraphical age**
- Weichselian
 - Upper Pleistocene
 - Saalian
 - Elsterian
 - Middle Pleistocene
 - Lower Pleistocene
 - Ionian
 - Gelasian
 - Pleistocene
 - Quaternary
 - Pliocene
 - pre-Quaternary

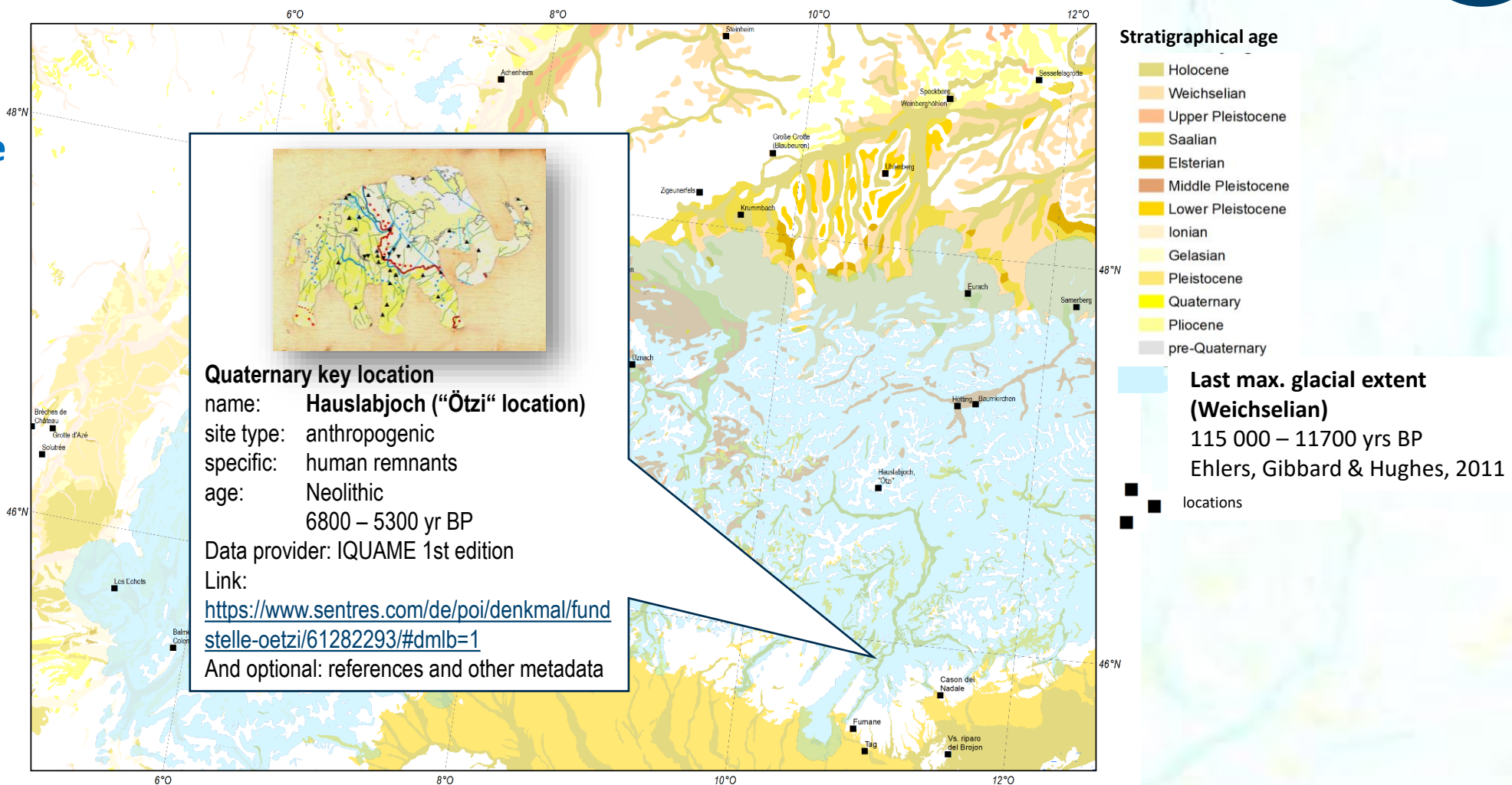


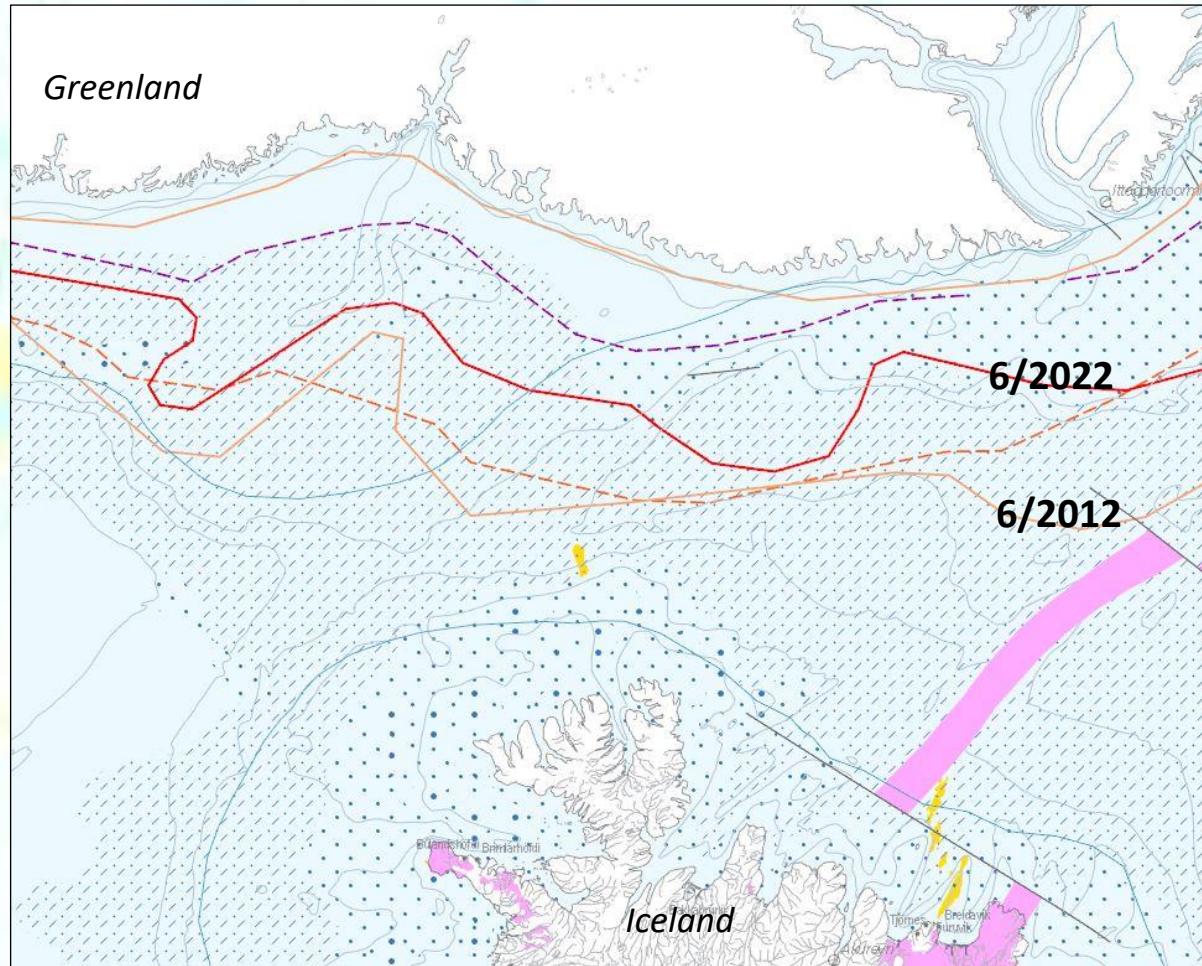
- active faults**
- Historic (2000 yrs bp – present)
 - Holocene
 - Quaternary
 - pre-Quaternary
 - unknown

Example from the Iberian Peninsula



Example from the Western and Central Alps





recent sea ice extent, June

— 2012

— 2022

mean sea ice extent 1980 -2010

- - - June

- - - July

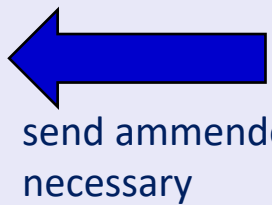
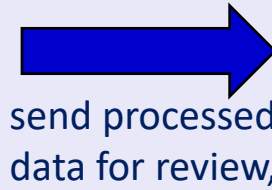
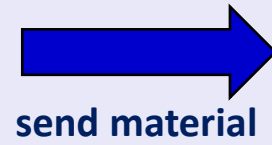
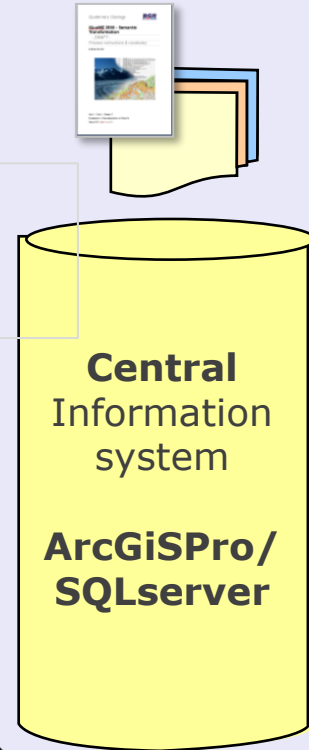
Source Meereisportal, AWI, Bremerhaven, Germany



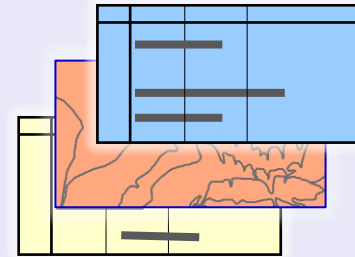
preparation
standard vocabulary,
guidelines, topo-
graphic base

processing
compile, generalise
Harmonize, edit
and portray

**consultation
& harmonisation**

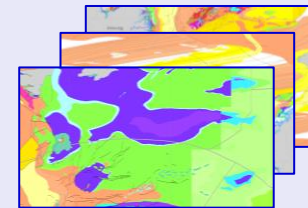


IQUAME participants

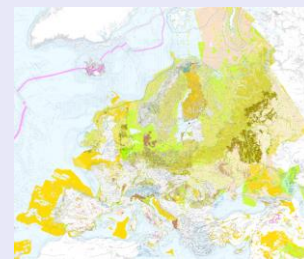


- national data
production

use vocabulary
provide map data



review
by participants,
advisory board



**data release
publication**

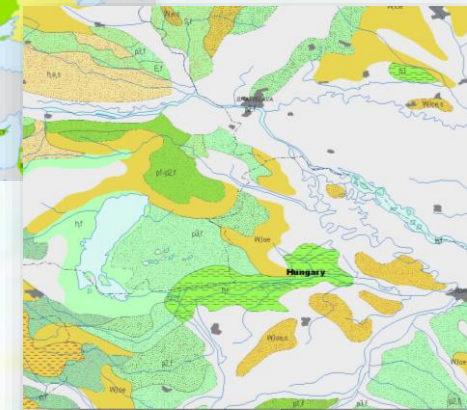
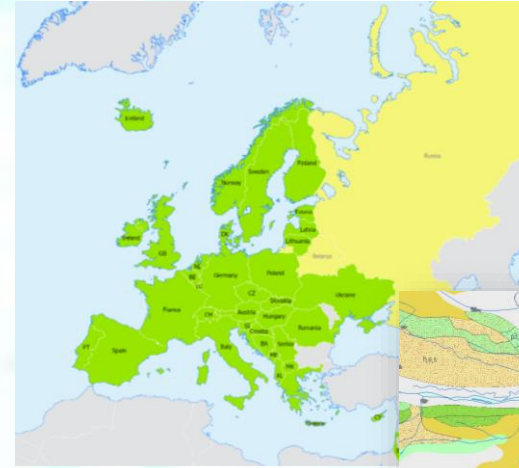
WWW





Challenges ...

- acquisition of most recent data from the member countries
- the harmonisation across political boundaries
- transformation of partner data to common standards, i.e. INSPIRE and IQUAME project vocabularies
- Compilation and evaluation of data and information from heterogeneous sources (different authors, format, etc)
- meet and work (and harmonize!) on-line



Legend	Description
[Green]	...
[Yellow]	...
[Orange]	...
[Red]	...
[Blue]	...
[Purple]	...
[Pink]	...
[Brown]	...
[Grey]	...



Legend	Description
[Green]	...
[Yellow]	...
[Orange]	...
[Red]	...
[Blue]	...
[Purple]	...
[Pink]	...
[Brown]	...
[Grey]	...





IQUAME 2500 – numerous sources



Data sources	theme
<p>national contributions by IQUAME members</p>	<ul style="list-style-type: none"> • lithology* • age (geochronological)* • genesis: event environment, event process* • glaciogenic features • key locations • active faults • Max. glacial extents <p>* = specified by EC Directive INSPIRE Technical Guidelines</p>
<p>regional and cross-boundary datasets from other projects</p>	<ul style="list-style-type: none"> • EMODnet - Off-shore Quaternary geology / geomorphology • LGM datasets (Gibbard/Ehlers, Hughes et al.) • BRITICE data: updated LGM UK/Ireland • active faults (SHARE project) • DATED: LGM Northern Europe, direction of ice movement • Postglacial uplift project from SGU, 2014 • International Quaternary Map Draft of the Middle East, 2016 • IGME 5000 (2005): volcanic rocks, meteoritic impact structures, off-shore features, bathymetry,
<p>features from 1st edition (1967 -1995)</p>	<ul style="list-style-type: none"> • key localities • direction of ice movement (version 1995) • regional data from unavailable national contributions • Off-shore lithology • Limits of transgressions, ancient shorelines
<p>publications</p>	<ul style="list-style-type: none"> • On new data from trans-boundary, regional and local mapping





Building the IQUAME: next steps (continuously: hunting and gathering)



2023

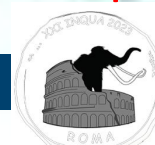
- 4. May: IQUAME on-line Workshop
- XXI INQUA in Rome: Session and presentation, harmonisation and consultation workshop

2024

- spring: review and preparation workshop
- August: Presentation at 37th International Geological Congress (IGC), Busan, South Korea in session: „Mapping the Quaternary geology: from detailed regional mapping campaigns to small-scale compilations“
- on-line availability of first harmonized layer at BGR Geoportal

2025 – 2027

- continuous publication of harmonised layers
- several consultation and editing workshops
- **presentation and celebration of final version at INQUA 2027!**





The IQUAME 2500 - printed out in original scale for the INQUA 2023 Congress in Rome



A big **THANK YOU** to the
IQUAME participants for their valuable contributions,
the kind support of the scientific advisors and
the continuing support of CGMW and INQUA!





Warm Invitation to the IGC Session „Geoscience information, geological mapping and Modelling“



IGC
2024
the 37th International Geological
Congress 2024



Conveners:

Kristine Asch & Marco Pantaloni

Foreseen Key Note speakers:

Hans-Georg Krenmayr
Manuel Pubellier

Category	Regular Session
Title	Geoscience information, geological mapping and modelling
Theme	T22 GIS and Remote Sensing;
Full description	<p>The last few years have been characterized by rapid progress in techniques of data acquisition, data management, and geologic and geothematic mapping representation. In parallel, there have been a number of attempts at both semantic and cartographic harmonization processes, which are often still being debated. This session aims to present the progress made in these fields, either through the results obtained by the various cartographic harmonization projects whether worldwide, continental or regional scales (CGMW 5 Million Map, OneGeology, EGDI, EMODnet, CSA-GSEU...).</p> <p>A detailed focus will be made on recent developments and projects in the field of geologic mapping and modelling, harmonisation techniques and procedures, pre- and post-processing data and methods for the identification of geological information especially for surface geological and structural information.</p>

