



THE IMPACT OF THE INSPIRE DIRECTIVE ON GEOLOGIC DATA MODELS OF GEOLOGICAL SURVEYS. THE IGME (SPAIN) CASE

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Who are we?

The Instituto Geológico y Minero de España (Geological Survey of Spain)

- Senior (founded 1849) public research autonomous institution attached to the Ministry of Science and Innovation
- Main Earth Sciences Research Centre of Spain. Total 447 employees, 341 graduated
- Specialized in various fields of activity such as geology, environment, hydrogeology, mineral resources, natural hazards and land use planning
- IGME facilities, including its headquarters, project offices in several places around the country, laboratories, warehouses, drill core repository, library and museum, are equipped with advanced technology and technical resources
- IGME is the national centre for the creation of knowledge infrastructure, information and R&D in Earth Sciences

INSPIRE THEMES AND THE IGME



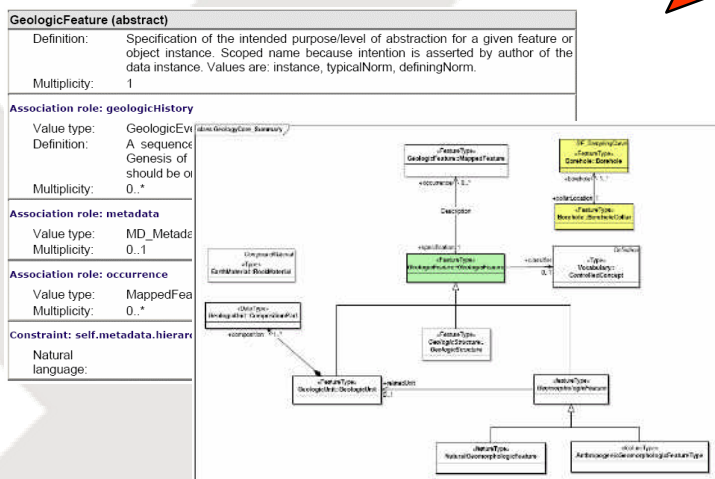
Geological Surveys are involved in several of these themes. Some of them are closely related with the activities and responsibilities of Geological Surveys.



INSPIRE REQUIERES

- Metadata
- Interoperability of spatial datasets
- Network services

Data model



INSPIRE
Infrastructure for Spatial Information in Europe

D2.8.II.4 Data Specification on Geology – Draft Guidelines



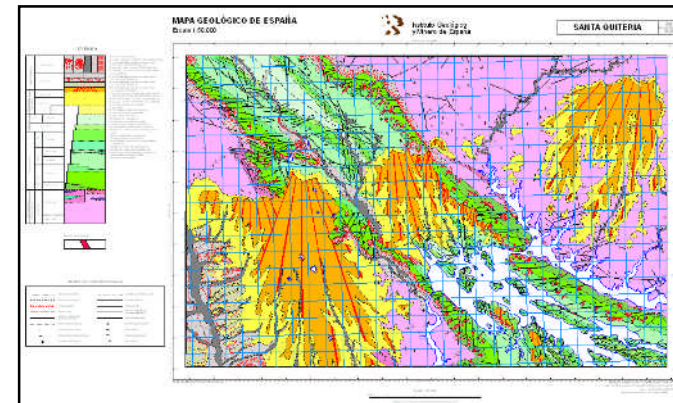
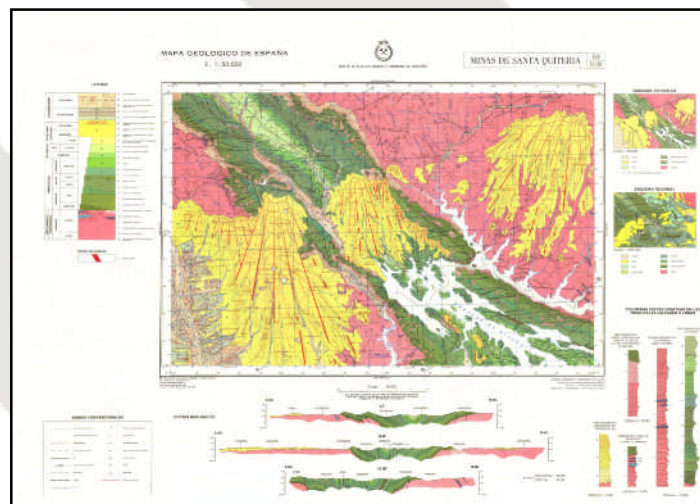
Terminology

DeterminationMethodTerm		FaultTypeTerm		CompositionPartRoleTerm	
Term	Definition	Term	Definition	Term	Definition
Calculated average orientation	Orientation value (co-ordinates) estimated from air photo measurements	Detachment fault	A regional-scale fault with right along the fault trace of the fault	Bed lithosome	Lithosome in lithostratigraphic unit that occurs as individual beds interleaved with other constituents on the outcrop (m) scale or larger.
Estimate from distance	Orientation of fault directly, e.g. by use of value quality	Dextral strike slip fault	Fault with right along the fault trace of the fault	Blocks	Geologic unit constituent is present as masses with generally sharp boundaries and block-like geometry within a matrix of some other material emplaced by processes at the earth's surface—e.g. volcanic eruption or mass wasting. Implication is that blocks were derived from the same source geologic unit and emplaced in the described unit.
Measure on outcrop	Orientation of fault directly, e.g. by use of value quality	Extraction fault	A fault whose two rock masses by brittle deformation	Concretion	Hard, compact mass or aggregate of mineral matter, normally subspherical but commonly oblate, disc-shaped or irregular. Formed from precipitation from solution about a nucleus or centre. Use as a geologic unit part should be restricted to concretions that are too large to consider as constituents in the rock material that composes the unit.
Method unknown	Orientation of fault directly, e.g. by use of value quality	Fault	A discrete surface of brittle deformation	Cyclic bedding package	Lithosome characterized by an internal sequence of units, which is repeated in a stacked sequence; e.g. fining-upward sequence, thickening upward sequence, bouma sequence.
Photogeologic determination	Orientation of fault directly, e.g. by use of value quality	High angle reverse	Reverse fault t extent, for which the fault dips which slip or se	Enclave	General term for a polyminerale aggregate enclosed in a granitoid.
Standard on site measure	Orientation of fault directly, e.g. by use of value quality	High-angle normal fault	Fault that dips the fault with th to footwall rock	Facies	Represents a particular body of rock that is a lateral variant of a lithostratigraphic unit, or a variant of a lithodemic unit. Contrast with lithosome in being a particular, connected body of rock, as opposed to a kind of rock body that is repeated in many places in a unit.
Three point determination	Orientation of fault directly, e.g. by use of value quality	Horizontal fault	Fault that dips the fault	Geologic unit matrix	Lithosome in a geologic unit that is generally interstitial to other constituents, e.g. in a mass wasting deposit, melange, tuff breccia.
Visual surface estimation on outcrop	Orientation of fault directly, e.g. by use of value quality	Left normal fault	High angle fault displacement t mapped trace.	Inclusion	Geologic unit constituent is present as masses with generally sharp boundaries enclosed within a matrix of some other material.
				Irregular lithosome	lithosome in a mixed/heterogeneous lithodemic unit that occurs in irregular bodies

IGME'S GEOLOGIC MAPS (I)

National Geologic Map at 1:50.000 scale – MAGNA (1970-2003) - 1.135 sheets

- Sheets are independent, don't match on borders.
- Different topographic references, geology doesn't fit with latest ones.
- + Explanatory report.
- + Complementary information: samples, chemical analysis, ...



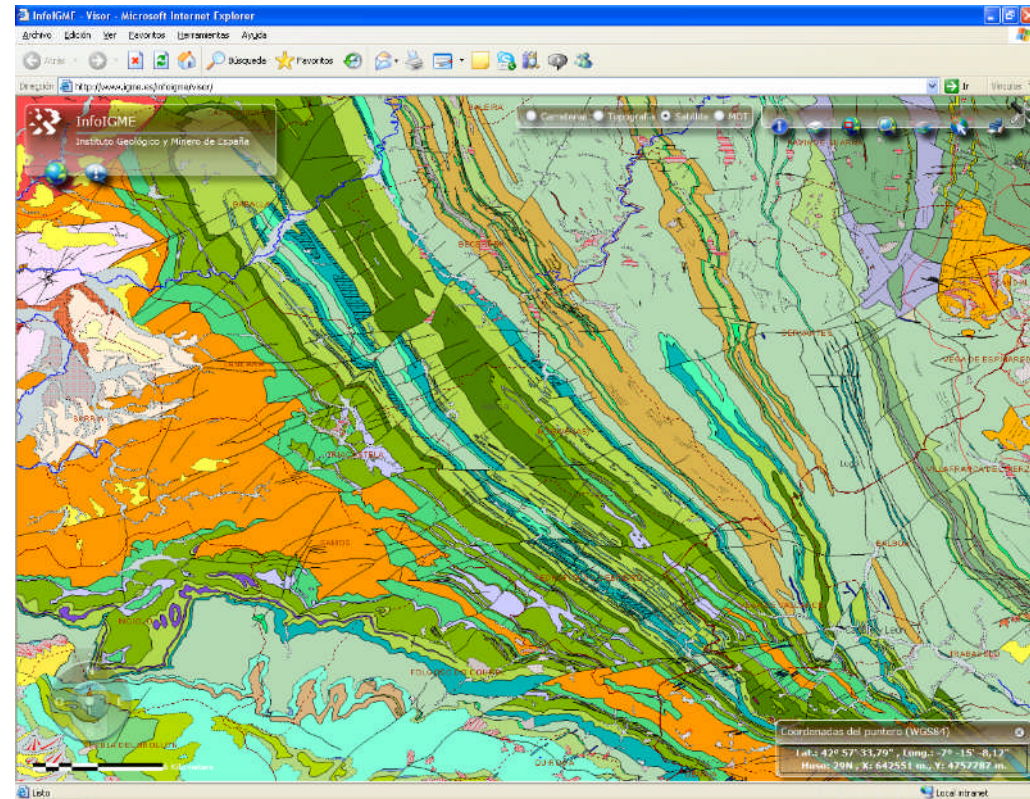
IGME'S GEOLOGIC MAPS (II)

Continuous Geologic Digital Map at 1:50.000 scale – GEODE (2006-2013)

20 continental zones and 10 insular zones – Source: MAGNA maps



- + Seamless map.
- + Fits with the current topographic maps.
- + 100% digital.
- Without explanatory report.
- Without complementary information.
- Occasional generalization.



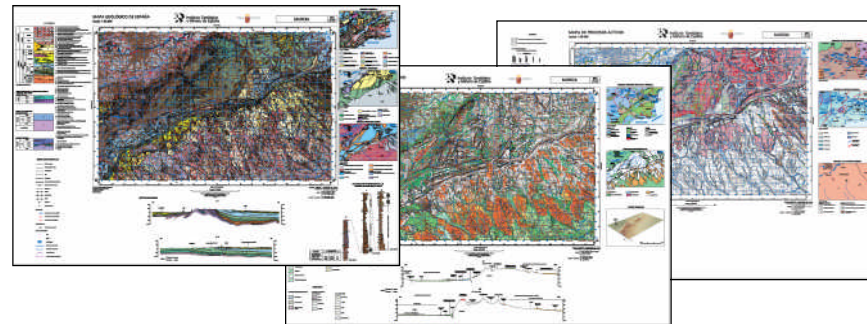
IGME'S GEOLOGIC MAPS (III)

Digital National Geologic Map at 1:50.000 scale – (2008- ?)

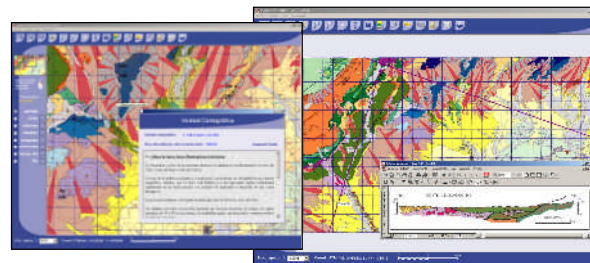
- + MAGNA
- + GEODE



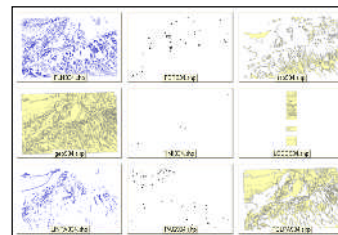
- Only 10 sheets available.
- Uncertain future.



Pdf maps



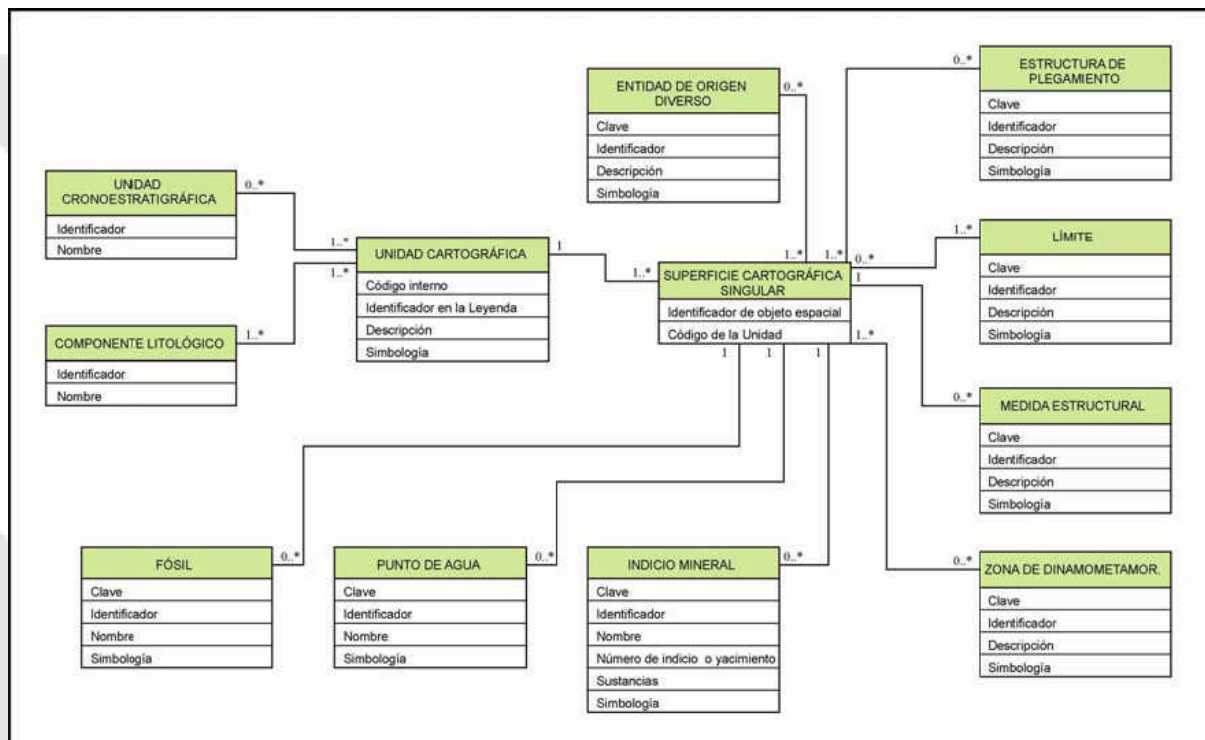
Application



Raw digital data



IGME's GEOLOGIC DATA MODELS



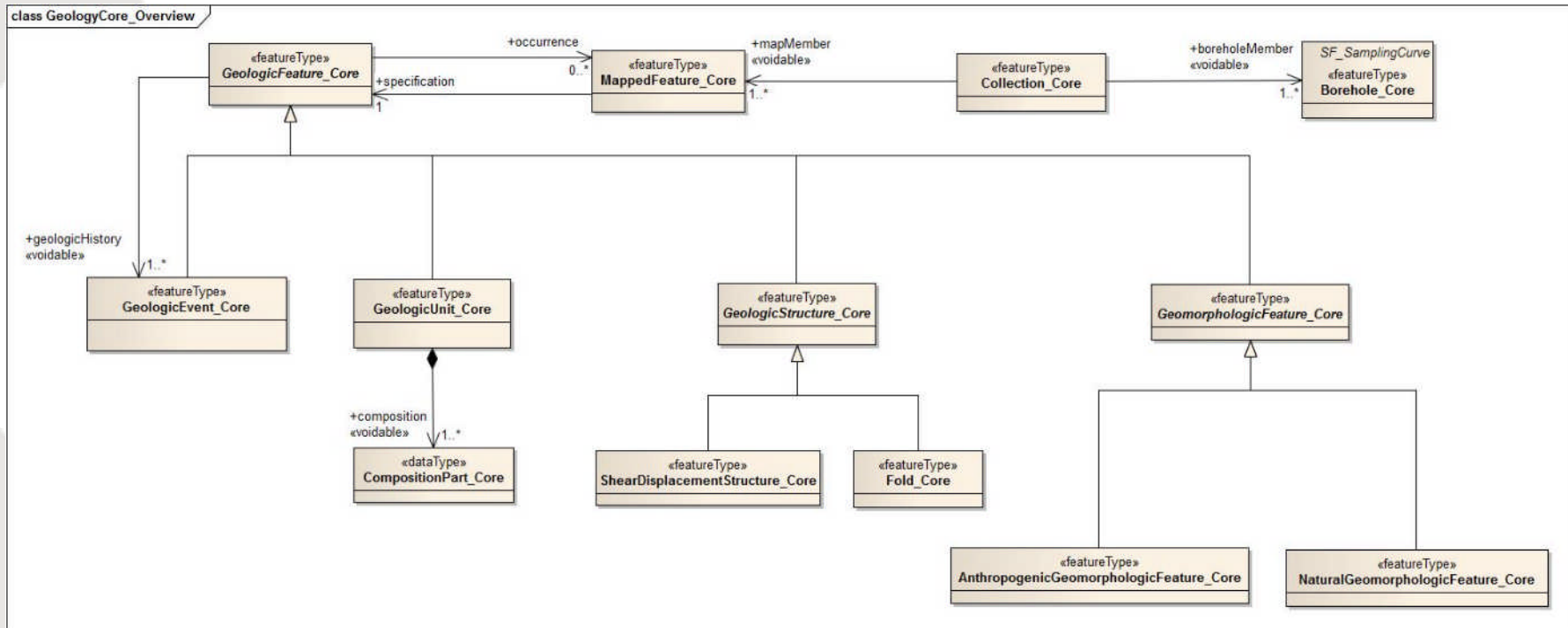
FEATURES

- Fold
- GeologicUnit
- GeologicContact
- MappedGeologicUnit
- Other geologic structures
- MetamorphicProcess
- MineralOccurrence
- LandForm
- WaterPoint
- Fossil

PROPERTIES

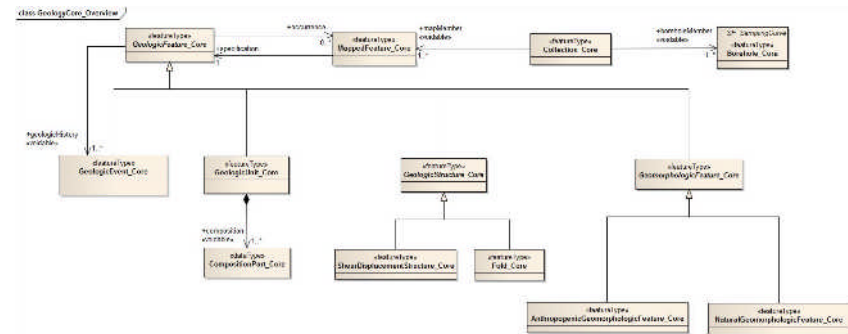
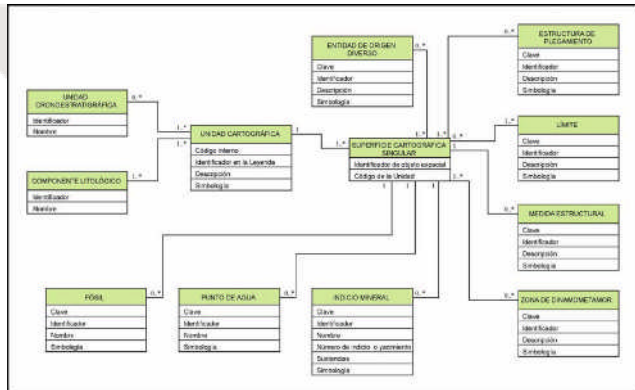
- Age
- Author's description
- Fold Type
- Lithology
- Fault Type
- Commodity

INSPIRE GEOLOGIC DATA MODEL (V 2.9)





GEOLOGIC DATA MODEL COMPARASION



- + Geologic structures
- <> Lithology and age terms
- + Survey points
- + Water points → Hidrogeology subdomain
- + Mineral occurrences → Mineral resources theme

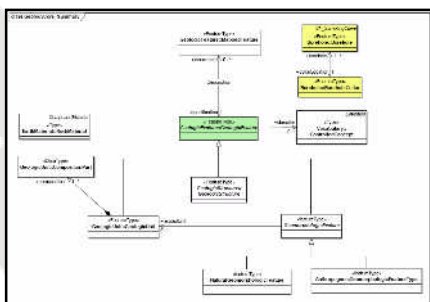
- + GeologicEvent
- + CompositionPart
- + Vocabularies



GEOLOGIC DATA MODEL CHOICE (I)

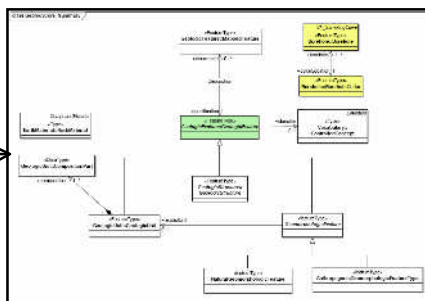
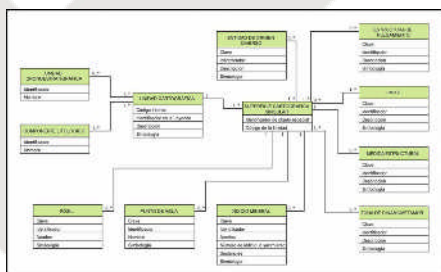


Option 1: INSPIRE model becomes IGME model



Information is lost.

Option 2: IGME model remains, INSPIRE model is added, both models existing side by side

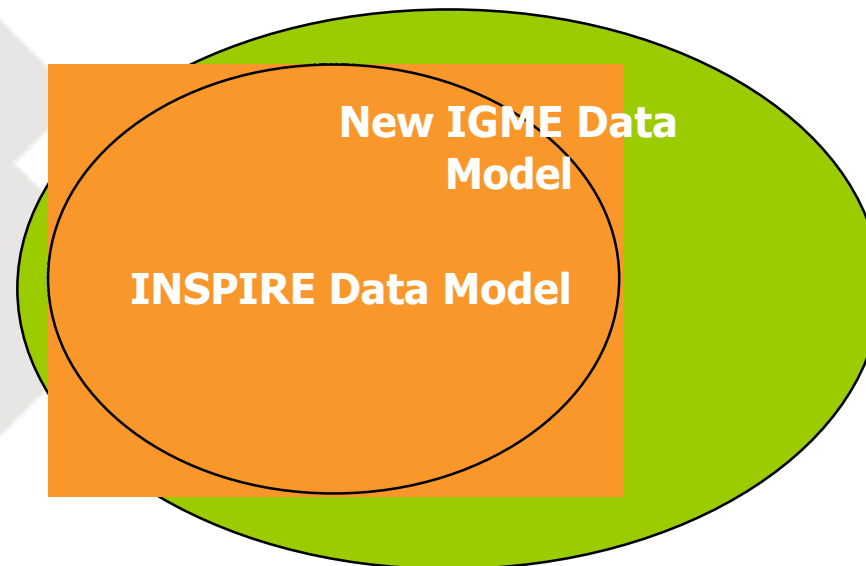


Interchange is needed
Data inconsistency

GEOLOGIC DATA MODEL CHOICE (II)



Option 3: New data model: INSPIRE + IGME



But ... just the INSPIRE core data model or the INSPIRE full data model?

GEOLOGIC DATA MODEL CHOICE (III)



The answer may be found out looking at the information involved in the process

Geological Information, priority I (December 2015): GEODE

In the testing and consultation period (June-October 2011) the effort required to the adoption of INSPIRE data model (v. 2.0) was evaluated on GEODE maps.

INSPIRE Full model

INSPIRE Core model

1,3 units/day

7 units/day

5.800 geological units

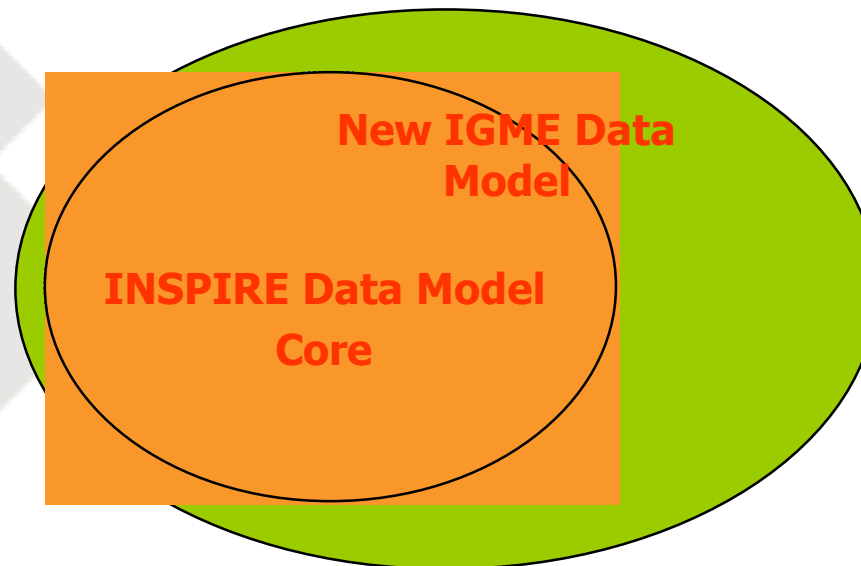
20 men/year

4 men/year

GEOLOGIC DATA MODEL CHOICE (IV)



New IGME data model: INSPIRE core + IGME data model



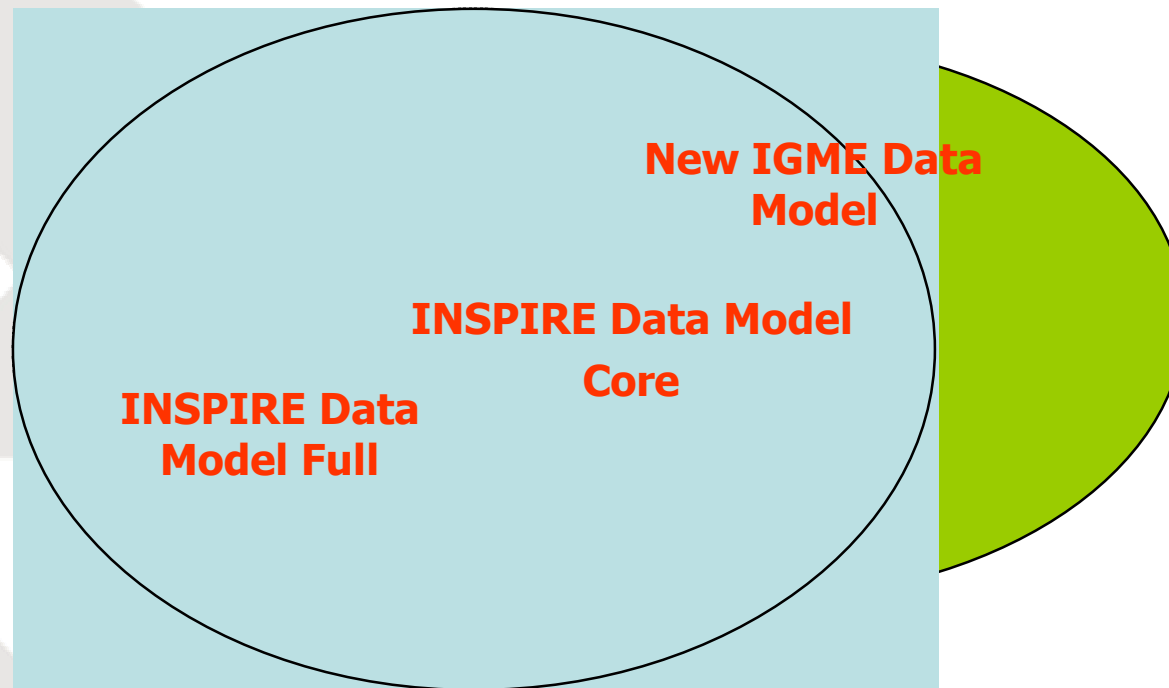
It's the feasible choice

But ... what are we going to do with new collected data?

GEOLOGIC DATA MODEL CHOICE (IV)



Forthcoming geologic information might be collected taking into account the full data model, but this doesn't suppose a new IGME's data model.



In any case, geologists should be involved in the INSPIRE implementation process.



VOCABULARIES - ROCKS



Different cases, different solutions

An IGME term and an INSPIRE term are synonymous

IGME term = INSPIRE term

An IGME term and an INSPIRE term are similar or equivalent

IGME term = INSPIRE term

An IGME term is in a lower level of the INSPIRE classification

Broader INSPIRE term will be used

An IGME term includes some INSPIRE terms

INSPIRE narrower terms will be used

An IGME term doesn't match because of different rock classification

Further analysis must be done

IGME's vocabulary and INSPIRE's vocabulary should be linked tightly

VOCABULARIES – AGE (I)

IGME_ID	IGMETerm	INSPIRETerm	INSPIRE_ID
33320101	Holoceno Inferior		
33320000	Holoceno	Holocene	a1.1.1.1.1
33313000	Pleistoceno	Late/Upper	a1.1.1.1.2.1
33312000	Pleistoceno Medio		
33311201	Ioniense	Ionian	a1.1.1.1.2.2
33311101	Calabriense	Calabrian	a1.1.1.1.2.3
33311000	Pleistoceno Inferior		
33310000	Pleistoceno	Pleistocene	a1.1.1.1.2
33300000	Cuaternario	Quaternary	a1.1.1.1
33222301	Gelasiese	Gelasian	a1.1.1.1.2.4
33222201	Piacenziense	Piacenzian	a1.1.1.2.1.1
33222112	Villafrangiense		
33222000	Plioceno Superior		
33221112	Rusciniense		
33221101	Zanclayense	Zanclean	a1.1.1.2.1.2
33221000	Plioceno Inferior		
33220000	Plioceno	Pliocene	a1.1.1.2.1
33213601	Messiniense	Messinian	a1.1.1.2.2.1
33213501	Tortoniese	Tortonian	a1.1.1.2.2.2
33213122	Turoliense		
33213112	Vallesiense		
33213000	Mioceno Superior		
33212401	Serravaliense	Serravallian	a1.1.1.2.2.3
33212301	Langhiense	Langhian	a1.1.1.2.2.4
33212000	Mioceno Medio		
33211244	Aragoniense		
33211234	Aragoniense Medio		
33211224	Aragoniense Inferior		
33211212	Aragoniense		
33211201	Burdigaliense	Burdigalian	a1.1.1.2.2.5
33211112	Rambliese		
33211101	Aquitaniense	Aquitanian	a1.1.1.2.2.6
33211000	Mioceno Inferior		
33210000	Mioceno	Miocene	a1.1.1.2.2
33200000	Neógeno	Neogene	a1.1.1.2

IGME_ID	IGMETerm	INSPIRETerm	INSPIRE_ID
33320101	Holoceno Inferior	Holocene	a1.1.1.1.1
33320000	Holoceno	Holocene	a1.1.1.1.1
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33300000	Cuaternario	Quaternary	a1.1.1.1
33222301	Gelasiese	Gelasian	a1.1.1.1.2.4
33222201	Piacenziense	Piacenzian	a1.1.1.2.1.1
33222112	Villafrangiense	Piacenzian	a1.1.1.2.1.1
33222000	Plioceno Superior	Piacenzian	a1.1.1.2.1.1
33221112	Rusciniense	Zanclean	a1.1.1.2.1.2
33221101	Zanclayense	Zanclean	a1.1.1.2.1.2
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33213601	Messiniense	Messinian	a1.1.1.2.2.1
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33213122	Turoliense	Messinian	a1.1.1.2.2.1
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33213000	Mioceno Superior		
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33212000	Mioceno Medio		
33211244	Aragoniense		
33211234	Aragoniense Medio		
33211224	Aragoniense Inferior		
33211212	Aragoniense		
33211201	Burdigaliense	Burdigalian	a1.1.1.2.2.5
33211112	Rambliese		
33211101	Aquitaniense	Aquitanian	a1.1.1.2.2.6
33211000	Mioceno Inferior		
33210000	Mioceno	Miocene	a1.1.1.2.2
33200000	Neógeno	Neogene	a1.1.1.2

All IGME terms have to be matched with the INSPIRE terms

VOCABULARIES – AGE (II)



IGME_ID	IGMETerm	INSPIRETerm	INSPIRE_ID	LowerInspireAge	UpperInspireAge
33320101	Holoceno Inferior	Holocene	a1.1.1.1.1		
33320000	Holoceno	Holocene	a1.1.1.1.1		
33313000	Pleistoceno Superior	Late/Upper	a1.1.1.1.2.1		
33312000	Pleistoceno Medio	Ionian	a1.1.1.1.2.2		
33311201	Ioniese	Ionian	a1.1.1.1.2.2		
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33222301	Gelasiese	Gelasian	a1.1.1.1.2.4		
33222201	Piacenziense	Piacenzian	a1.1.1.2.1.1		
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33222000	Plioceno Superior	Piacenzian	a1.1.1.2.1.1		
33221112	Rusciniense	Zanclean	a1.1.1.2.1.2		
33221101	Zancleyense	Zanclean	a1.1.1.2.1.2		
33221000	Plioceno Inferior	Zanclean	a1.1.1.2.1.2		
33220000	Plioceno	Pliocene	a1.1.1.2.1		
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33213122	Turoliense	Messinian	a1.1.1.2.2.1		
33213112	Vallesiense	Tortonian	a1.1.1.2.2.2		
33213000	Mioceno Superior			Tortonian	Messinian
33212401	Serravaliense	Serravallian	a1.1.1.2.2.3		
33212301	Langhiense	Langhian	a1.1.1.2.2.4		
33212000	Mioceno Medio			Langhian	Serravallian
33211244	Aragoniense Superior			Serravaliense	Tortonian
33211234	Aragoniense Medio			Langhian	Serravaliense
33211224	Aragoniense Inferior			Burdigalian	Langhian
33211212	Aragoniense			Burdigalian	Tortonian
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33211000	Mioceno Inferior			Aquitanian	Burdigalian
33210000	Mioceno	Miocene	a1.1.1.2.2		
33200000	Neógeno	Neogene	a1.1.1.2		

In case of not direct correlation, the lower and the upper INSPIRE terms will be used



CONCLUSIONS



The establishment of the subdomain “geology” in the theme “Geology” of the INSPIRE Directive, makes it compulsory to merge IGME’s model and INSPIRE’s core model , in order not to lose existing information.

The INSPIRE full model might be used for the new collected data.

All IGME’s terms shall be matched with INSPIRE’s terms.

INSPIRE doesn’t only concern IS (Information Systems) staff, field geologists and researches should also involved.

An extensive training program about INSPIRE metadata, data specifications and services must be undertaken, that should implicate all staff carrying out the compiling and treatment of the spatial geological data.

INSPIRE will only be successfully implemented in Spain on time if it’s clearly supported by IGME’s management.

THANKS FOR YOUR ATTENTION



Instituto Geológico
y Minero de España