



Organization and implementation of an INSPIRE registry in France

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Organization and implementation of an INSPIRE registry in France

Etienne Taffoureau, BRGM



Géosciences pour une Terre durable

brgm

Outline

- > Framework
- > Organization and methodology for implementing a French Registry
- > An example of BRGM register
- > The BRGM approach to registry implementation
- > Re3gistry & UKGovLD features
- > Conclusions & perspectives

Framework

- > **Article 10** of the Directive requires that Member States ensure that **any information, including data, codes and technical classifications**, needed for compliance with the Directive **are made available to public authorities or third parties**.
- > Delivery against this article is being achieved through **the creation of a French Registry within geocatalogue.fr**. This will provide Data Publishers with access to code lists and other reference data and schemas required at a FR level and not located at other sources, e.g. the EC INSPIRE geoportal.
- > INSPIRE includes only one legal obligation related to registers: **extensions by data providers of the code lists** mandated in Commission Regulation (EU) No 1089/2010 on interoperability of spatial data sets and services need to be published in registers.
- > However, MS and thematic communities are setting up **registers for other purposes** as well, e.g. to have **a single repository of all organizations** in a MS responsible for implementing INSPIRE, including their unique identifiers. In general, registers are useful in all situations where, by a reference code rather than free text, in data exchange, ambiguities or inconsistencies can be avoided. Also registers can facilitate the internationalization of user interfaces by providing multilingual labels.



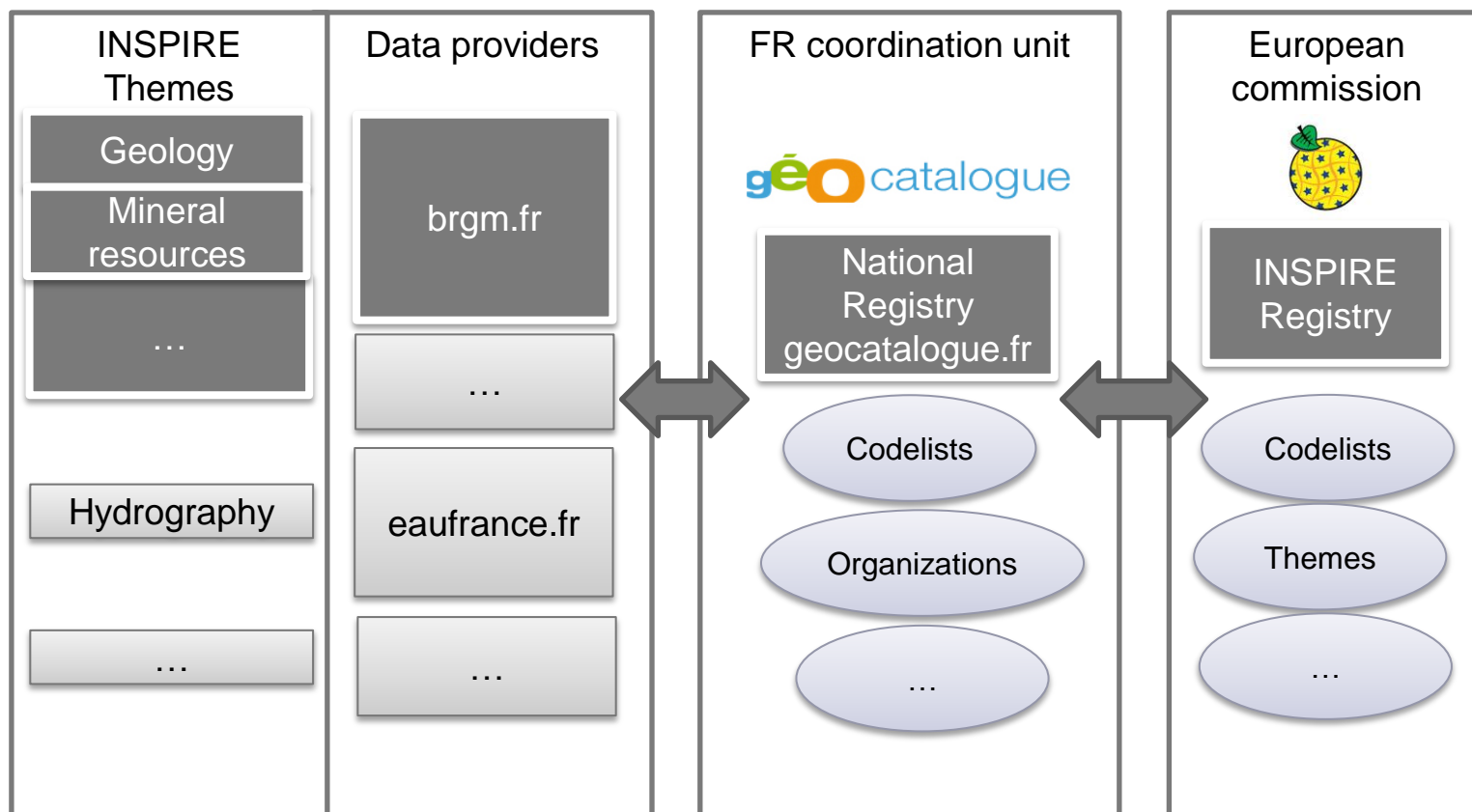
A geological map of the Monts d'Ardenne region, showing various geological units and structures. The map is overlaid with a 3D wireframe model. The title "Organization and methodology for implementing a French Registry" is centered over the map. The map includes labels for geological units such as h3c, h3a-b, h3a, h3, h3b, h3d, h3e, h3f, h3g, h3h, h3i, h3j, h3k, h3l, h3m, h3n, h3o, h3p, h3q, h3r, h3s, h3t, h3u, h3v, h3w, h3x, h3y, h3z, h3aa, h3ab, h3ac, h3ad, h3ae, h3af, h3ag, h3ah, h3ai, h3aj, h3ak, h3al, h3am, h3an, h3ao, h3ap, h3aq, h3ar, h3as, h3at, h3au, h3av, h3aw, h3ax, h3ay, h3az, h3ba, h3bb, h3bc, h3bd, h3be, h3bf, h3bg, h3bh, h3bi, h3bj, h3bk, h3bl, h3bm, h3bn, h3bo, h3bp, h3bq, h3br, h3bs, h3bt, h3bu, h3bv, h3bw, h3bx, h3by, h3bz, h3ca, h3cb, h3cc, h3cd, h3ce, h3cf, h3cg, h3ch, h3ci, h3cj, h3ck, h3cl, h3cm, h3cn, h3co, h3cp, h3cq, h3cr, h3cs, h3ct, h3cu, h3cv, h3cw, h3cx, h3cy, h3cz, h3da, h3db, h3dc, h3dd, h3de, h3df, h3dg, h3dh, h3di, h3dj, h3dk, h3dl, h3dm, h3dn, h3do, h3dp, h3dq, h3dr, h3ds, h3dt, h3du, h3dv, h3dw, h3dx, h3dy, h3dz, h3ea, h3eb, h3ec, h3ed, h3ee, h3ef, h3eg, h3eh, h3ei, h3ej, h3ek, h3el, h3em, h3en, h3eo, h3ep, h3eq, h3er, h3es, h3et, h3eu, h3ev, h3ew, h3ex, h3ey, h3ez, h3fa, h3fb, h3fc, h3fd, h3fe, h3ff, h3fg, h3fh, h3fi, h3fj, h3fk, h3fl, h3fm, h3fn, h3fo, h3fp, h3fq, h3fr, h3fs, h3ft, h3fu, h3fv, h3fw, h3fx, h3fy, h3fz, h3ga, h3gb, h3gc, h3gd, h3ge, h3gf, h3gg, h3gh, h3gi, h3gj, h3gk, h3gl, h3gm, h3gn, h3go, h3gp, h3gq, h3gr, h3gs, h3gt, h3gu, h3gv, h3gw, h3gx, h3gy, h3gz, h3ha, h3hb, h3hc, h3hd, h3he, h3hf, h3hg, h3hh, h3hi, h3hj, h3hk, h3hl, h3hm, h3hn, h3ho, h3hp, h3hq, h3hr, h3hs, h3ht, h3hu, h3hv, h3hw, h3hx, h3hy, h3hz, h3ia, h3ib, h3ic, h3id, h3ie, h3if, h3ig, h3ih, h3ii, h3ij, h3ik, h3il, h3im, h3in, h3io, h3ip, h3iq, h3ir, h3is, h3it, h3iu, h3iv, h3iw, h3ix, h3iy, h3iz, h3ja, h3jb, h3jc, h3jd, h3je, h3jf, h3jg, h3jh, h3ji, h3jj, h3jk, h3jl, h3jm, h3jn, h3jo, h3jp, h3jq, h3jr, h3js, h3jt, h3ju, h3jv, h3jw, h3jx, h3jy, h3jz, h3ka, h3kb, h3kc, h3kd, h3ke, h3kf, h3kg, h3kh, h3ki, h3kj, h3kk, h3kl, h3km, h3kn, h3ko, h3kp, h3kq, h3kr, h3ks, h3kt, h3ku, h3kv, h3kw, h3kx, h3ky, h3kz, h3la, h3lb, h3lc, h3ld, h3le, h3lf, h3lg, h3lh, h3li, h3lj, h3lk, h3ll, h3lm, h3ln, h3lo, h3lp, h3lq, h3lr, h3ls, h3lt, h3lu, h3lv, h3lw, h3lx, h3ly, h3lz, h3ma, h3mb, h3mc, h3md, h3me, h3mf, h3mg, h3mh, h3mi, h3mj, h3mk, h3ml, h3mm, h3mn, h3mo, h3mp, h3mq, h3mr, h3ms, h3mt, h3mu, h3mv, h3mw, h3mx, h3my, h3mz, h3na, h3nb, h3nc, h3nd, h3ne, h3nf, h3ng, h3nh, h3ni, h3nj, h3nk, h3nl, h3nm, h3nn, h3no, h3np, h3nq, h3nr, h3ns, h3nt, h3nu, h3nv, h3nw, h3nx, h3ny, h3nz, h3oa, h3ob, h3oc, h3od, h3oe, h3of, h3og, h3oh, h3oi, h3oj, h3ok, h3ol, h3om, h3on, h3oo, h3op, h3oq, h3or, h3os, h3ot, h3ou, h3ov, h3ow, h3ox, h3oy, h3oz, h3pa, h3pb, h3pc, h3pd, h3pe, h3pf, h3pg, h3ph, h3pi, h3pj, h3pk, h3pl, h3pm, h3pn, h3po, h3pp, h3pq, h3pr, h3ps, h3pt, h3pu, h3pv, h3pw, h3px, h3py, h3pz, h3qa, h3qb, h3qc, h3qd, h3qe, h3qf, h3qg, h3qh, h3qi, h3qj, h3qk, h3ql, h3qm, h3qn, h3qo, h3qp, h3qq, h3qr, h3qs, h3qt, h3qu, h3qv, h3qw, h3qx, h3qy, h3qz, h3ra, h3rb, h3rc, h3rd, h3re, h3rf, h3rg, h3rh, h3ri, h3rj, h3rk, h3rl, h3rm, h3rn, h3ro, h3rp, h3rq, h3rr, h3rs, h3rt, h3ru, h3rv, h3rw, h3rx, h3ry, h3rz, h3sa, h3sb, h3sc, h3sd, h3se, h3sf, h3sg, h3sh, h3si, h3sj, h3sk, h3sl, h3sm, h3sn, h3so, h3sp, h3sq, h3sr, h3ss, h3st, h3su, h3sv, h3sw, h3sx, h3sy, h3sz, h3ta, h3tb, h3tc, h3td, h3te, h3tf, h3tg, h3th, h3ti, h3tj, h3tk, h3tl, h3tm, h3tn, h3to, h3tp, h3tq, h3tr, h3ts, h3tt, h3tu, h3tv, h3tw, h3tx, h3ty, h3tz, h3ua, h3ub, h3uc, h3ud, h3ue, h3uf, h3ug, h3uh, h3ui, h3uj, h3uk, h3ul, h3um, h3un, h3uo, h3up, h3uq, h3ur, h3us, h3ut, h3uu, h3uv, h3uw, h3ux, h3uy, h3uz, h3va, h3vb, h3vc, h3vd, h3ve, h3vf, h3vg, h3vh, h3vi, h3vj, h3vk, h3vl, h3vm, h3vn, h3vo, h3vp, h3vq, h3vr, h3vs, h3vt, h3vu, h3vv, h3vw, h3vx, h3vy, h3vz, h3wa, h3wb, h3wc, h3wd, h3we, h3wf, h3wg, h3wh, h3wi, h3wj, h3wk, h3wl, h3wm, h3wn, h3wo, h3wp, h3wq, h3wr, h3ws, h3wt, h3wu, h3wv, h3ww, h3wx, h3wy, h3wz, h3xa, h3xb, h3xc, h3xd, h3xe, h3xf, h3xg, h3xh, h3xi, h3xj, h3xk, h3xl, h3xm, h3xn, h3xo, h3xp, h3xq, h3xr, h3xs, h3xt, h3xu, h3xv, h3xw, h3xx, h3xy, h3xz, h3ya, h3yb, h3yc, h3yd, h3ye, h3yf, h3yg, h3yh, h3yi, h3yj, h3yk, h3yl, h3ym, h3yn, h3yo, h3yp, h3yq, h3yr, h3ys, h3yt, h3yu, h3yv, h3yw, h3yx, h3yy, h3yz, h3za, h3zb, h3zc, h3zd, h3ze, h3zf, h3zg, h3zh, h3zi, h3zj, h3zk, h3zl, h3zm, h3zn, h3zo, h3zp, h3zq, h3zr, h3zs, h3zt, h3zu, h3zv, h3zw, h3zx, h3zy, h3zz.

2113.21 5765 13 0

-1.89 3740.46 -625.5

Organization and methodology for implementing a French Registry

Organization for implementing a French Registry



Methodology for implementing of a French registry

> Identification of priority themes :

- Utility and Government Services
- Land Use & Land cover
- Area management/restriction/regulation zones and reporting units
- Biodiversity themes : Habitats and Biotopes, Species Distribution, Bio-geographical Regions
- Geology, Mineral resources, Natural risk zones, Hydrography, environmental monitoring facility, Production and Industrial Facilities, Agricultural and Aquaculture Facilities

> Identification of a workflow and methods (eg. for designing URI) for managing registers

> Test of registry opensource softwares (work in progress!) :

- Re3gistry (<https://joinup.ec.europa.eu/software/re3gistry>)
- UKGovLD (<https://github.com/UKGovLD>)

> Publication of the registry in a beta version (by the end of 2017)

> Set up of registers for extended INSPIRE code lists and link to the central INSPIRE code list register



An example of BRGM register

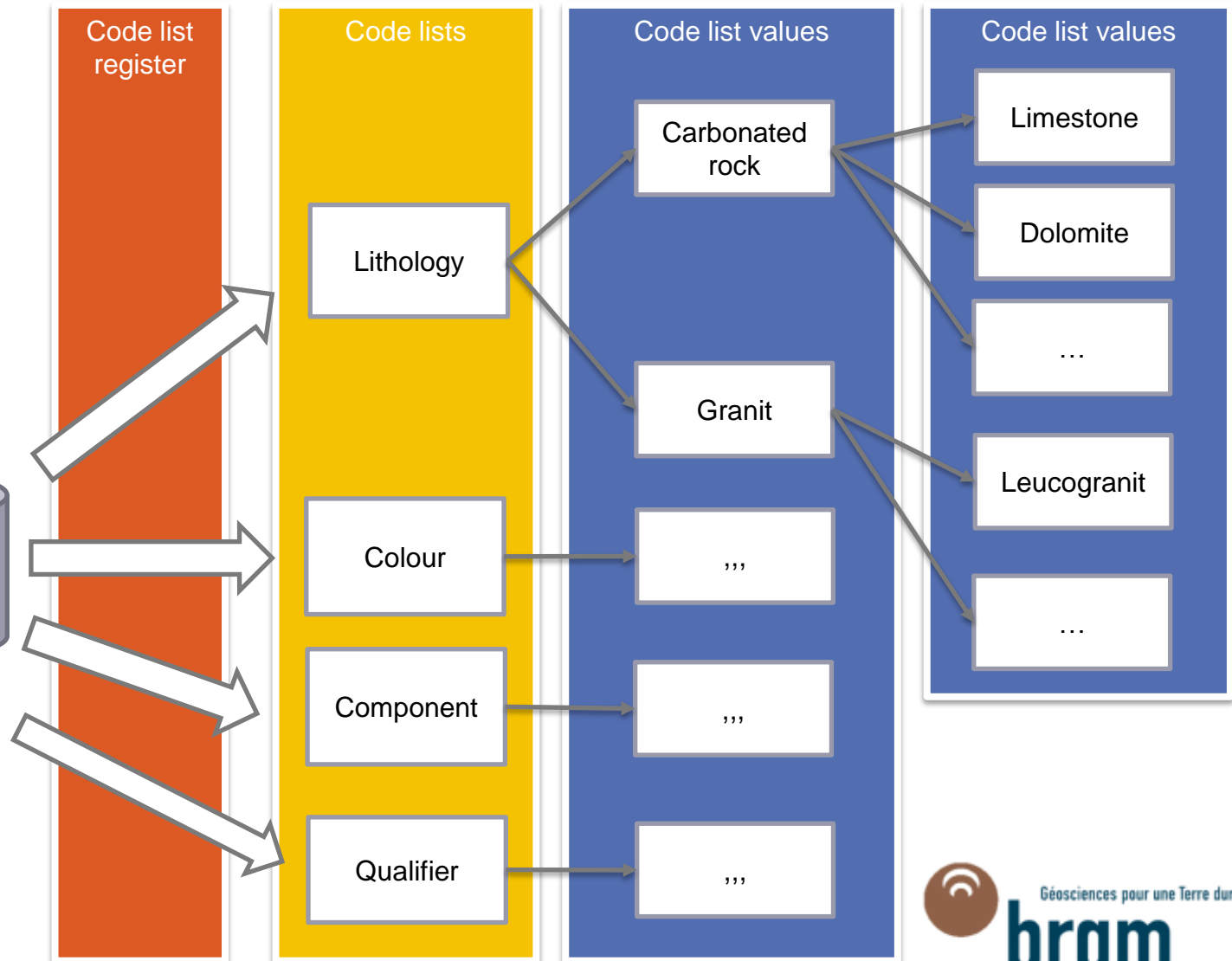
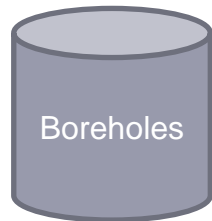
2113 21 5765 13 0

-1.89 3740 46 -625.5

INSPIRE Conference, Strasbourg, 2017-09-06

Example : Description of boreholes

Lithology =
lithology1 +
lithology2 +
colour +
component +
qualifier



BRGM registry : code list register

code list register

ID: <http://registry.brgm-rec.fr/codelist>

Label: **code list register**

Content Summary: The code list register contains the code lists and their values.

Owner: **BRGM**

Register manager: **BRGM**

Control body:

Submitter:

















Contact point: Contact BRGM

Licence: Non applicable

Other formats:



Code Lists

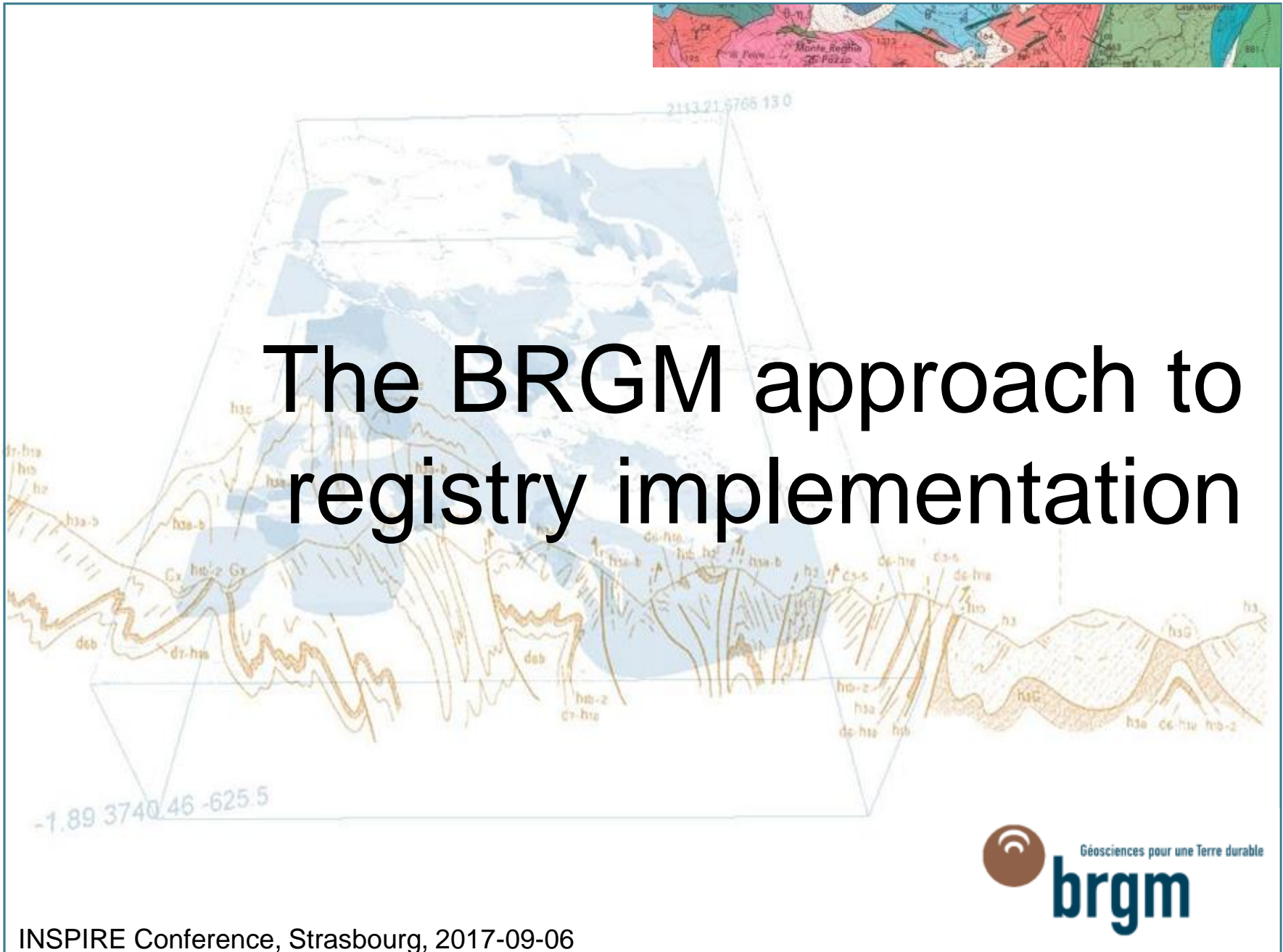
Filter Label	Filter Themes	Filter Status
Label	Themes	Status
Color 		Valid 
Composant 		Valid 
Deposit class 		Valid 
Gitology 		Valid 
Lithology 		Valid 
Lithostratigraphy 		Valid 
Morphology 		Valid 
Qualifiant 		Valid 

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The BRGM approach to registry implementation

INSPIRE Conference, Strasbourg, 2017-09-06

Best practices for registers & registries

>The BRGM approach is in accordance with "Best Practices for registers and registries & Technical Guidelines for the INSPIRE register federation"

(<https://inspire.ec.europa.eu/id/document/tg/registers-and-register-federation>):

- 1/ Use well defined roles, responsibilities and procedures for register management
- 2/ Use resolvable URIs (HTTP-URIs) as identifiers for registers and register items
- 3/ Use item classes
- 4/ Use well-defined statuses
- 5/ Do not delete items
- 6/ Provide registers in different formats
- 7/ Use content negotiation for serving registers available in multiple formats
- 8/ Provide registers in different languages

Best practice 1: Use well defined roles, responsibilities and procedures for register management

>The roles and responsibilities are defined in [ISO 19135-1] :

- **Register owner:** a register owner is an organization that has established one or more registers, and has primary responsibility for the management, dissemination and intellectual content of those registers.
- **Register manager:** a register owner may delegate the role of register manager to another organization. A register manager may manage multiple registers.
- **Submitting organizations:** a submitting organization is an organization that is qualified under criteria determined by the register owner to propose changes to the content of a register.
- **Control body:** a control body is a group of technical experts appointed by a register owner to decide on the acceptability of proposals for changes to the content of a register. A control body may not be required for simple registers.
- **Registry manager:** a registry manager is a person or an organization responsible for the day-to-day management of a registry. A register manager may engage a third-party service provider to perform this service.
- **Register user:** Register users access a registry in order to use one or more of the registers held in that registry. Register users include any person or organization interested in accessing or influencing the content of a register.

Roles, responsibilities and procedures for BRGM register management

code list register

ID: <http://registry.brgm-rec.fr/codelist>

Label: **code list register**

Content Summary: The code list register contains the code lists and their values.

Owner: **BRGM**

Register manager: **BRGM**

Control body:

Submitter:

















Contact point: Contact BRGM

Licence: Non applicable

Other formats:



Code Lists

Filter Label	Filter Themes	Filter Status
Label	Themes	Status
Color 		Valid 
Composant 		Valid 
Deposit class 		Valid 
Gitology 		Valid 
Lithology 		Valid 
Lithostratigraphy 		Valid 
Morphology 		Valid 
Qualifiant 		Valid 

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Best practice 2: Use resolvable URIs (HTTP-URIs) as identifiers for registers and register items

- The EU INSPIRE Directive calls for *“a common framework for the unique identification of spatial objects, to which identifiers under national systems can be mapped in order to ensure interoperability between them”*
- The codelist register is identified by the following HTTP URI:
<http://resource.brgm.fr/registry/codelist>
- The register item “lithology” in the codelist register is identified by the following HTTP URI:
<http://resource.brgm.fr/registry/codelist/lithologie>
- The register item “clay” in the codelist register is identified by the following HTTP URI:
<http://resource.brgm.fr/registry/codelist/lithology/SE024>
- Beyond the register requirements, a procedure for managing URI (to reference datasets, scientific publications, ...) is being created for BRGM

Best practice 3: Use item classes

> As the hierarchical INSPIRE register BRGM code list register contains two item classes, each with its own specific attributes:

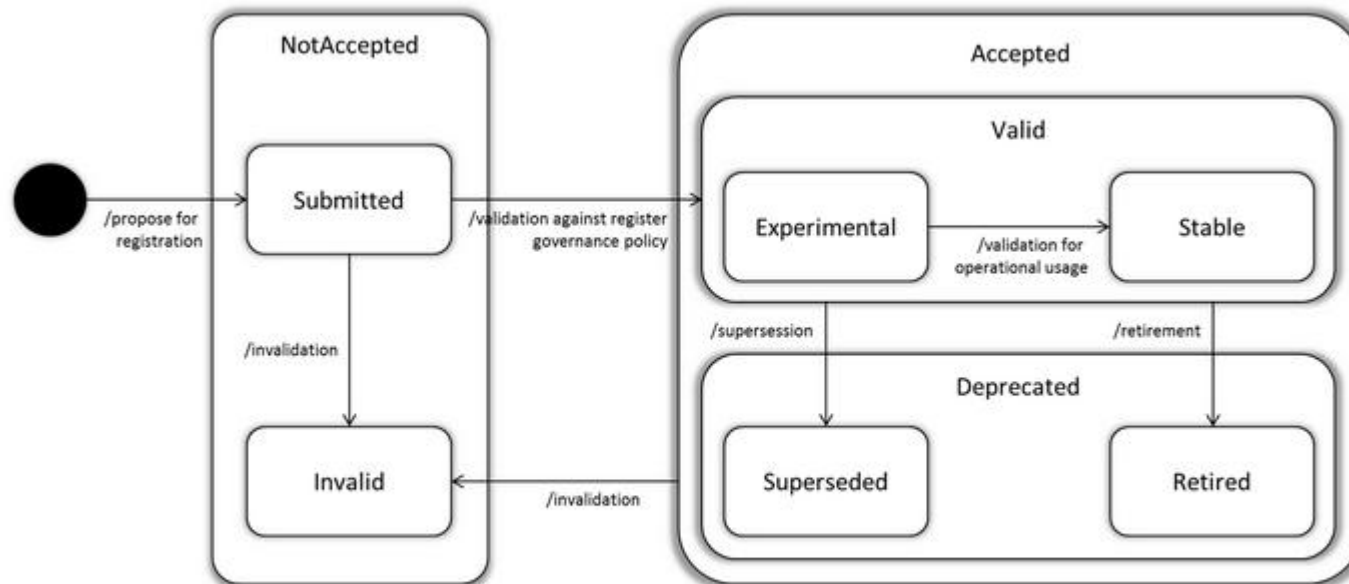
- Code list (containing e.g. information about the extensibility)
- Code list value
- Each codelist value can be associated with other values

Best practice 4: Use well-defined statuses

>The INSPIRE registry uses the following status values :

- **submitted:** The item has been entered into the register, but the control body has not accepted the proposal to add it.
- **valid:** The item has been accepted, is recommended for use, and has not been superseded or retired.
- **invalid:** A decision has been made that a previously valid register item contains a substantial error and is invalid, and will normally have been replaced by a corrected item.
- **retired:** A decision has been made that the item is no longer recommended for use. It has not been superseded by another item.
- **superseded:** The item has been superseded by another item and is no longer recommended for use.

Best practice 4: Use well-defined statuses



Note: entities with status 'NotAccepted' are not considered to be members of the register.

Note: entities with status 'Accepted' are considered to be members of the register and are included in the default response to a register READ request.

Note: it is permitted, albeit unusual to invalidate a deprecated entity.

UKgovLD status schema

Best practice 4: Use well-defined statuses

UKGovLD	Re3gistry	ISO 19135
notAccepted	-	notValid
submitted	submitted	submitted
reserved	-	flags a reserved entry, same semantics as submitted
invalid	invalid	invalid
accepted	-	-
valid	valid	-
experimental	-	the item is being trialed and might be withdrawn or replaced
stable	-	no change is currently anticipated
deprecated	-	-
superseded	superseded	superseded
retired	retired	retired

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Best practice 5: Do not delete items

- Instead of deleting items, a status that states the element as *retired* or *invalidated* shall be used (see previous slide)

Best practice 6: Provide registers in different formats

Registre de listes de codes Recherche...

Identifiant: <http://registry.brgm-rec.fr/codelist>

Etiquette: **Registre de listes de codes**

Résumé: Le registre de listes de codes contient les listes de codes et leurs valeurs.

Registre BRGM Browse About Advanced

<http://registry.brgm-rec.fr/ukgovld> / [codelist](#) / [_lithologie](#) stable

Register: lithologie

URI: <http://registry.brgm-rec.fr/ukgovld/codelist/lithologie>

Décrit la lithologie

Download formats available

RDF ttl	plain	with metadata
RDF/XML	plain	with metadata
JSON-LD	plain	with metadata
CSV	plain	with metadata
Export all	export	

[Core metadata](#)

[Reg metadata](#)

[All properties](#)

... currently empty

Developed by [Epimorphics Ltd](#)

Couleur		Validé
Gitologie		Validé
Lithologie		Validé
Lithostratigraphie		Validé
Morphologie		Validé
Qualifiant		Validé

Résultats par page Montrer 1 à 8 de 8 résultats

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Best practice 7: Use content negotiation for serving registers available in multiple formats

- **Both Re3gistry and UKGovLD softwares support content-negotiation. Different representations of the items can be served according to the content type specified in the Accept: header of the HTTP Request.**
- **The example below shows the call to the same resource with two different formats (RDF/XML and RDF/ttl).**
 - GET <http://registry.brgm-rec.fr/codelist/lithologie>
HTTP/1.1 Accept: application/rdf+xml
 - GET http://registry.brgm-rec.fr/ukgovld/codelist/_lithologie HTTP/1.1 Accept: application/turtle+xml

Best practice 8: Provide registers in different languages

>The registry system provides the information in multiple languages :

- It depends on the language of the user interface
- Default language is French
- Some code list values are available in English, eg. the morphology code list (“mineral resources” INSPIRE theme)

LEX MORPHOLOGIE

ID	PERE	FRANCAIS	ANGLAIS
A		Corps minéralisé primaire concordant à sub-concordant	Concordant to subconcordant primary orebody
A10	A	Couche	Bed
A11	A10	Couche stratiforme : mono ou multi-couches (syn-encaissant)	Stratiform bed: single or multi-layered (syn-depositional with host rock)
A12	A10	Couche stratoïde (mono ou multi-couches)	Stratabound bed (single or multi-layered)
A20	A	Amas, lentille, pod concordant à sub-concordant de minerai massif à sub-massif	Concordant to subconcordant mass, lens or pod of massive to submassive ore
A21	A20	Amas et lentille stratiformes (syn-encaissant) de minerai massif à sub-massif	Stratiform mass or lens of massive to submassive ore (syn-depositional with host rock)
A22	A20	Amas et lentille sub-concordants ou stratoïdes (stratabound) de minerai massif à sub-massif	Subconcordant or stratabound mass or lens of massive to submassive ore
A23	A20	Pod, corps podiforme	Pod, pod-shaped body



	Re3gistry v1.3	UKGovLD v1.2
Installation / configuration	Complex architecture Several components to install Not easy in a specific configuration	Easy to install and configure
Customization (formats & registers)	Flexible (via transformation files, underlying model) Not trivial	Flexible (based on linked-data principles) Not trivial
Customization (UI)	Not tested	Not tested
Documentation	https://ies-svn.jrc.ec.europa.eu/projects/registry-development No user guide for the UI	https://github.com/UKGovLD/registry-core/wiki No user guide for the UI
Support	https://ies-svn.jrc.ec.europa.eu/projects/registry-development/issues	https://github.com/UKGovLD/registry-core/issues
Editing UI	No (v2.0)	Yes
Import formats	CSV	RDF
Authentication method	ECAS, SHIRO	SHIRO, Google account
Export formats	XML (Re3gistry), RDF/XML, JSON, XML (ISO 19135), Atom, CSV	RDF turtle, RDF/XML, JSON, CSV
API	Read-only	Read / write
Content negotiation	Yes	Yes
Search engine	Solr	Solr
Performance	Not tested	Not tested
Security	Acunetix tests in progress Solr (v4.8) directly available by the client	Acunetix tests in progress

Conclusions & perspectives

- >Code lists and organizations registers have already been implemented**
- >Re3gistry and UKGovLD softwares have been tested:**
 - Both respond to need of publishing INSPIRE code lists
 - The CSV format is useful for importing data (UKGovLD needs a converter tool) but an editing mode is needful
 - They have common output formats (eg. XML/RDF) but the syntax is different
 - UKGovLD seems to be more adapted for a linked-data approach
- >The challenge is to set up of registers for extended INSPIRE code lists and link to the central INSPIRE code list register: harvest or reference scenario?**
- >A publication of a french registry in a beta version is expected by the end of 2017. To be continued...**



The background of the slide features a detailed geological map of the Monts d'Ardenne region. The map is oriented with North at the top. It shows various geological units labeled with codes such as 'h3a-b', 'h3c', 'h3d', 'h3e', 'h3f', 'h3g', 'h3h', 'h3i', 'h3j', 'h3k', 'h3l', 'h3m', 'h3n', 'h3o', 'h3p', 'h3q', 'h3r', 'h3s', 'h3t', 'h3u', 'h3v', 'h3w', 'h3x', 'h3y', 'h3z', 'h3aa', 'h3ab', 'h3ac', 'h3ad', 'h3ae', 'h3af', 'h3ag', 'h3ah', 'h3ai', 'h3aj', 'h3ak', 'h3al', 'h3am', 'h3an', 'h3ao', 'h3ap', 'h3aq', 'h3ar', 'h3as', 'h3at', 'h3au', 'h3av', 'h3aw', 'h3ax', 'h3ay', 'h3az', 'h3ba', 'h3bb', 'h3bc', 'h3bd', 'h3be', 'h3bf', 'h3bg', 'h3bh', 'h3bi', 'h3bj', 'h3bk', 'h3bl', 'h3bm', 'h3bn', 'h3bo', 'h3bp', 'h3bq', 'h3br', 'h3bs', 'h3bt', 'h3bu', 'h3bv', 'h3bw', 'h3bx', 'h3by', 'h3bz', 'h3ca', 'h3cb', 'h3cc', 'h3cd', 'h3ce', 'h3cf', 'h3cg', 'h3ch', 'h3ci', 'h3cj', 'h3ck', 'h3cl', 'h3cm', 'h3cn', 'h3co', 'h3cp', 'h3cq', 'h3cr', 'h3cs', 'h3ct', 'h3cu', 'h3cv', 'h3cw', 'h3cx', 'h3cy', 'h3cz', 'h3da', 'h3db', 'h3dc', 'h3dd', 'h3de', 'h3df', 'h3dg', 'h3dh', 'h3di', 'h3dj', 'h3dk', 'h3dl', 'h3dm', 'h3dn', 'h3do', 'h3dp', 'h3dq', 'h3dr', 'h3ds', 'h3dt', 'h3du', 'h3dv', 'h3dw', 'h3dx', 'h3dy', 'h3dz', 'h3ea', 'h3eb', 'h3ec', 'h3ed', 'h3ee', 'h3ef', 'h3eg', 'h3eh', 'h3ei', 'h3ej', 'h3ek', 'h3el', 'h3em', 'h3en', 'h3eo', 'h3ep', 'h3eq', 'h3er', 'h3es', 'h3et', 'h3eu', 'h3ev', 'h3ew', 'h3ex', 'h3ey', 'h3ez', 'h3fa', 'h3fb', 'h3fc', 'h3fd', 'h3fe', 'h3ff', 'h3fg', 'h3fh', 'h3fi', 'h3fj', 'h3fk', 'h3fl', 'h3fm', 'h3fn', 'h3fo', 'h3fp', 'h3fq', 'h3fr', 'h3fs', 'h3ft', 'h3fu', 'h3fv', 'h3fw', 'h3fx', 'h3fy', 'h3fz', 'h3ga', 'h3gb', 'h3gc', 'h3gd', 'h3ge', 'h3gf', 'h3gg', 'h3gh', 'h3gi', 'h3gj', 'h3gk', 'h3gl', 'h3gm', 'h3gn', 'h3go', 'h3gp', 'h3gq', 'h3gr', 'h3gs', 'h3gt', 'h3gu', 'h3gv', 'h3gw', 'h3gx', 'h3gy', 'h3gz', 'h3ha', 'h3hb', 'h3hc', 'h3hd', 'h3he', 'h3hf', 'h3hg', 'h3hh', 'h3hi', 'h3hj', 'h3hk', 'h3hl', 'h3hm', 'h3hn', 'h3ho', 'h3hp', 'h3hq', 'h3hr', 'h3hs', 'h3ht', 'h3hu', 'h3hv', 'h3hw', 'h3hx', 'h3hy', 'h3hz', 'h3ia', 'h3ib', 'h3ic', 'h3id', 'h3ie', 'h3if', 'h3ig', 'h3ih', 'h3ii', 'h3ij', 'h3ik', 'h3il', 'h3im', 'h3in', 'h3io', 'h3ip', 'h3iq', 'h3ir', 'h3is', 'h3it', 'h3iu', 'h3iv', 'h3iw', 'h3ix', 'h3iy', 'h3iz', 'h3ja', 'h3jb', 'h3jc', 'h3jd', 'h3je', 'h3jf', 'h3jg', 'h3jh', 'h3ji', 'h3jj', 'h3jk', 'h3jl', 'h3jm', 'h3jn', 'h3jo', 'h3jp', 'h3jq', 'h3jr', 'h3js', 'h3jt', 'h3ju', 'h3jv', 'h3jw', 'h3jx', 'h3jy', 'h3jz', 'h3ka', 'h3kb', 'h3kc', 'h3kd', 'h3ke', 'h3kf', 'h3kg', 'h3kh', 'h3ki', 'h3kj', 'h3kk', 'h3kl', 'h3km', 'h3kn', 'h3ko', 'h3kp', 'h3kq', 'h3kr', 'h3ks', 'h3kt', 'h3ku', 'h3kv', 'h3kw', 'h3kx', 'h3ky', 'h3kz', 'h3la', 'h3lb', 'h3lc', 'h3ld', 'h3le', 'h3lf', 'h3lg', 'h3lh', 'h3li', 'h3lj', 'h3lk', 'h3ll', 'h3lm', 'h3ln', 'h3lo', 'h3lp', 'h3lq', 'h3lr', 'h3ls', 'h3lt', 'h3lu', 'h3lv', 'h3lw', 'h3lx', 'h3ly', 'h3lz', 'h3ma', 'h3mb', 'h3mc', 'h3md', 'h3me', 'h3mf', 'h3mg', 'h3mh', 'h3mi', 'h3mj', 'h3mk', 'h3ml', 'h3mm', 'h3mn', 'h3mo', 'h3mp', 'h3mq', 'h3mr', 'h3ms', 'h3mt', 'h3mu', 'h3mv', 'h3mw', 'h3mx', 'h3my', 'h3mz', 'h3na', 'h3nb', 'h3nc', 'h3nd', 'h3ne', 'h3nf', 'h3ng', 'h3nh', 'h3ni', 'h3nj', 'h3nk', 'h3nl', 'h3nm', 'h3nn', 'h3no', 'h3np', 'h3nq', 'h3nr', 'h3ns', 'h3nt', 'h3nu', 'h3nv', 'h3nw', 'h3nx', 'h3ny', 'h3nz', 'h3oa', 'h3ob', 'h3oc', 'h3od', 'h3oe', 'h3of', 'h3og', 'h3oh', 'h3oi', 'h3oj', 'h3ok', 'h3ol', 'h3om', 'h3on', 'h3oo', 'h3op', 'h3oq', 'h3or', 'h3os', 'h3ot', 'h3ou', 'h3ov', 'h3ow', 'h3ox', 'h3oy', 'h3oz', 'h3pa', 'h3pb', 'h3pc', 'h3pd', 'h3pe', 'h3pf', 'h3pg', 'h3ph', 'h3pi', 'h3pj', 'h3pk', 'h3pl', 'h3pm', 'h3pn', 'h3po', 'h3pp', 'h3pq', 'h3pr', 'h3ps', 'h3pt', 'h3pu', 'h3pv', 'h3pw', 'h3px', 'h3py', 'h3pz', 'h3qa', 'h3qb', 'h3qc', 'h3qd', 'h3qe', 'h3qf', 'h3qg', 'h3qh', 'h3qi', 'h3qj', 'h3qk', 'h3ql', 'h3qm', 'h3qn', 'h3qo', 'h3qp', 'h3qq', 'h3qr', 'h3qs', 'h3qt', 'h3qu', 'h3qv', 'h3qw', 'h3qx', 'h3qy', 'h3qz', 'h3ra', 'h3rb', 'h3rc', 'h3rd', 'h3re', 'h3rf', 'h3rg', 'h3rh', 'h3ri', 'h3rj', 'h3rk', 'h3rl', 'h3rm', 'h3rn', 'h3ro', 'h3rp', 'h3rq', 'h3rr', 'h3rs', 'h3rt', 'h3ru', 'h3rv', 'h3rw', 'h3rx', 'h3ry', 'h3rz', 'h3sa', 'h3sb', 'h3sc', 'h3sd', 'h3se', 'h3sf', 'h3sg', 'h3sh', 'h3si', 'h3sj', 'h3sk', 'h3sl', 'h3sm', 'h3sn', 'h3so', 'h3sp', 'h3sq', 'h3sr', 'h3ss', 'h3st', 'h3su', 'h3sv', 'h3sw', 'h3sx', 'h3sy', 'h3sz', 'h3ta', 'h3tb', 'h3tc', 'h3td', 'h3te', 'h3tf', 'h3tg', 'h3th', 'h3ti', 'h3tj', 'h3tk', 'h3tl', 'h3tm', 'h3tn', 'h3to', 'h3tp', 'h3tq', 'h3tr', 'h3ts', 'h3tt', 'h3tu', 'h3tv', 'h3tw', 'h3tx', 'h3ty', 'h3tz', 'h3ua', 'h3ub', 'h3uc', 'h3ud', 'h3ue', 'h3uf', 'h3ug', 'h3uh', 'h3ui', 'h3uj', 'h3uk', 'h3ul', 'h3um', 'h3un', 'h3uo', 'h3up', 'h3uq', 'h3ur', 'h3us', 'h3ut', 'h3uu', 'h3uv', 'h3uw', 'h3ux', 'h3uy', 'h3uz', 'h3va', 'h3vb', 'h3vc', 'h3vd', 'h3ve', 'h3vf', 'h3vg', 'h3vh', 'h3vi', 'h3vj', 'h3vk', 'h3vl', 'h3vm', 'h3vn', 'h3vo', 'h3vp', 'h3vq', 'h3vr', 'h3vs', 'h3vt', 'h3vu', 'h3vv', 'h3vw', 'h3vx', 'h3vy', 'h3vz', 'h3wa', 'h3wb', 'h3wc', 'h3wd', 'h3we', 'h3wf', 'h3wg', 'h3wh', 'h3wi', 'h3wj', 'h3wk', 'h3wl', 'h3wm', 'h3wn', 'h3wo', 'h3wp', 'h3wq', 'h3wr', 'h3ws', 'h3wt', 'h3wu', 'h3wv', 'h3ww', 'h3wx', 'h3wy', 'h3wz', 'h3xa', 'h3xb', 'h3xc', 'h3xd', 'h3xe', 'h3xf', 'h3xg', 'h3xh', 'h3xi', 'h3xj', 'h3xk', 'h3xl', 'h3xm', 'h3xn', 'h3xo', 'h3xp', 'h3xq', 'h3xr', 'h3xs', 'h3xt', 'h3xu', 'h3xv', 'h3xw', 'h3xx', 'h3xy', 'h3xz', 'h3ya', 'h3yb', 'h3yc', 'h3yd', 'h3ye', 'h3yf', 'h3yg', 'h3yh', 'h3yi', 'h3yj', 'h3yk', 'h3yl', 'h3ym', 'h3yn', 'h3yo', 'h3yp', 'h3yq', 'h3yr', 'h3ys', 'h3yt', 'h3yu', 'h3yv', 'h3yw', 'h3yx', 'h3yy', 'h3yz', 'h3za', 'h3zb', 'h3zc', 'h3zd', 'h3ze', 'h3zf', 'h3zg', 'h3zh', 'h3zi', 'h3zj', 'h3zk', 'h3zl', 'h3zm', 'h3zn', 'h3zo', 'h3zp', 'h3zq', 'h3zr', 'h3zs', 'h3zt', 'h3zu', 'h3zv', 'h3zw', 'h3zx', 'h3zy', 'h3zz'. The map also shows topographic features like rivers and lakes, and is overlaid with a grid. Coordinates are visible at the top (2113.21 5766 13.0) and bottom left (-1.89 3740.46 -625.5). A small inset map in the top right corner shows the location of the study area within a larger regional context.

Thank you for your attention!

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