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Interoperability / FAIR Data : building on Standards and Best Practices to achieve it

Sylvain Grellet, H el ene Bressan, Kathi Schleidt, Abdelfettah Feliachi, Micka el
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RÉPUBLIQUE
FRANÇAISE

*Liberté
Égalité
Fraternité*



Géosciences pour une Terre durable

brgm

SETTING THE SCENE

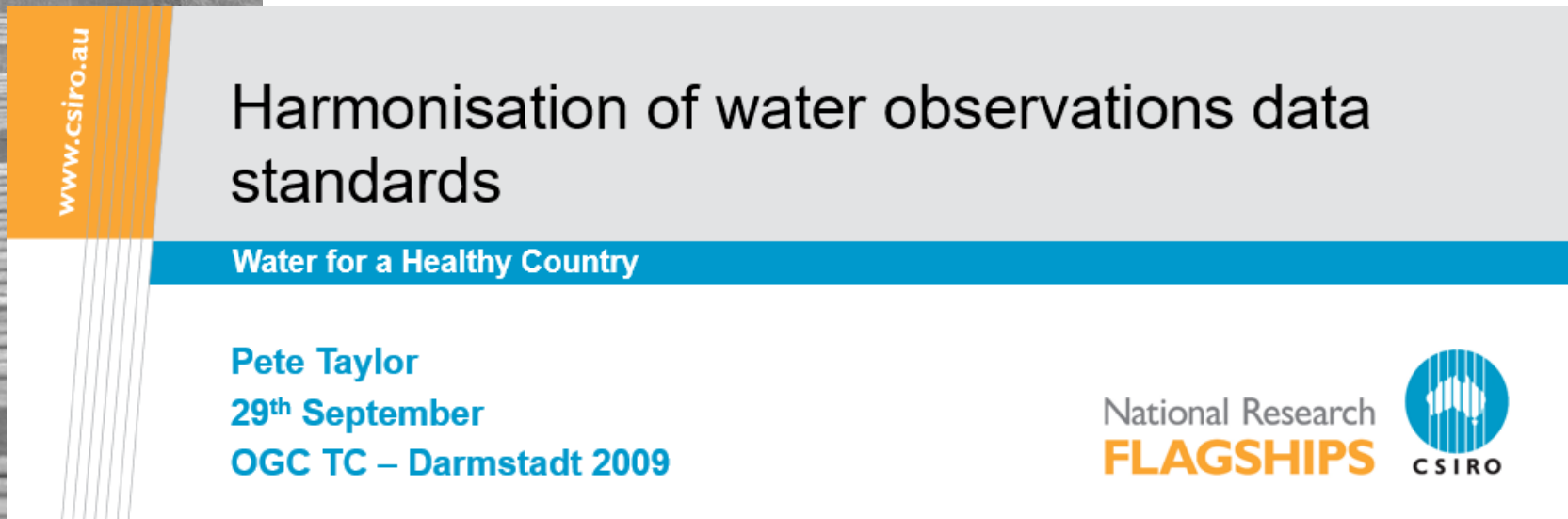


Sylvain Grellet – BRGM
ENSG – mastère GDM – 2023-01-20



Why do we need interoperability -> hydrology example

- Let's go there : https://external.ogc.org/twiki_public/HydrologyDWG/DarmstadtTc2009
- 2009_Sept_Darmstadt_HarmonisationObservations_PeterT.ppt



www.csiro.au

Harmonisation of water observations data standards

Water for a Healthy Country

Pete Taylor
29th September
OGC TC – Darmstadt 2009

National Research
FLAGSHIPS CSIRO



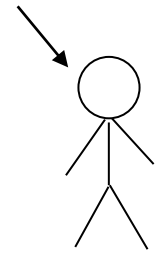
Why do we need interoperability -> hydrology example

The need for standards

- Sharing of hydrological data is somewhat ad-hoc, based largely on CSV files and FTP
- Leads to very inefficient (or non-existent) transfer and sharing of data
- Sharing requires a lot of transformation effort on the behalf of the data requestor
 - Parse different file formats
 - Understand the concepts
 - Metadata is often limited or non-existent, requiring follow up conversations

Why do we need interoperability -> hydrology example

Hydro Jack



Need flow data!

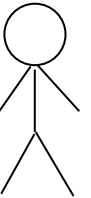
Hmm maybe Don can help...

RING RING

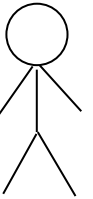
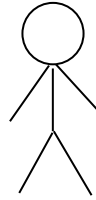
Hi Don, I need some upper Derwent flow readings for my geochemical model. Any ideas?



Hmm, I've got one site. I'll send it through...

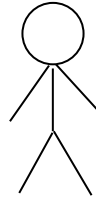


Why do we need interoperability -> hydrology example



10 minutes...

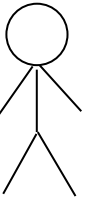
Why do we need interoperability -> hydrology example



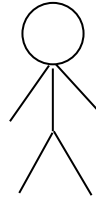
10 minutes...



To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



Why do we need interoperability -> hydrology example

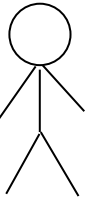


RING RING

Ok. Got the data.
Where is the site
located?

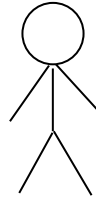


To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



Oh, it's at laughing jack bridge.

Why do we need interoperability -> hydrology example

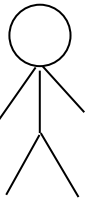


RING RING

Ok. Got the data.
Where is the site
located?
Coordinates?



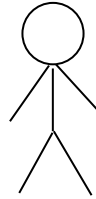
To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



Oh, it's at laughing jack bridge.

Ummm. (papers shuffle)
147.123 -41.588

Why do we need interoperability -> hydrology example



RING RING

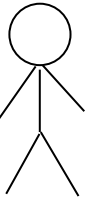
Ok. Got the data.
Where is the site
located?

Coordinates?

What reference
system??



To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1

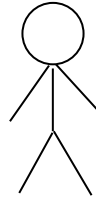


Oh, it's at laughing jack bridge.

Ummm. (papers shuffle)
147.123 -41.588

I think it's GDA94

Why do we need interoperability -> hydrology example



RING RING

Ok. Got the data.
Where is the site
located?

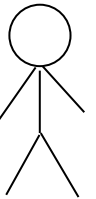
Coordinates?

What reference
system??

Ok. What sensor is
used?



To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



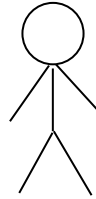
Oh, it's at laughing jack bridge.

Ummm. (papers shuffle)
147.123 -41.588

I think it's GDA94

It's calculated from the stream
gauge reading using a rating
curve..

Why do we need interoperability -> hydrology example



RING RING

Ok. Got the data.
Where is the site
located?

Coordinates?

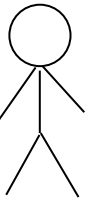
What reference
system??

Ok. What sensor is
used?

Oh...how accurate is
that?



To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



Oh, it's at laughing jack bridge.

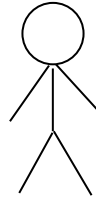
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gauge reading using a rating
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Umm.....

Why do we need interoperability -> hydrology example



RING RING

Ok. Got the data.
Where is the site
located?

Coordinates?

What reference
system??

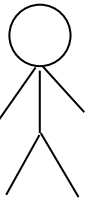
Ok. What sensor is
used?

Oh...how accurate is
that?

DON?



To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



Oh, it's at laughing jack bridge.

Ummm. (papers shuffle)
147.123 -41.588

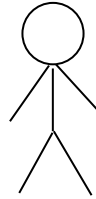
I think it's GDA94

It's calculated from the stream
gauge reading using a rating
curve..

Umm.....

CLICK

Why do we need interoperability -> hydrology example



RING RING

Ok. Got the data.
Where is the site
located?

Coordinates?

What reference
system??

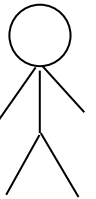
Ok. What sensor is
used?

Oh...how accurate is
that?

DON?



To: Jack
01/02/09, 3.2, 3, 1
01/02/09, 3.1, 3, 1



*How often have you been Hydro Jack
(or Don) ?*

Oh, it's at laughing jack bridge.

Ummm. (papers shuffle)
147.123 -41.588

I think it's GDA94

It's calculated from the stream
gauge reading using a rating
curve..

Umm.....

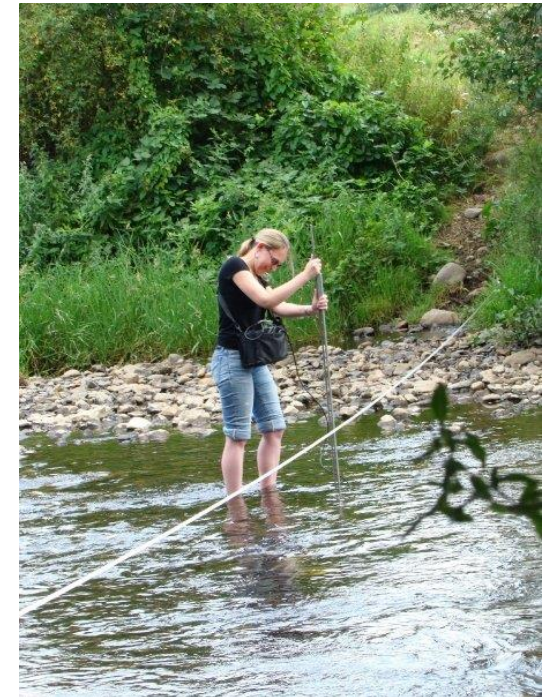
CLICK

Why do we need interoperability -> geoscience example




Trad : *Linked data registries and vocabulaires*


Data quality & interoperability thanks to semantics




Why do we need interoperability -> geoscience example



I observe on this outcrop the possibility of presence of **Mispickel (FeAsS)**, near **Beaulieu**



Let's analyze heavy metals in this sample sampled near **Beaulieu:**
As, Fe, Pb, ...



I observe on this outcrop the possibility of presence of **Arsenopyrite**

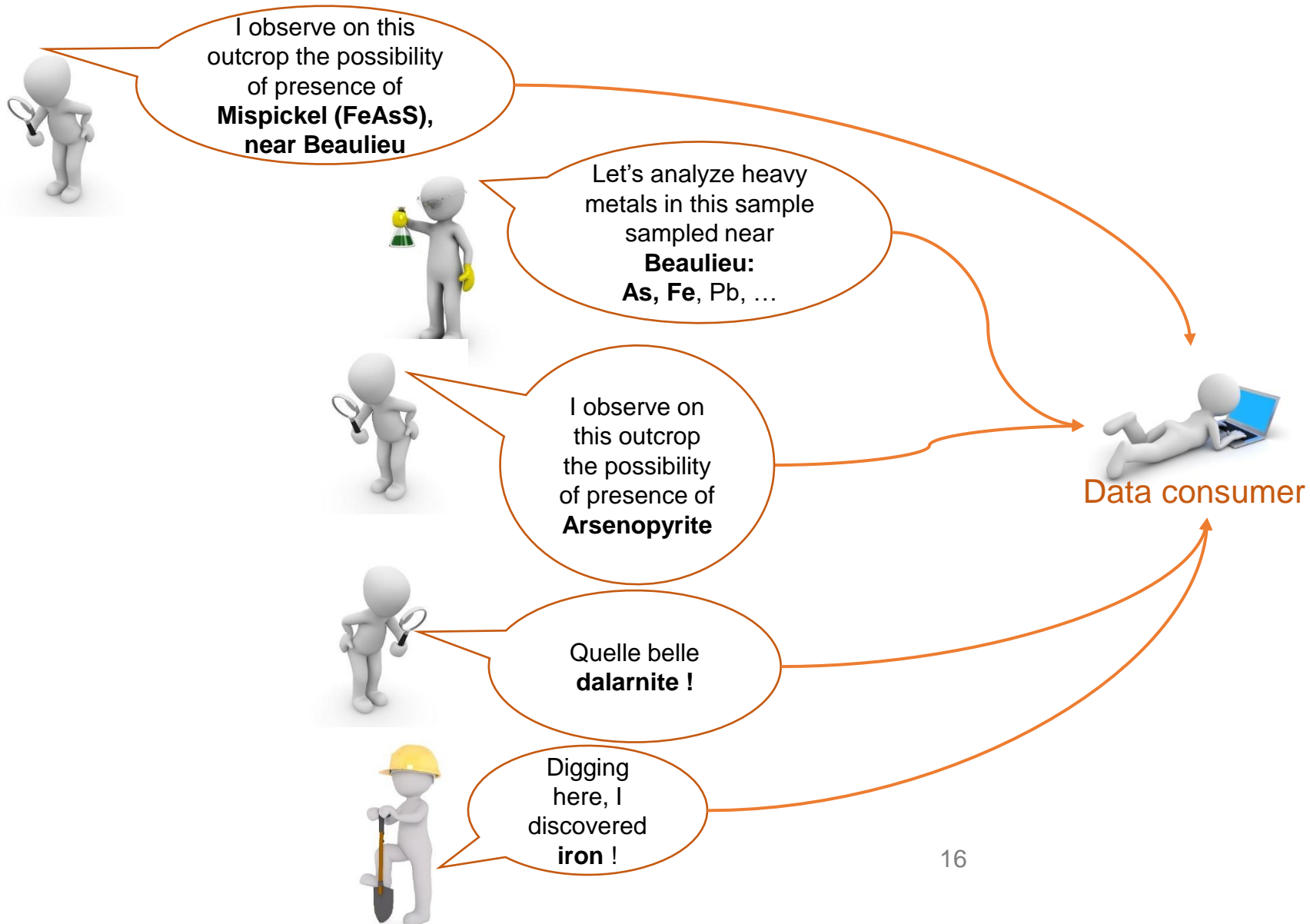


Quelle belle **dalarnite !**

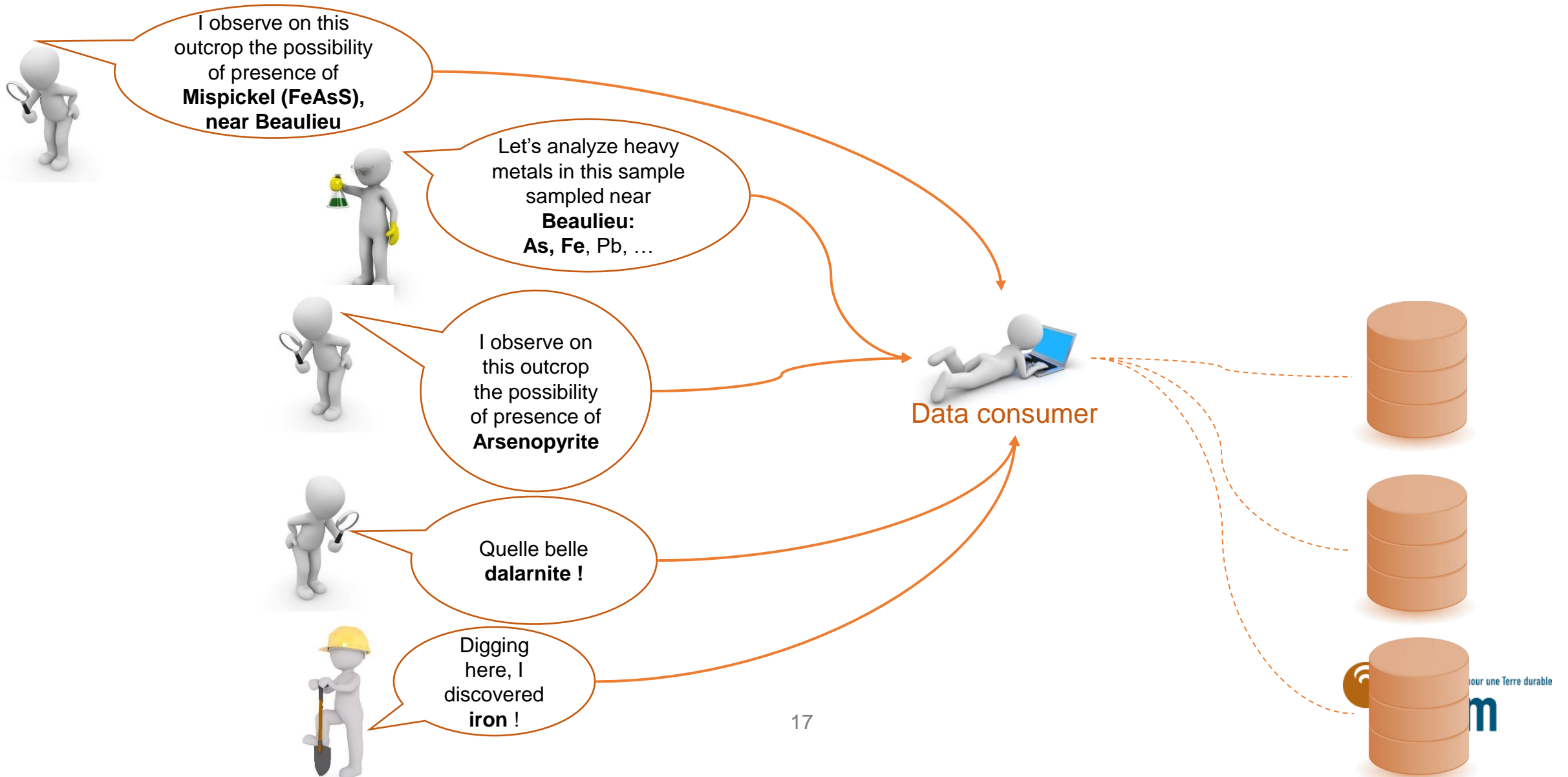


Digging here, I discovered **iron !**

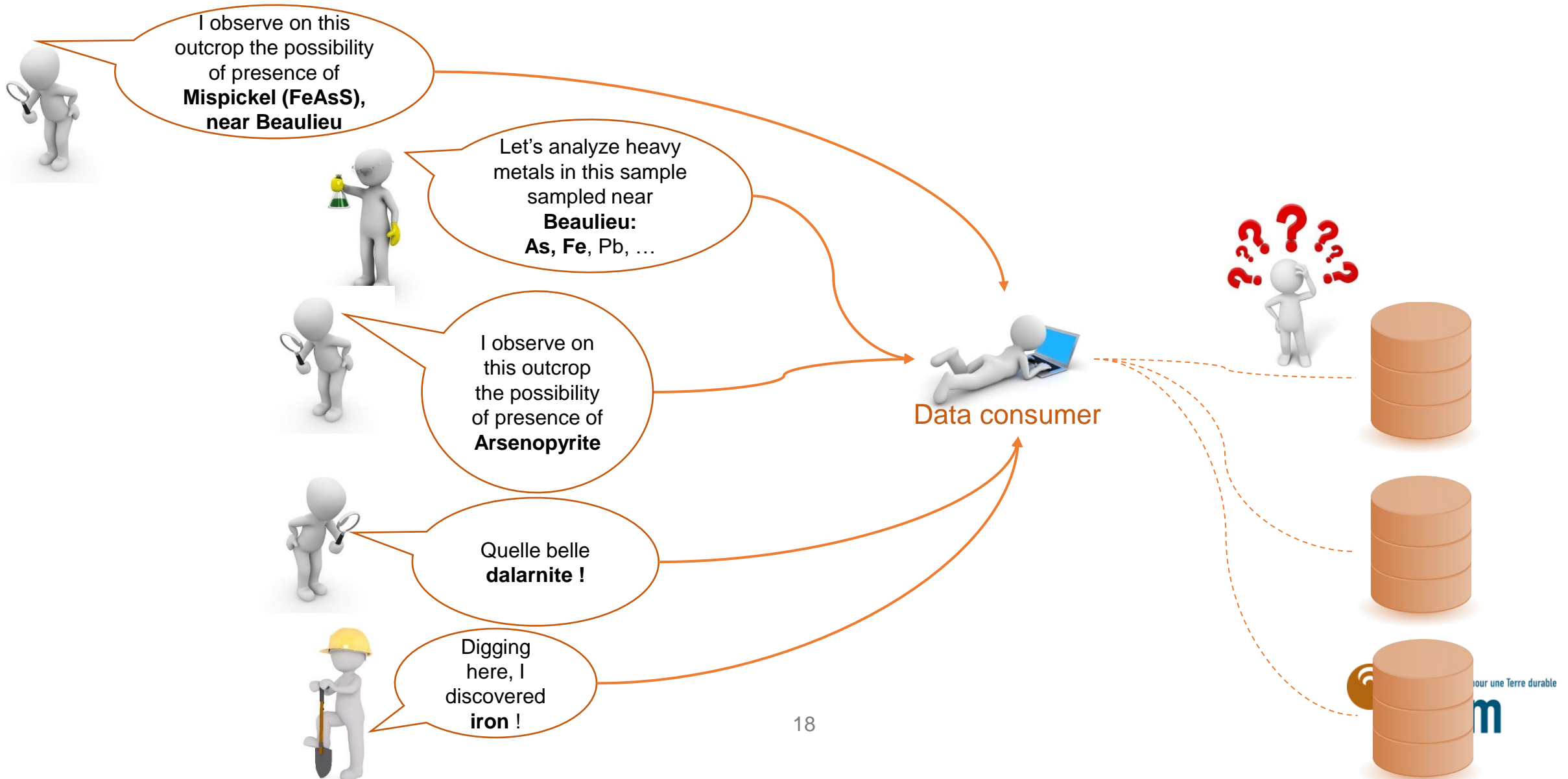
Why do we need interoperability -> geoscience example



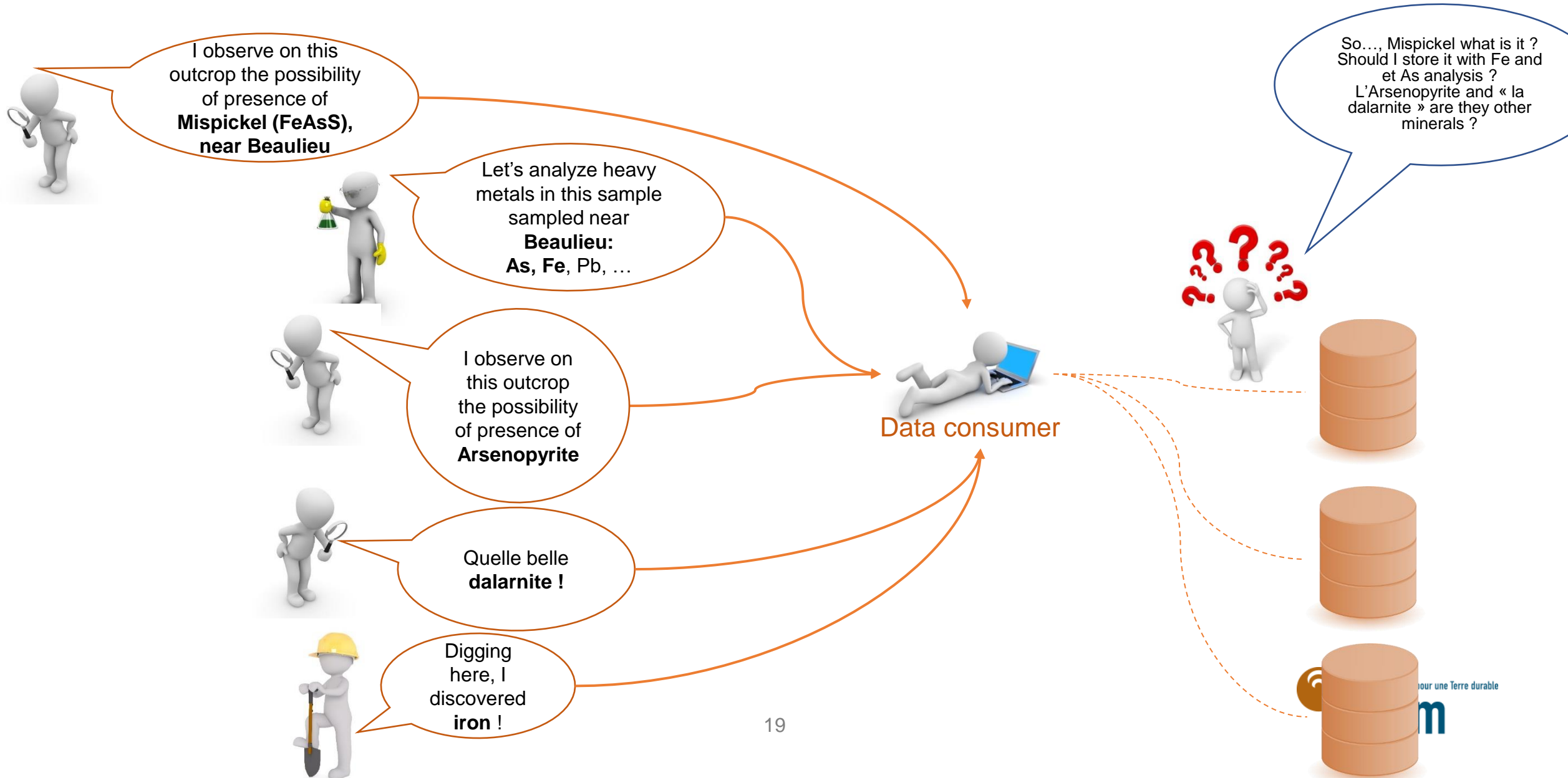
Why do we need interoperability -> geoscience example



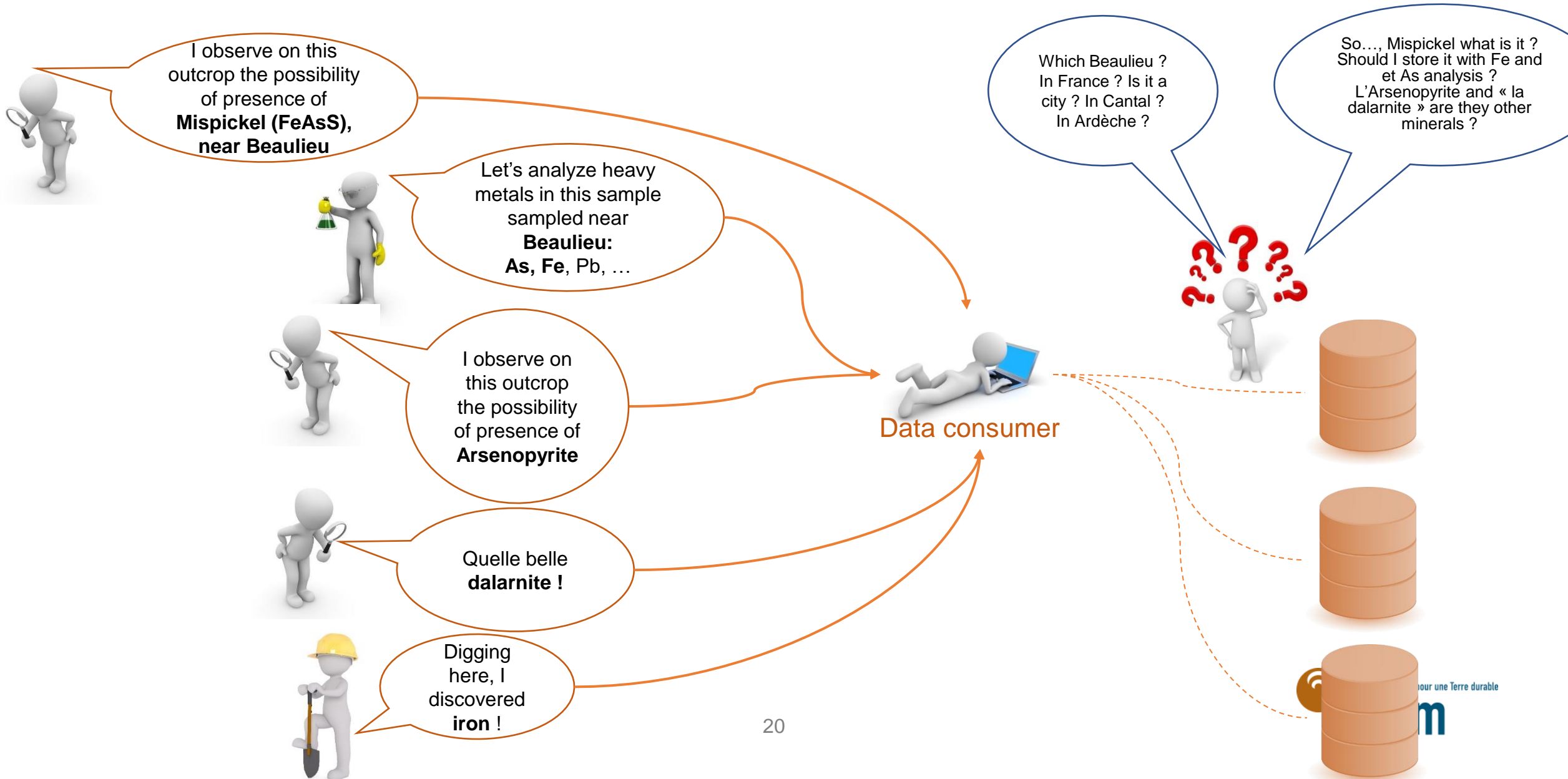
Why do we need interoperability -> geoscience example



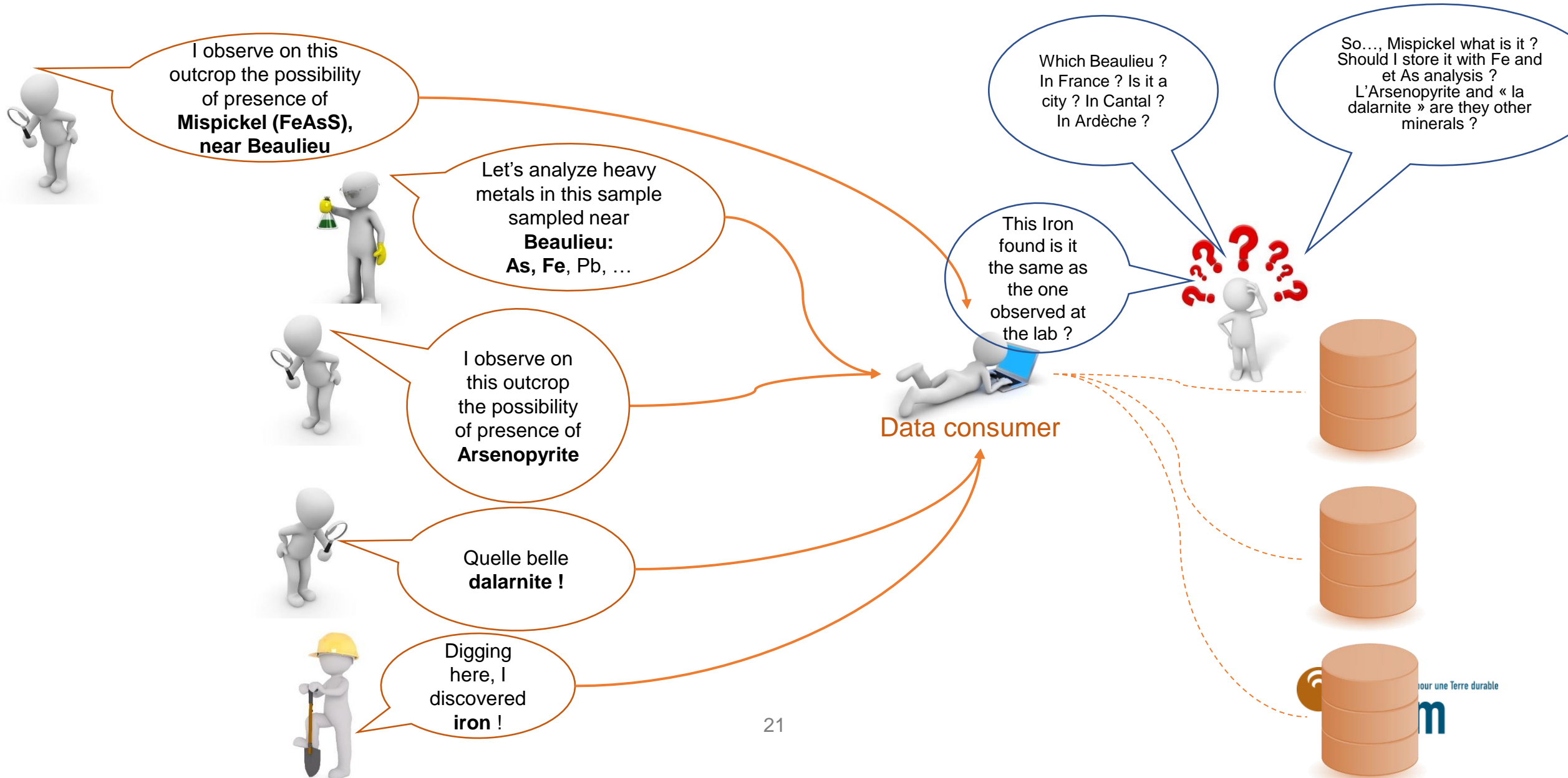
Why do we need interoperability -> geoscience example



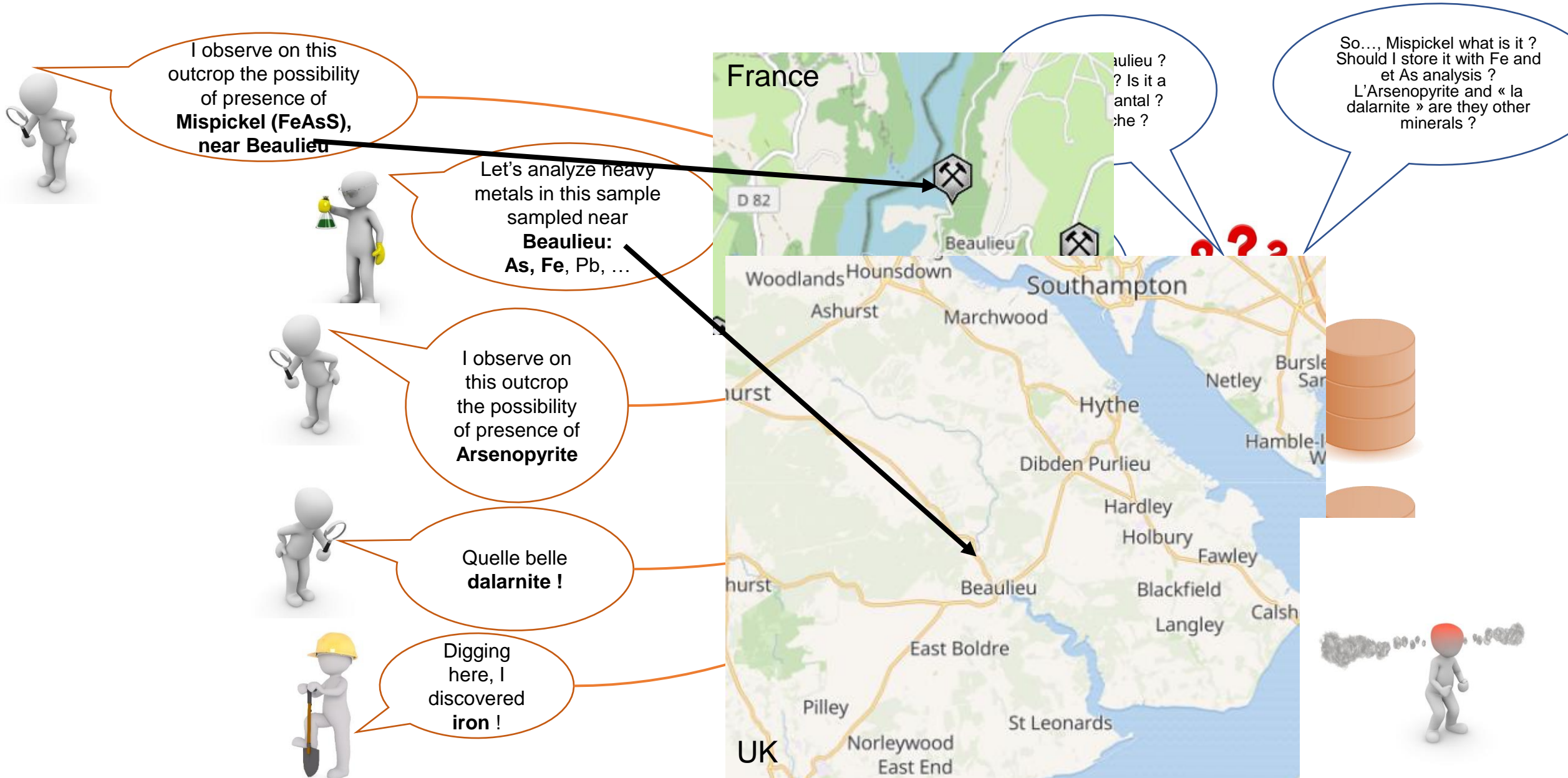
Why do we need interoperability -> geoscience example



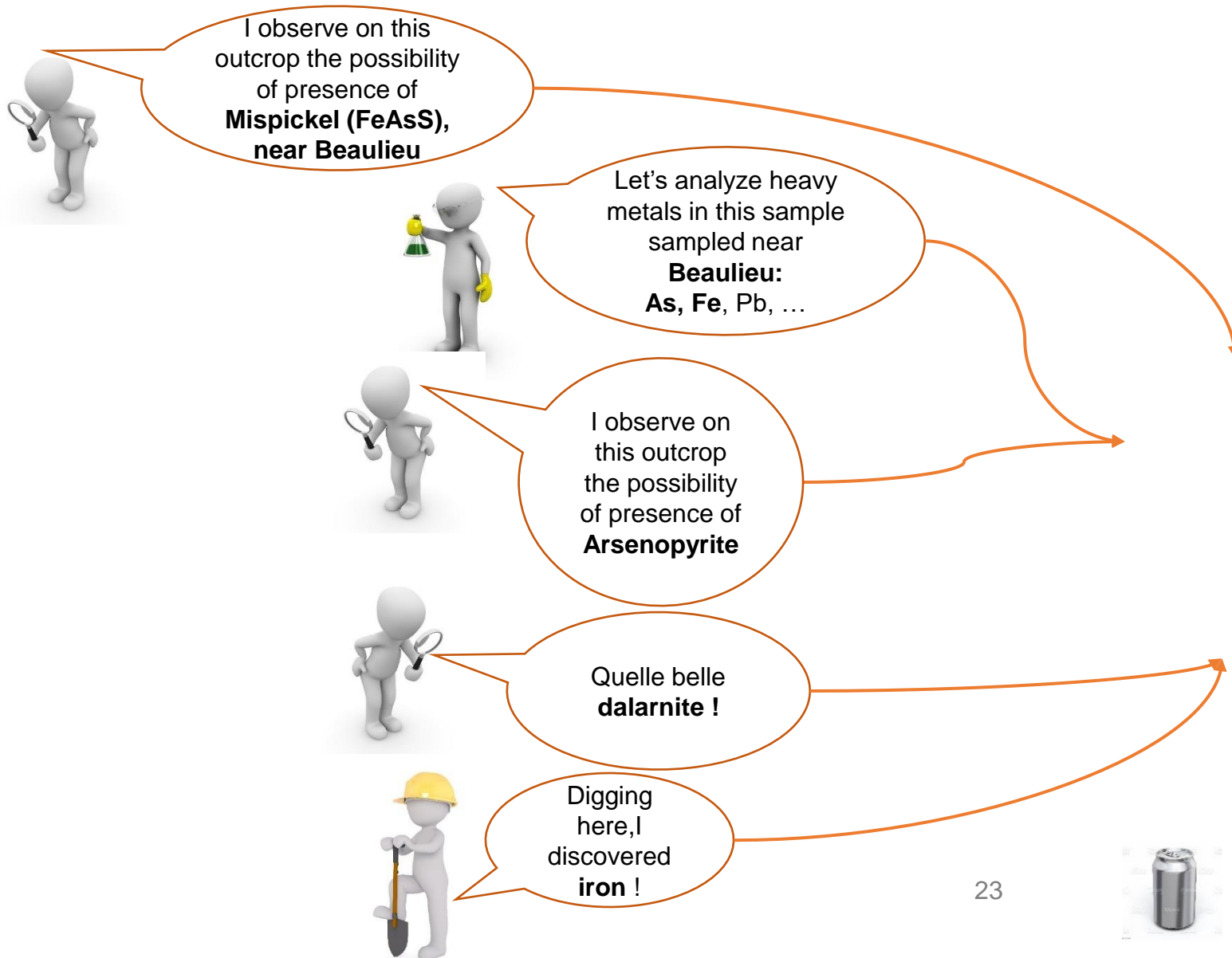
Why do we need interoperability -> geoscience example



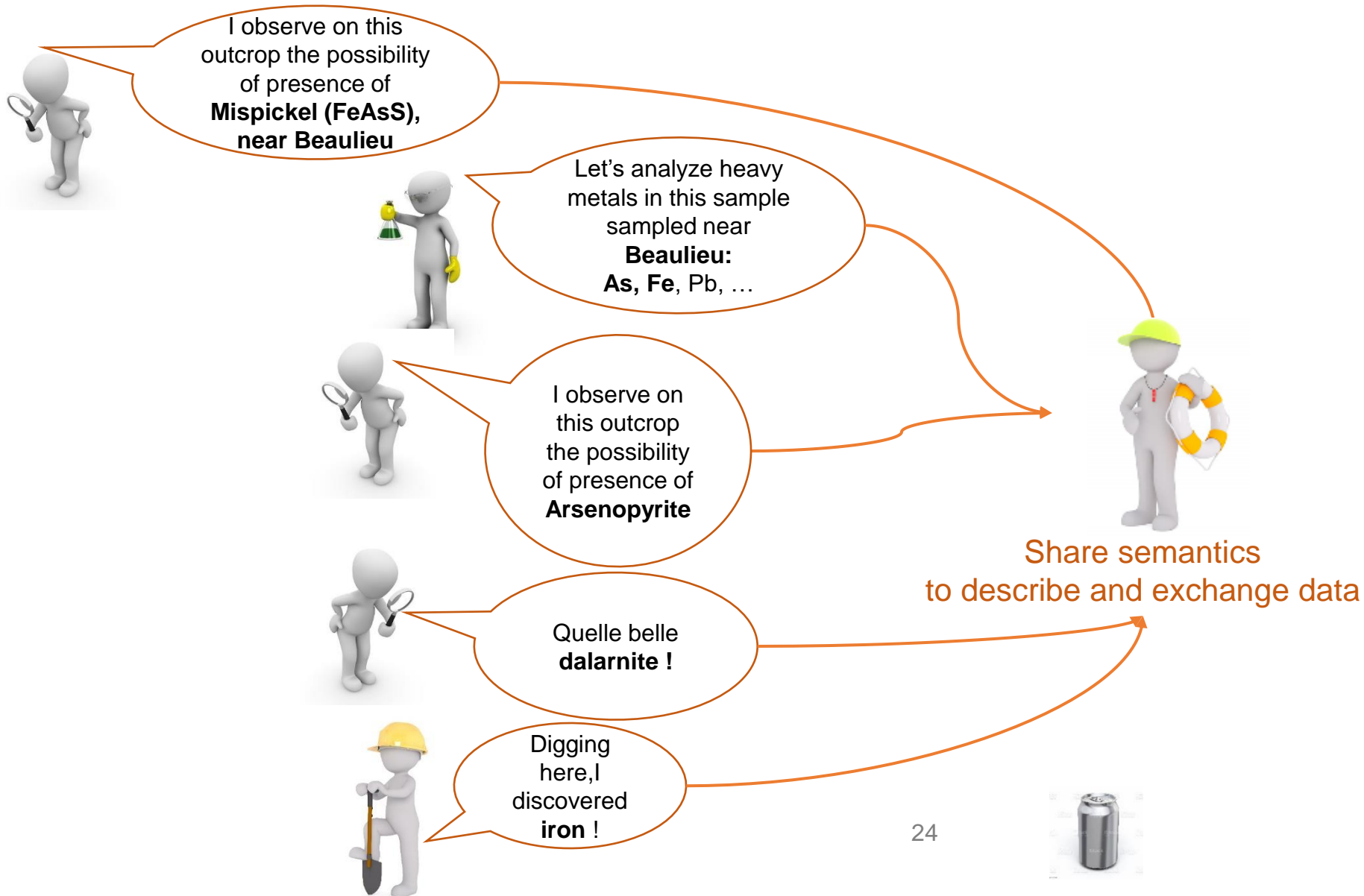
Why do we need interoperability -> geoscience example



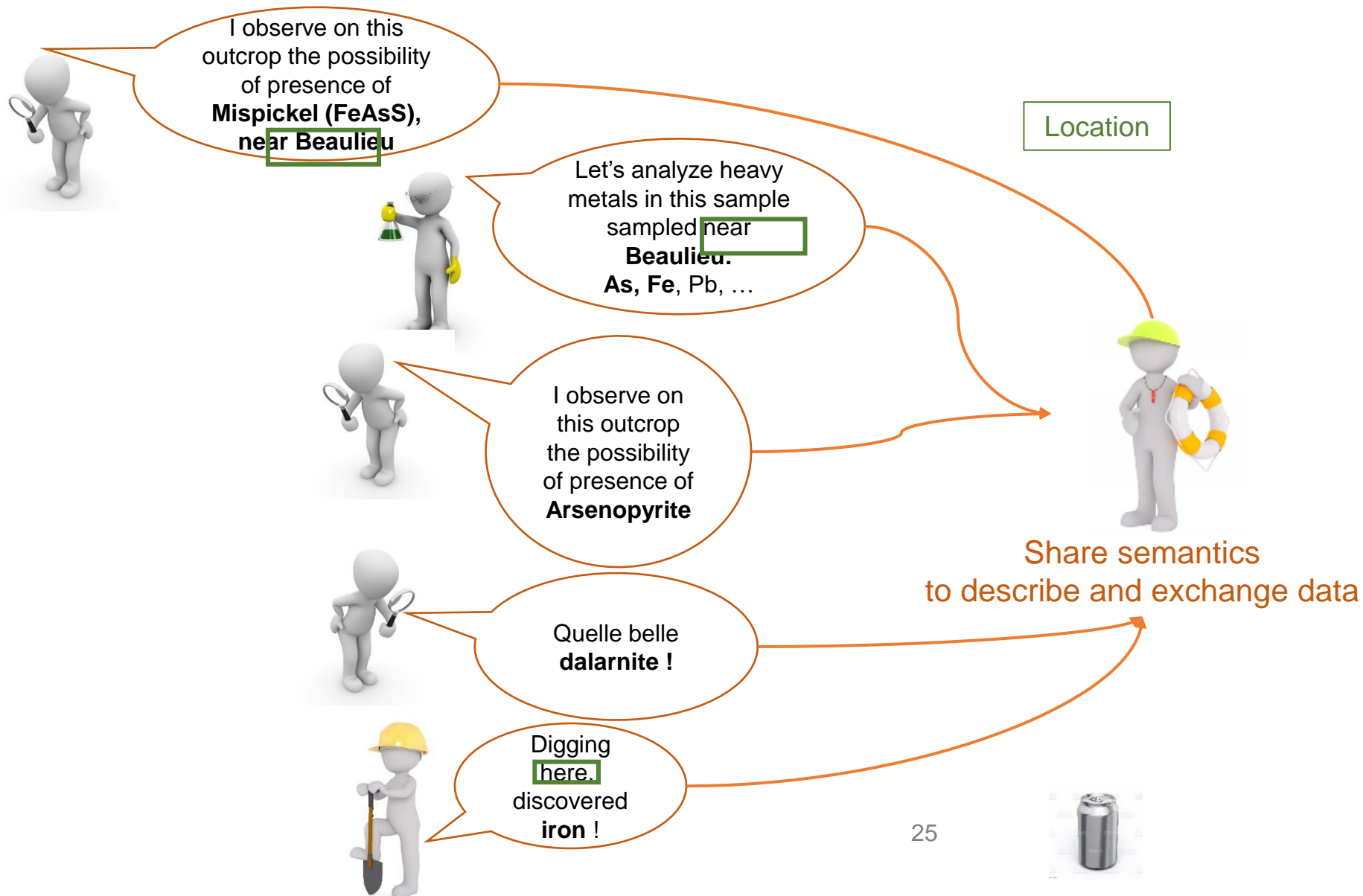
Why do we need interoperability -> geoscience example



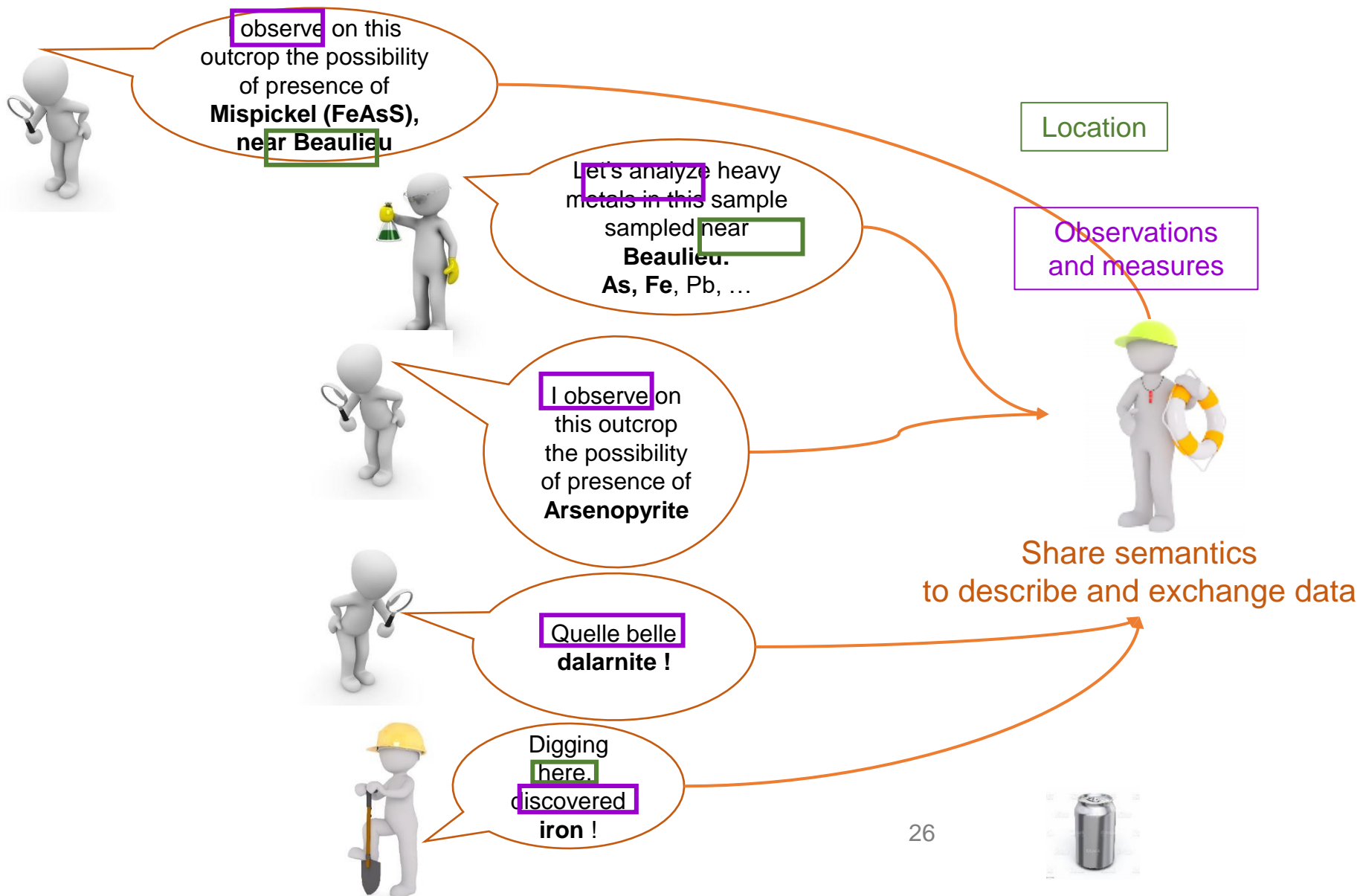
Why do we need interoperability -> geoscience example



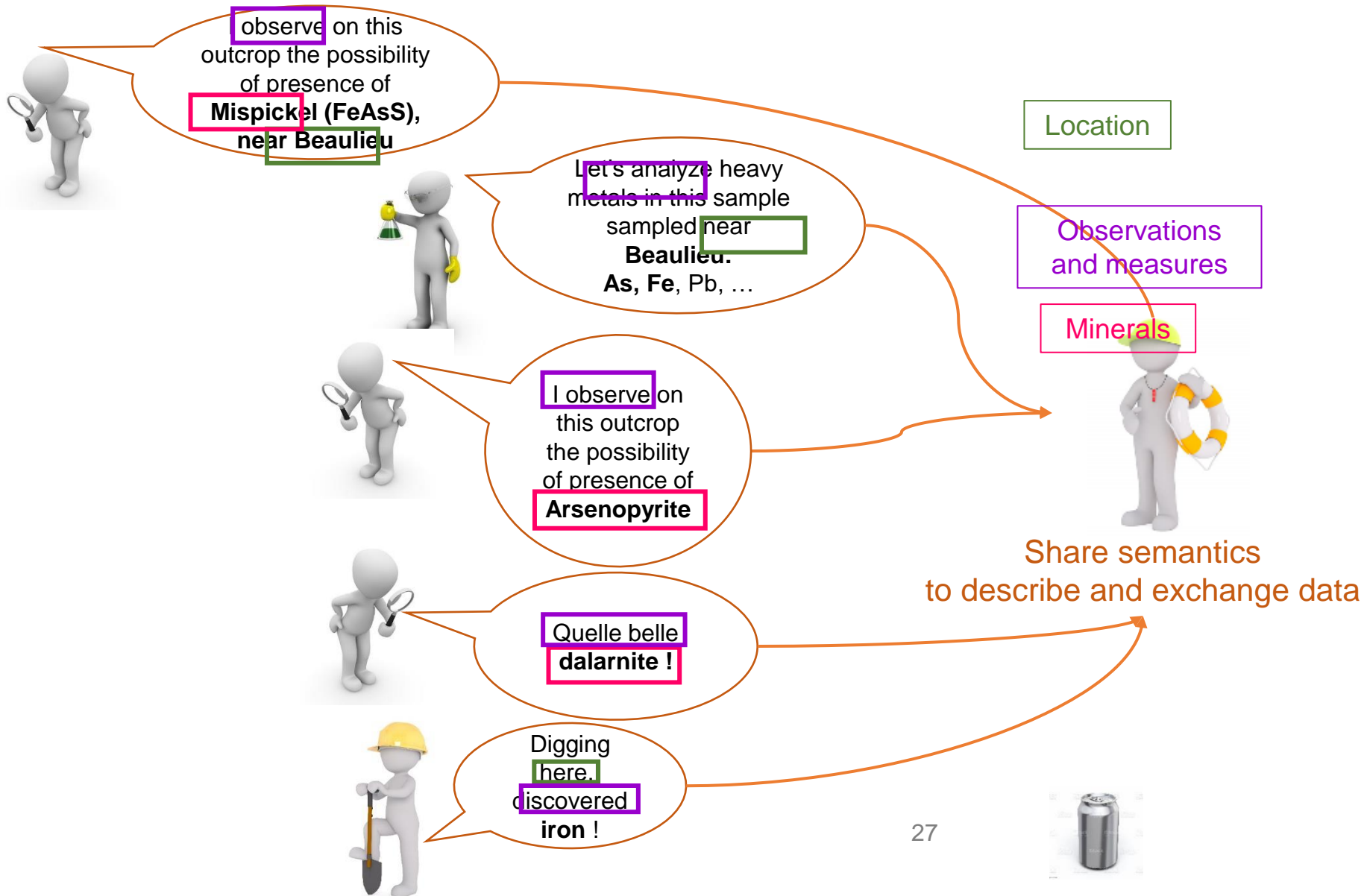
Why do we need interoperability -> geoscience example



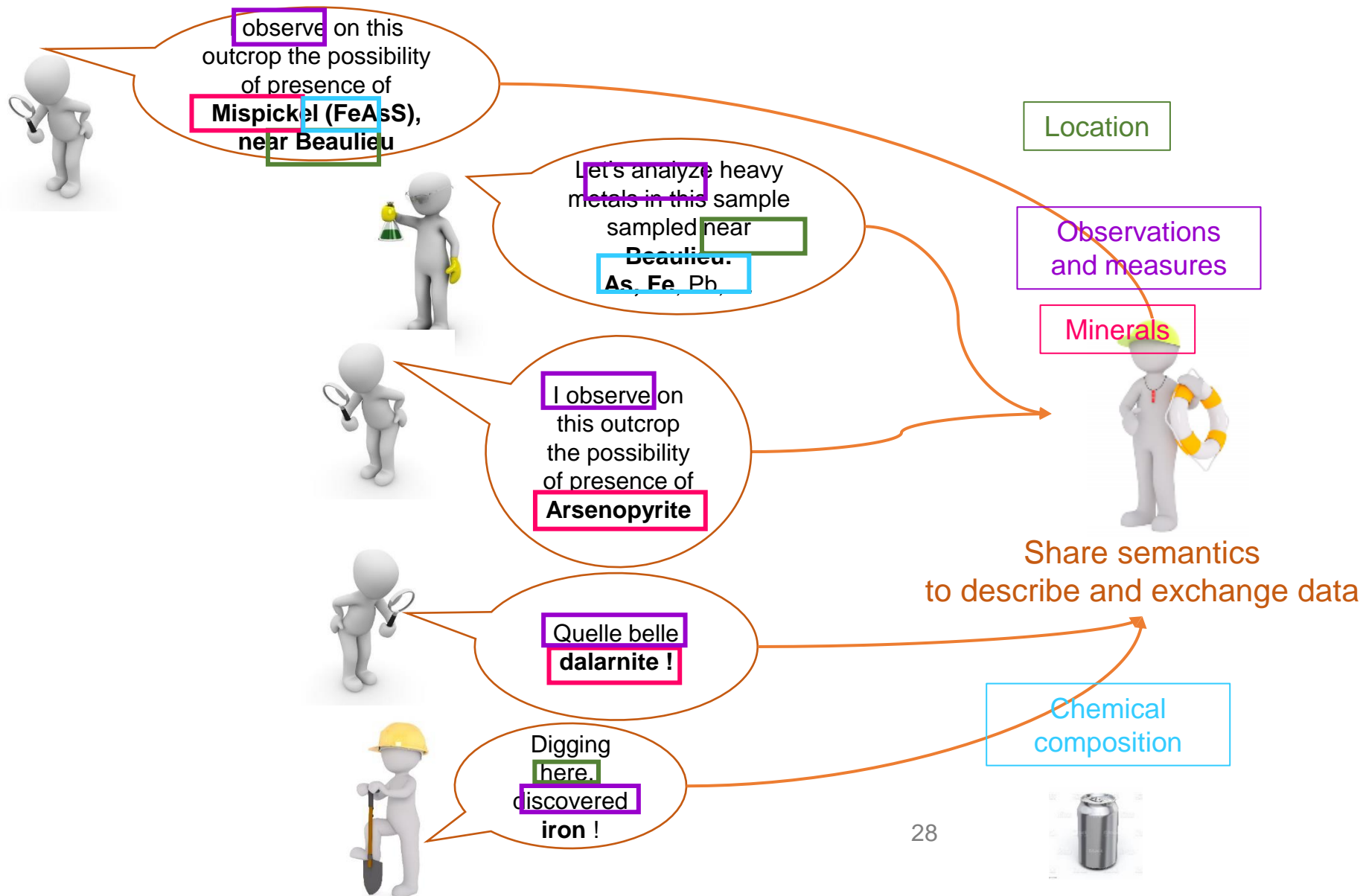
Why do we need interoperability -> geoscience example



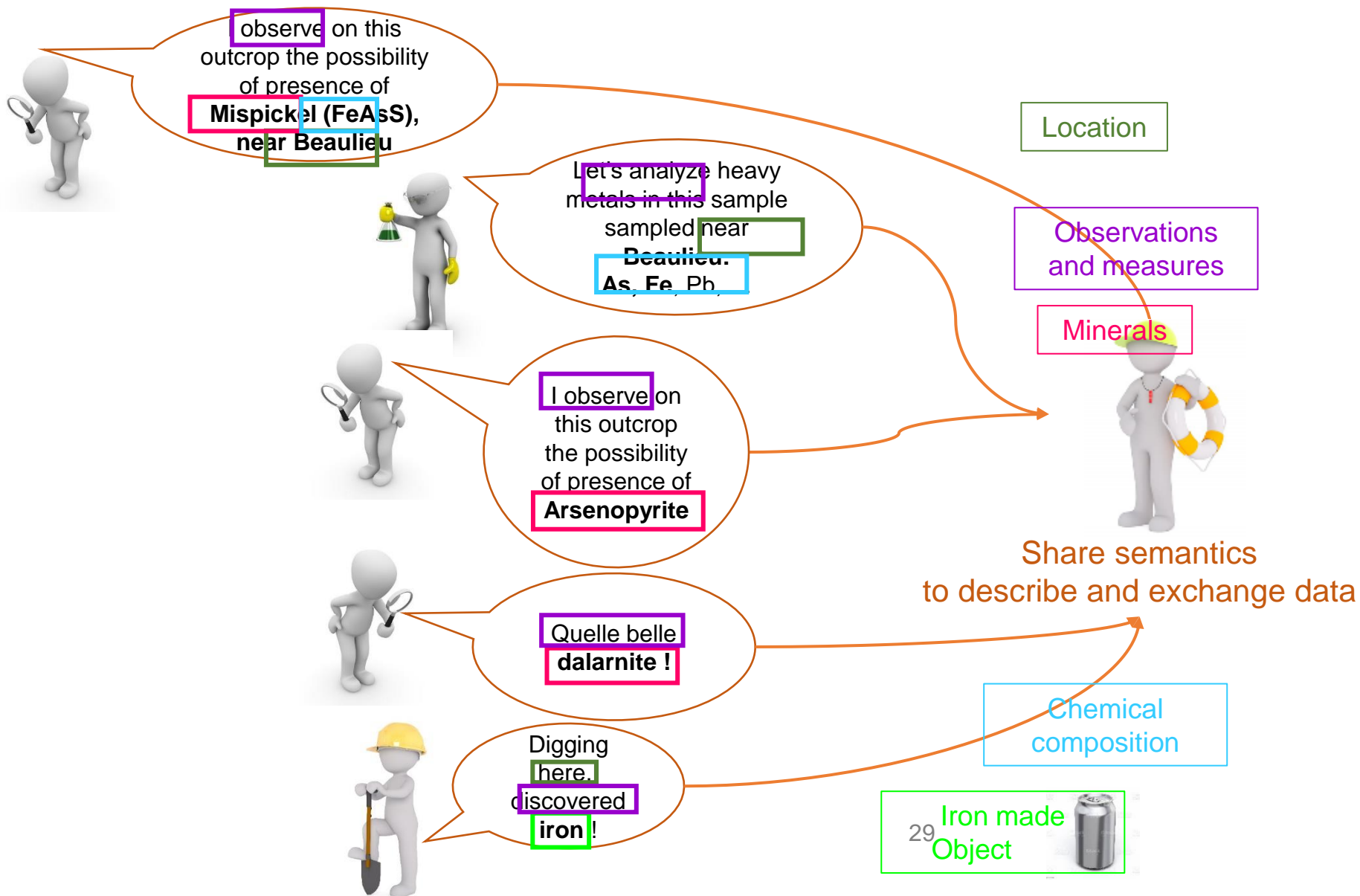
Why do we need interoperability -> geoscience example



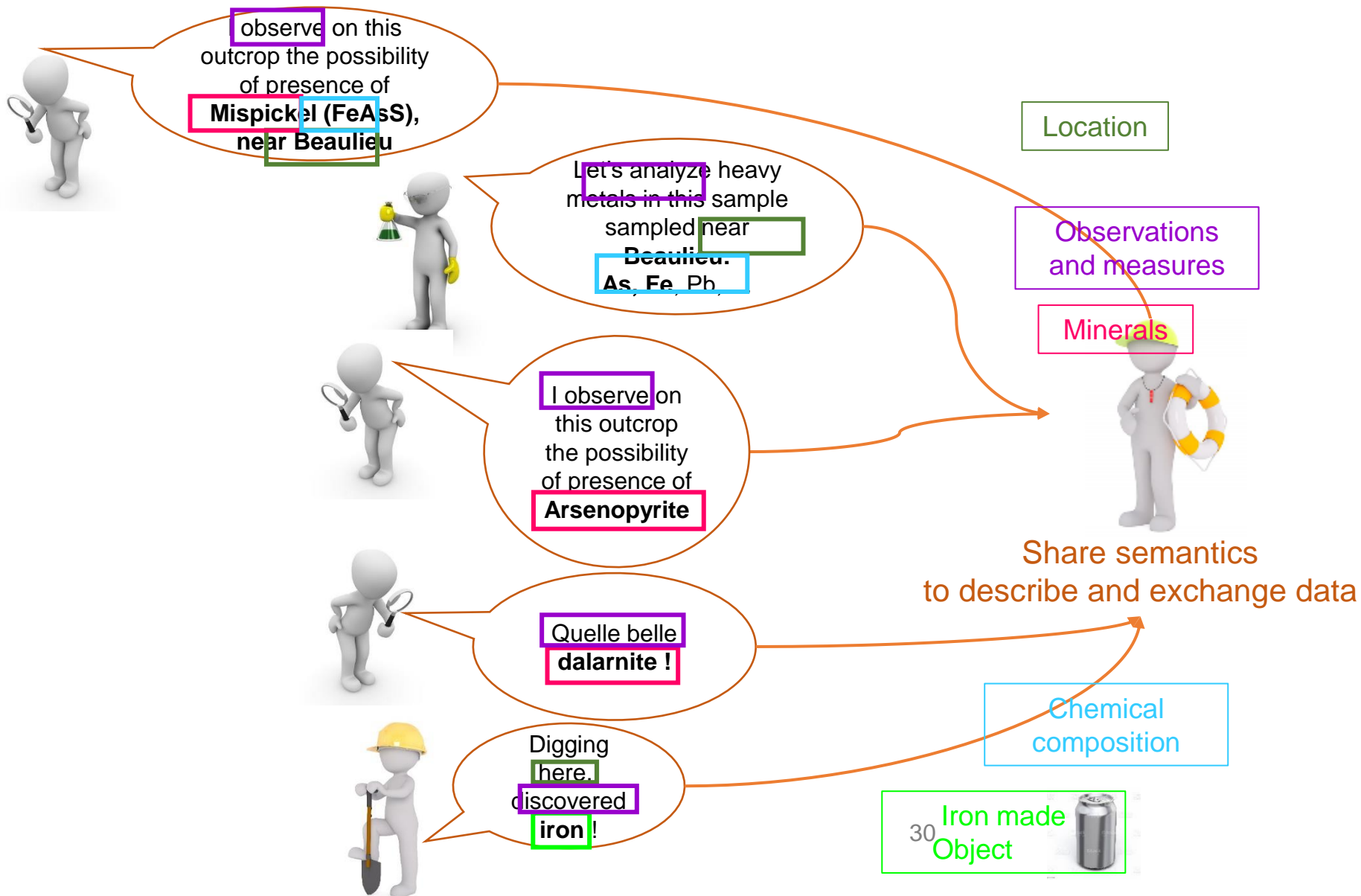
Why do we need interoperability -> geoscience example



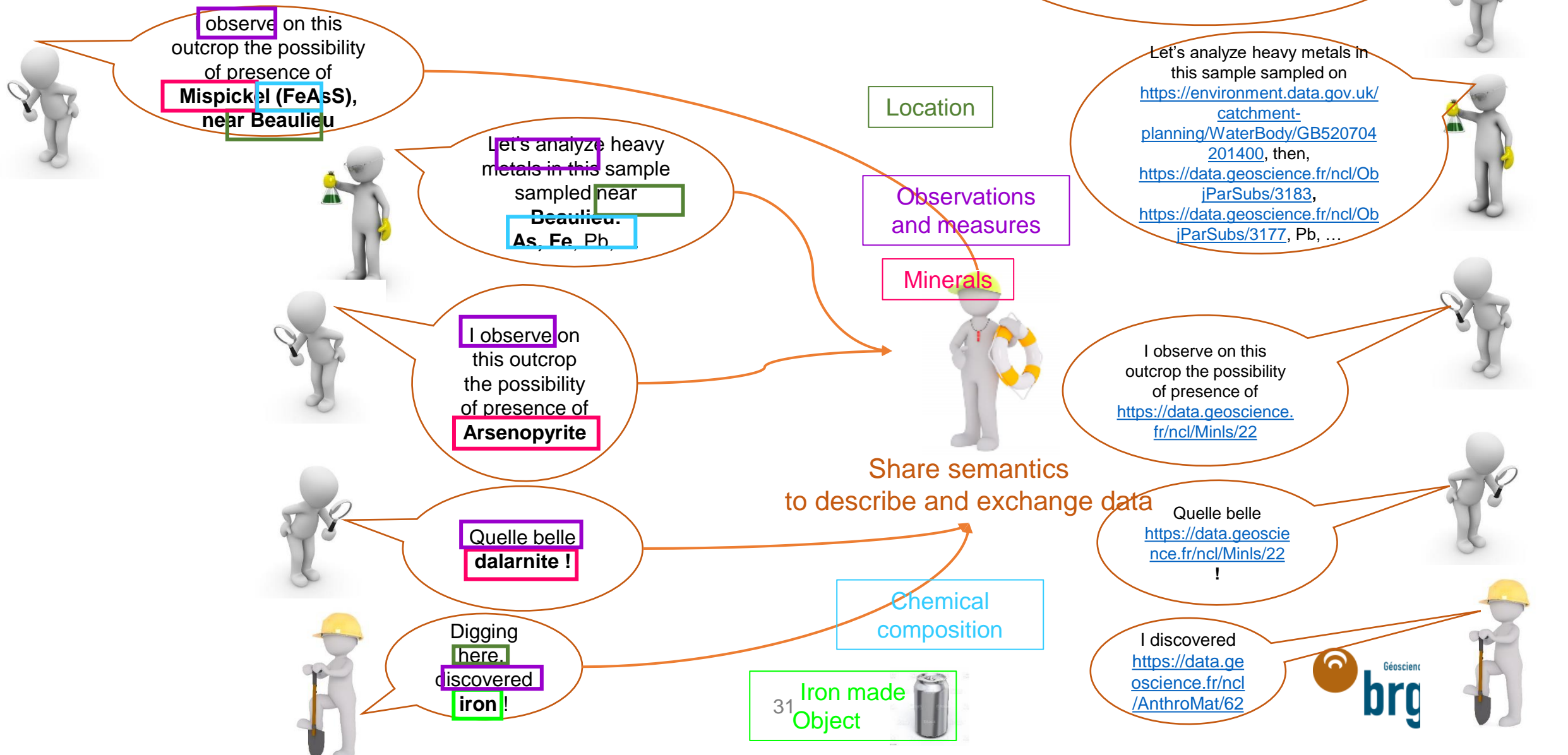
Why do we need interoperability -> geoscience example



Why do we need interoperability -> geoscience example



Why do we need interoperability



do we need interoperability -> geoscience example

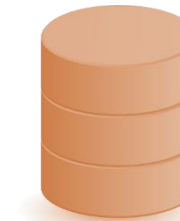
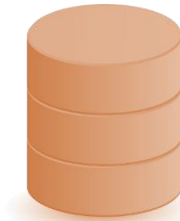
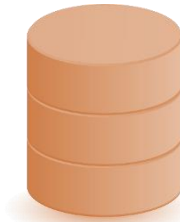
I observe on this outcrop the possibility of presence of <https://data.geoscience.fr/ncl/Minls/22> (FeAsS), near <http://id.insee.fr/geo/commune/15020>

Let's analyze heavy metals in this sample sampled on <https://environment.data.gov.uk/catchment-planning/WaterBody/GB520704201400>, then, <https://data.geoscience.fr/ncl/ObjParSubs/3183>, <https://data.geoscience.fr/ncl/ObjParSubs/3177>, Pb, ...

I observe on this outcrop the possibility of presence of <https://data.geoscience.fr/ncl/Minls/22>

Quelle belle <https://data.geoscience.fr/ncl/Minls/22> !

I discovered <https://data.geoscience.fr/ncl/AnthroMat/62>



Share semantics to describe and exchange data

do we need interoperability -> geoscience example

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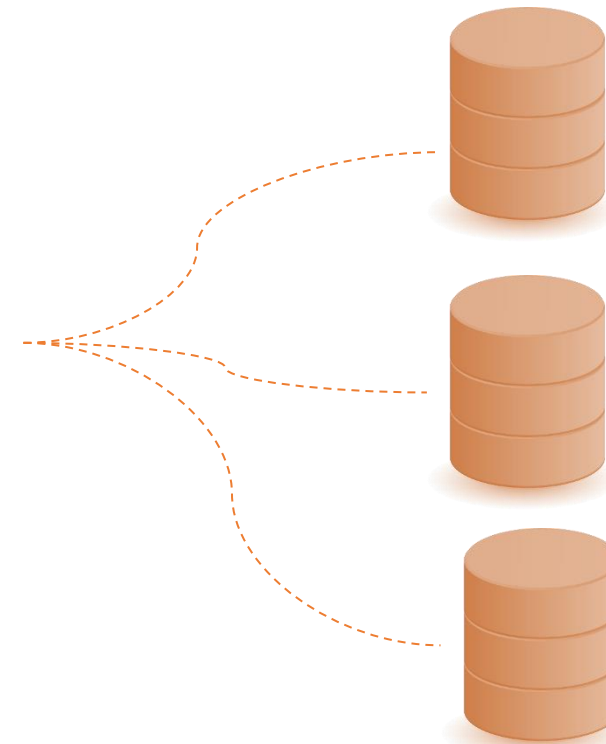
Let's analyze heavy metals in this sample sampled on <https://environment.data.gov.uk/catchment-planning/WaterBody/GB520704201400>, then, <https://data.geoscience.fr/ncl/ObjParSubs/3183>, <https://data.geoscience.fr/ncl/ObjParSubs/3177>, Pb, ...

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Interoperable data



Share semantics to describe and exchange data

do we need interoperability -> geoscience example

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Interoperable data

No more siloed data

Share semantics to describe and exchange data

do we need interoperability -> geoscience example



I observe on this outcrop the possibility of presence of <https://data.geoscience.fr/ncl/Minls/22> (FeAsS), near <http://id.insee.fr/geo/commune/15020>



Let's analyze heavy metals in this sample sampled on <https://environment.data.gov.uk/catchment-planning/WaterBody/GB520704201400>, then, <https://data.geoscience.fr/ncl/ObjParSubs/3183>, <https://data.geoscience.fr/ncl/ObjParSubs/3177>, Pb, ...



I observe on this outcrop the possibility of presence of <https://data.geoscience.fr/ncl/Minls/22>



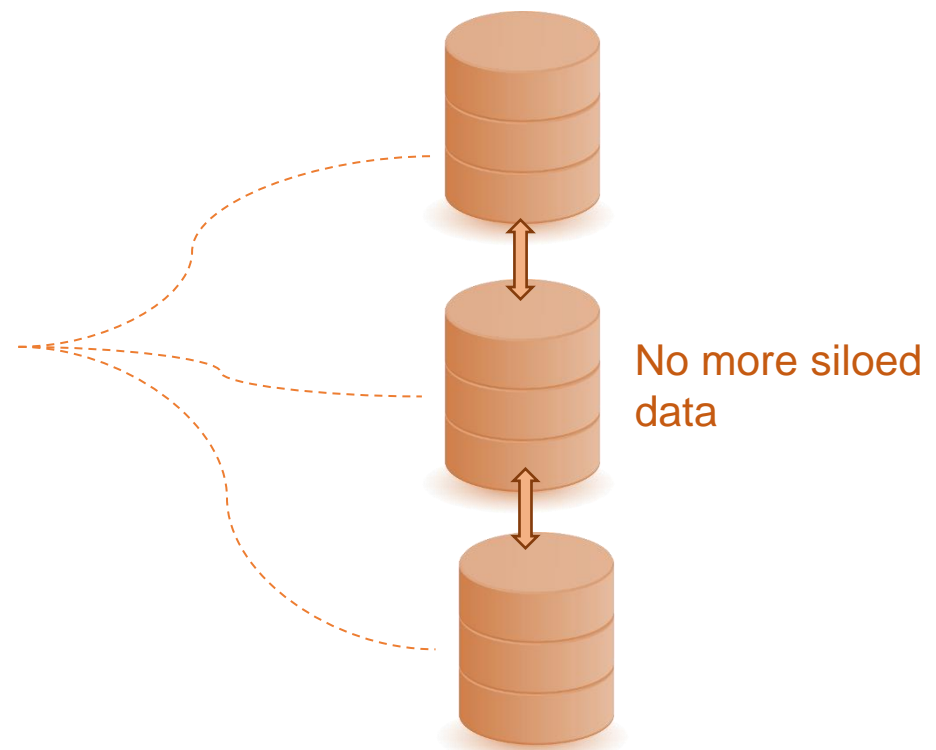
Quelle belle <https://data.geoscience.fr/ncl/Minls/22> !



I discovered <https://data.geoscience.fr/ncl/AnthroMat/62>



Interoperable data



Share semantics to describe and exchange data

Why do we need interoperability -> space example

- Lead to the creation of OGC SWE – Sensor Web Enablement standards

Sensor Metadata!

Wired Nov. 10, 1999: Metric Math Mistake Muffed Mars Meteorology Mission

LISA GROSSMAN 11-10-99 07:00 AM

NOV. 10, 1999: METRIC MATH MISTAKE MUFFED MARS METEOROLOGY MISSION



BBC ONLINE NETWORK HOMEPAGE | SITEMAP | SCHEDULES | BBC INFORMATION | BBC EDUCATION | BBC WORLD SERVICE

BBC NEWS

News in Audio News in Video Newyddion Новости Noticias أخبار 国际新闻 粵語廣播

Thursday, September 30, 1999 Published at 18:53 GMT 19:53 UK

Sci/Tech

Confusion leads to Mars failure

The Mars Climate Orbiter: Now in pieces on the planet's surface

The Mars Climate Orbiter Spacecraft was lost because one Nasa team used imperial units while another used metric units for a key spacecraft operation.

Feedback
Low Graphics
Help

Sci/Tech Contents

Relevant Stories

- 24 Sep 99 | Sci/Tech [Scientist fights Mars setback](#)
- 23 Sep 99 | Sci/Tech [Mars probe feared destroyed](#)
- 23 Sep 99 | Sci/Tech [What the loss of Mars Climate Orbiter means](#)
- 17 Jul 99 | Sci/Tech [Astronauts call for Mars mission](#)

Internet Links

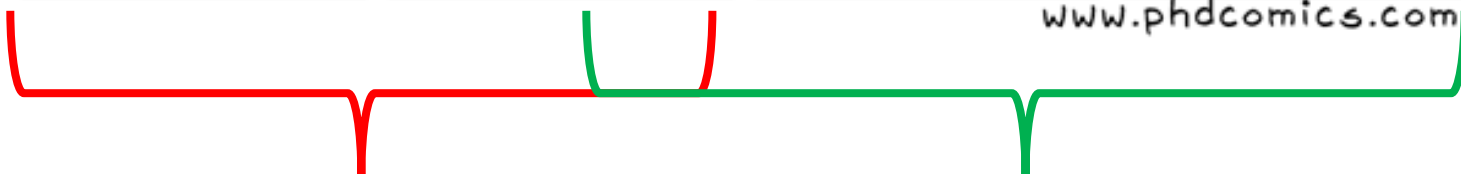
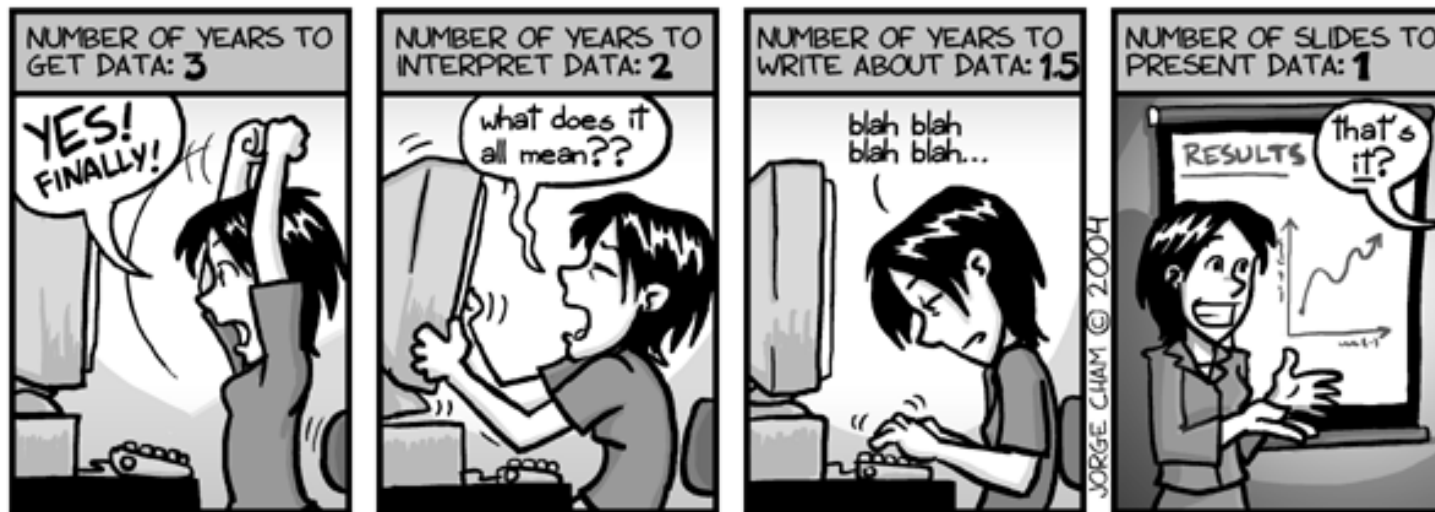
[Mars Climate Orbiter](#)

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Why do we need interoperability -> Research example



DATA: BY THE NUMBERS



Interoperability / FAIR data

for our domain colleagues do to their real work

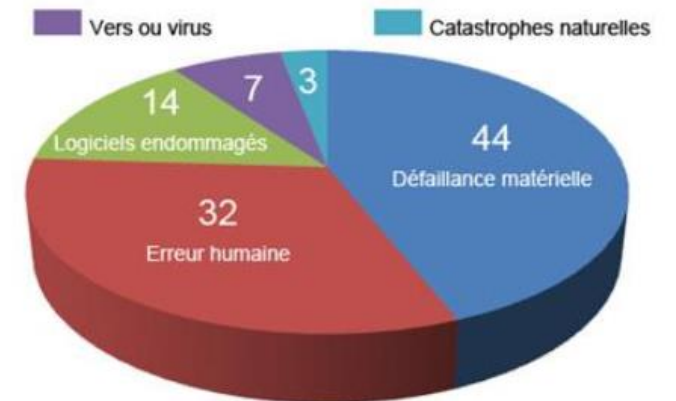
Why do we need interoperability -> Research example

20 years after publication, 80% of scientific data is lost

— III. Données de la recherche : pourquoi les gérer ?

20 ans après publication, 80 % des données scientifiques sont perdues...

- Pour les auteurs
- Pour les équipes, organismes, institutions
- Pour la recherche mondiale
- **Causes :**
 - Destruction des supports
 - Problème de version, obsolescence matérielle ou logicielle
 - Lieu de stockage indéfini
- **Conséquences :**
 - Perte de temps, d'argent (fonds publics...)
 - Pas de vérification des résultats possible
 - Pas de comparaison des résultats dans le temps ou l'espace
 - Pas de réutilisations (différentes)



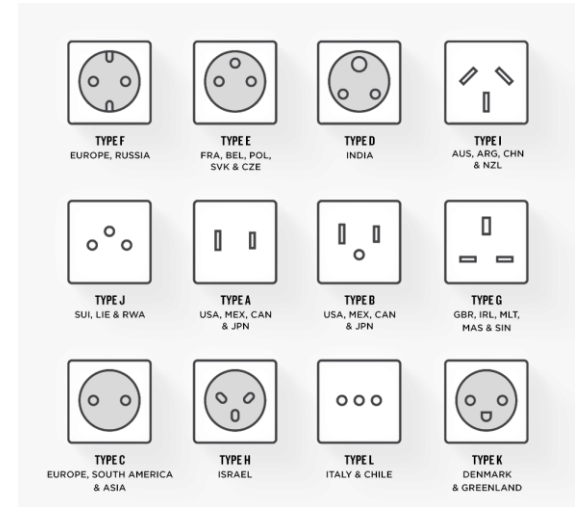
Why do we need interoperability

It's everywhere in our daily life

- Simple thing done everyday



Simple because normalized, we can easily plug our kettle at home or at the office



Adaptators exist when need be

- Shared driving signs*



With local specificities



* let's not discuss who is driving on the good(right) side of the road please ☺

Dream goal

Let's see what we could do if everyone played the interoperability game

- QGIS

The screenshot shows the QGIS interface with the XML view of an EnvironmentalMonitoringFacility entity. The XML structure is as follows:

```
fid http://ressource.brgm-rec.fr/data/Piezometre/06512X0037/STREMY.2
Element Value
  gml:TimePeriod
    @gml:id ObservingCapability.TimePeriod.14636
    gml:beginPosition 1977-10-06T13:00:00Z
    gml:endPosition 2018-03-30T02:00:00Z
  ef:processType
    @xlink:href http://inspire.ec.europa.eu/codelist/ProcessType/Value/process/
    @xlink:title Process
  ef:resultNature
    @xlink:href http://inspire.ec.europa.eu/codelist/ResultNature/Value/primary/
    @xlink:title primary
  ef:procedure
  ef:featureOfInterest
    @xlink:href http://ressource.brgm-rec.fr/data/EntiteHydroGeol/507AC00
    @xlink:title Entite hydrogeologique 507AC00
  ef:observedProperty
    @xlink:href http://ressource.brgm-rec.fr/data/somePath
    @xlink:title GroundWater.Level
  ef:broader
  ef:supersedes
  ef:supersededBy
  ef:reportedTo
    @nilReason http://inspire.ec.europa.eu/codelist/VoidReason/Value/Unpopulated
    @xsi:nil true
  ef:hasObservation
    @xlink:href http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06512X0037/STREMY.2&responseFormat=http://www.opengis.net/waterml/2.0&temporalFilter=om%3AphenomenonTime%2Clatest
    @xlink:title Latest value (WaterML 2.0 format): Raw groundwater level measurement from piezometer 06512X0037/STREMY.2
  ef:hasObservation
    @xlink:href http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06512X0037/STREMY.2&responseFormat=application/json&temporalFilter=om%3AphenomenonTime%2Clatest
    @xlink:title Latest value (JSON format): Raw groundwater level measurement from piezometer 06512X0037/STREMY.2
  ef:hasObservedProperty
    @xlink:href http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06512X0037/STREMY.2&responseFormat=http://www.opengis.net/waterml/2.0
    @xlink:title Latest value (WaterML 2.0 format): Raw groundwater level measurement from piezometer 06512X0037/STREMY.2
  ef:hasObservedProperty
    @xlink:href http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06512X0037/STREMY.2&MergeObservationsIntoDataArray=true
    @xlink:title groundwater level measurement from piezometer 06512X0037/STREMY.2
  ef:involvedIn
  ef:representativePoint
    gml:Point
      @srsDimension
```

The context menu is open over the URI `http://ressource.brgm-rec.fr/obs/RawOfferingPiezo/06512X0037/STREMY.2&responseFormat=http://www.opengis.net/waterml/2.0`, showing options like Copy value, Copy XPath, Resolve external, Swap X/Y, Embedded, and As a new layer.

The diagram on the right shows a flow from Borehole Index to Env. Monitoring Facility, which then connects to Observations / logs and Geology / HydroGeology.

Dereferencing related raw ground water level timeseries URI

See :

https://github.com/BRGM/gml_application_schema_toolbox/tree/master/docs/presentations/2018_INSPIRE_conference



Dream goal

Let's see what we could do if everyone played the interoperability game

- Linked data aware web client

Enter BRGM linked data resource URI here... OR

```
{}
"@id": "https://opengeospatial.github.io/ELFIE/FR/HY-WaterBody/sgwIEE-009-",
"@type": "HY_WaterBody",
"name": "La Somme Canalisée",
"fsp:hasGeometry": {
  "@type": "fsp:Geometry",
  "fsp:asWKT": "MULTILINESTRING((3 13347982042203 49 7409931557826 3 133170628680 49 7409863061587 3 13214210011018 49 7410646964317 3 1252874658722 49 7415840788399 3 1246553611381 49 74163055031 3 12161265730084 49 741860943894)(3 12161265730084 49 741860943894 3 12122729092244 49 741890079681)(3 06976861191596 49 7425710354124 3 06893673695938 49 7425768998422)(3 15918689153231 49 7427682536191 3 1586460279536 49 7422442393435 3 15275264729804 49 7419408914488 3 14587342803432 49 7415872285919 3 13899429797443 49 7412304817264 3 13556933117711 49 7410537433805 3 13490236704776 49 7410194423897 3 13347982042203 49 7409931557826)(3 12122729092244 49 741890079681 3 11843407483668 49 7421012769724 3 1115791627624
```

https://opengeospatial.github.io/ELFIE/FR/HY-WaterBody/sgwIEE-009-

http://opengeospatial/ontology/gem2#GW_HydrogeoUnit http://www.opengis.net/ontology/geom name http://opengeospatial/ontology/hy/HY_WaterBody Stabilize

River network traversed to its mouth

```
graph TD
    A("La Somme Canalisée") -- hydlowstreamWaterBody --> B("https://opengeospatial.github.io/ELFIE/FR/HY-WaterBody/sgwIEE390952")
    B -- hydlowstreamWaterBody --> C("https://opengeospatial.github.io/ELFIE/FR/HY-WaterBody/sgwIEE390710")
    C -- hydlowstreamWaterBody --> D("Rivière d'Haloué")
    E("Crue du Sêno-Turonien en Artois-Picardie") -- related --> D
    F("Crue du Sêno-Turonien en Artois-Picardie") -- related --> G("https://opengeospatial.github.io/ELFIE/FR/GW-HydrogeoUnit/sgw121AT")
```

https://opengeospatial.github.io/ELFIE/demo/surface_groundwater_network_interaction

Interoperability

Benefits

- 2 folds aspects
 - Either we have legal constraints (Re INSPIRE and FAIR presentation)
 - But when no constraints exist, how to set up a Data Sharing culture?

- Creating the necessary organizational context to opening / sharing data is already quite an endeavor
 - So, when this point is reached, the technical aspects should be straightforward.

Interoperability

Context

- More and more external pressure on organisations
 - Climate change
 - Health crisis
 - Reduced (public) fundings

=> Organizations cannot afford to reinvent their own wheel locally when it comes down to sharing data

- Even more when we have 90% of the solutions at hand
 - Experience shows that it's not a matter of IT issues (those can always be fixed)
 - It's a matter of organizing communities & changing behaviours

=> Let's explore how to do so

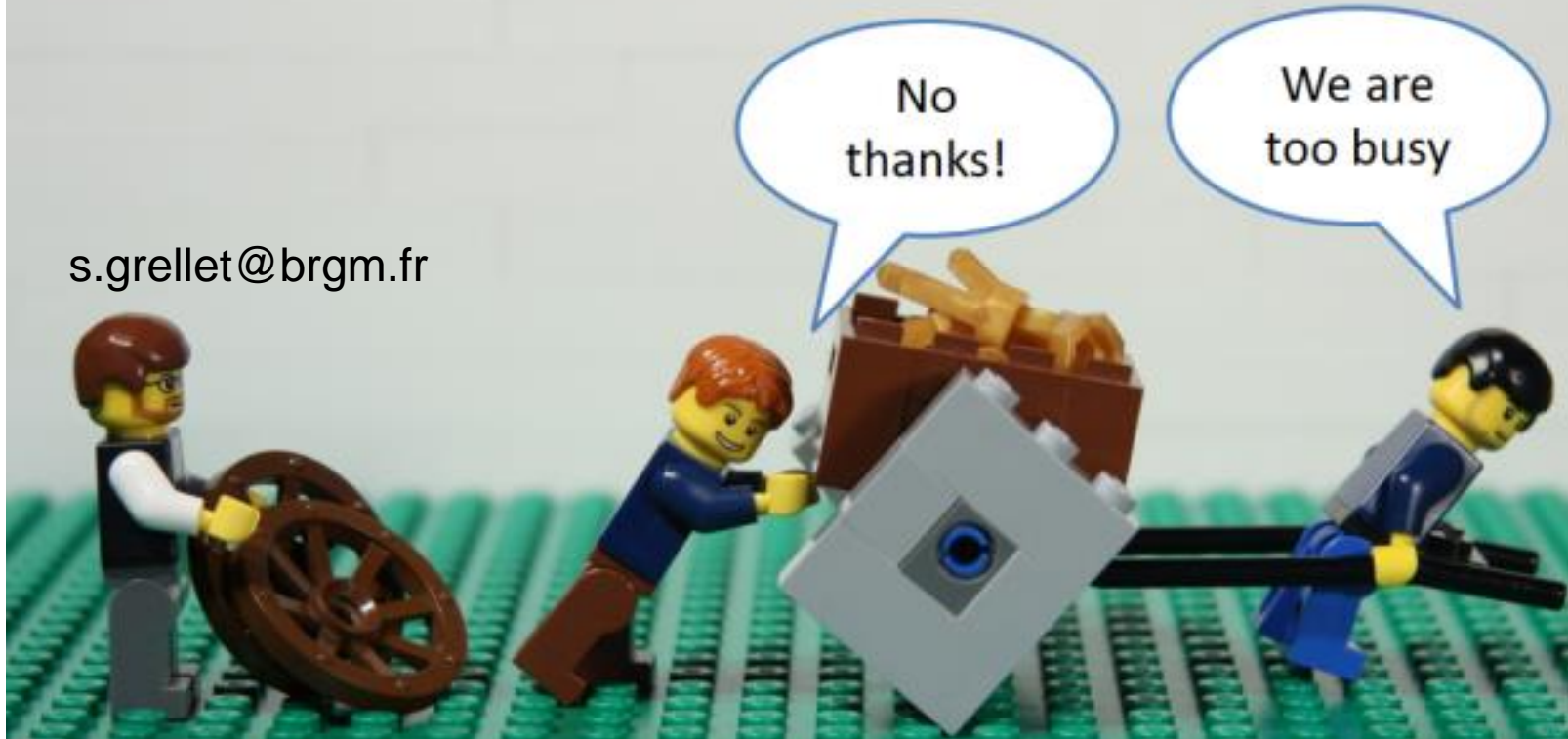
With local specificities

Thank you



Are you too busy to improve?

s.grellet@brgm.fr



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This illustration is inspired by and in part derived from the work by Scott Simmerman, "The Square Wheels Guy" <http://www.performancecompany.com/>

Thanks to

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