

Annex 7

The GeoDaRWIN Module

1. INTRODUCTION	2
2. METHODOLOGY	2
3. INFRASTRUCTURE	2
4. RESULTS	2
4.1 Mapping Postgresql – Geosciml	2
4.2 Model Of The New Database For Geology	3
4.3 Web interface	5
4.3.1 Welcome screen	5
4.4 Mineral	6
4.4.1 Add a mineral	6
4.4.2 Search a mineral	6
4.5 Sample	7
4.5.1 Add a sample	7
4.5.2 Search a sample	10
4.6 Contribution	11
4.6.1 Add a contribution	11
4.6.2 Search a contribution	12
4.7 Search in all modules	12
4.8 Admin – Add a user	14
4.9 Add a collection	15
5. DISSEMINATION AND VALORISATION	16
6. PUBLICATIONS	17

1. INTRODUCTION

The Royal Museum for Central Africa (RMCA) holds one of the largest world collections of geological samples and documents about Central Africa (Congo, Rwanda, Burundi), offering unique reference material. The Geology services of RMCA contain around 16,000 minerals, 300,000 rocks, 21,500 fossils, and 30,000 maps. Their Archives include field notes, books, maps, and aerial photography containing valuable complementary information.

The geology department of RMCA is divided in various sections: geodynamics and mineral resources, natural hazards and cartography, surface environments and collection management. These sections have very rich databases but they are not connected between them.

2. METHODOLOGY

The aim of the project is to centralize all data in a single system on a service that can be available both on the internet and intranet. It will thus offer a common relational data model for these different geological items.

A first model is created in MS Access, to be sure that everything is taken into account, with all the interactions.

This model is applied to a PostgreSQL database, with a web interface in php.

Model is divided in 4 big sections : Contributions, samples, locations and documents. A 5th section is there at administrative and security purposes.

Contribution is the center module, with links to other modules but inter-modules links also exist. A contribution can be someone publishing an article, someone who has determined a sample or the description of a place, so a contribution is the central link.

Test data will be used in a first time, before adding all the collection data.

The emphasis has been set on the integration of a hierarchical thesaurus of keywords, which can be mapped to several international vocabularies.

A Github repository of the database web interface in Symfony 3.4 is available at: https://github.com/naturalsciences/natural_heritage_geology.

A mapping has also been done between PostgreSQL and GeosciML for boreholes.

3. INFRASTRUCTURE

A dedicated server is used to run the PostgreSQL database (PostgreSQL 9.5.14 on x86_64-pc-linux-gnu) and the web interface.

This one is based on Symfony 3.4. Symfony has been chosen because of the knowledge already obtained with the development of DaRWIn in a previous version of Symfony. The PostgreSQL database is also chosen for the possibilities to work with geographical data, with the Postgis module.

4. RESULTS

4.1 Mapping Postgresql – GeosciML

Search has been done to discover how to map PostgreSQL data with GeosciML. Data from boreholes has been used for this. The data structure of GeosciML was based on an xsd file : <http://schemas.geosciML.org/geosciML/4.0/borehole.xsd>. Link between field names of PostgreSQL and those from borehole.xsd was done with the use of a tool called Hale studio, to facilitate the creation of the complex mapping files in XML. With an app-schema extension of Geoserver, the GML file could be used on the web with WFS:

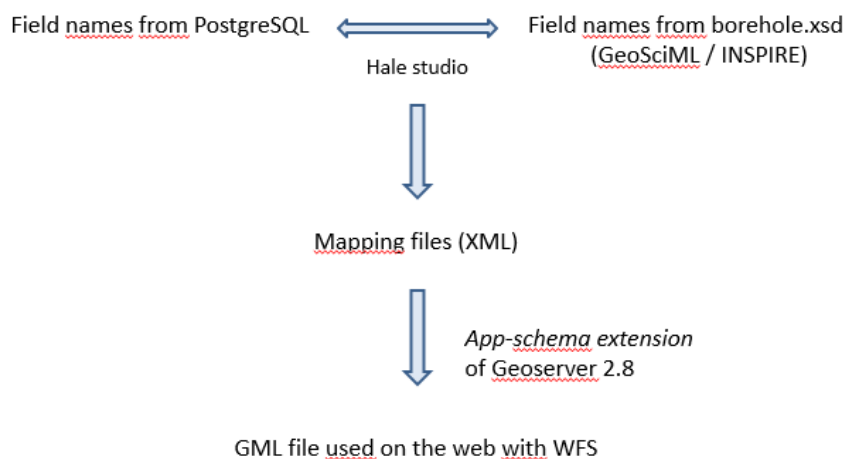


Figure 1. Schema of the mapping of database data to GeoSciML.

4.2 Model Of The New Database For Geology

Pascale Lahogue developed a model in Microsoft Access for a new database called GeoDarwin.

The model manages three categories of collection materials:

- field observations with their localization (e.g., coordinates, lithostratigraphy, drilling, structural analysis)
- samples (minerals, rocks, fossils) and the results of their analysis (e.g., constituent minerals of rocks, heavy minerals, granulometry, magnetic susceptibility)
- documents (e.g., maps, archives, aerial photos, satellite images, documentation).

A central category, Contributions, is the center of this model and is the link between data. Extra links exist also between each section. Test data were imported in this Access database : around 12,000 samples, 29,000 documents, and 30,500 localizations.

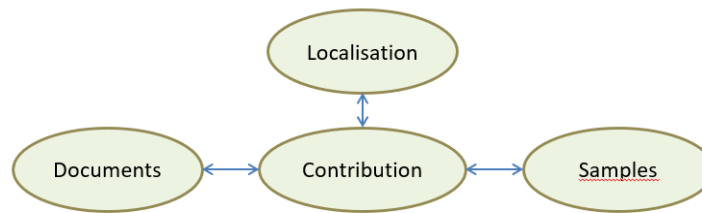


Figure 2. General structure of the database

Each section of this relational database contains 1-3 main tables, an amount of related tables and connection tables between sections.

Sections will also be subdivided into collections :

- minerals,
- rocks,
- maps,
- aerial photography,
- publications,
- boreholes,
-

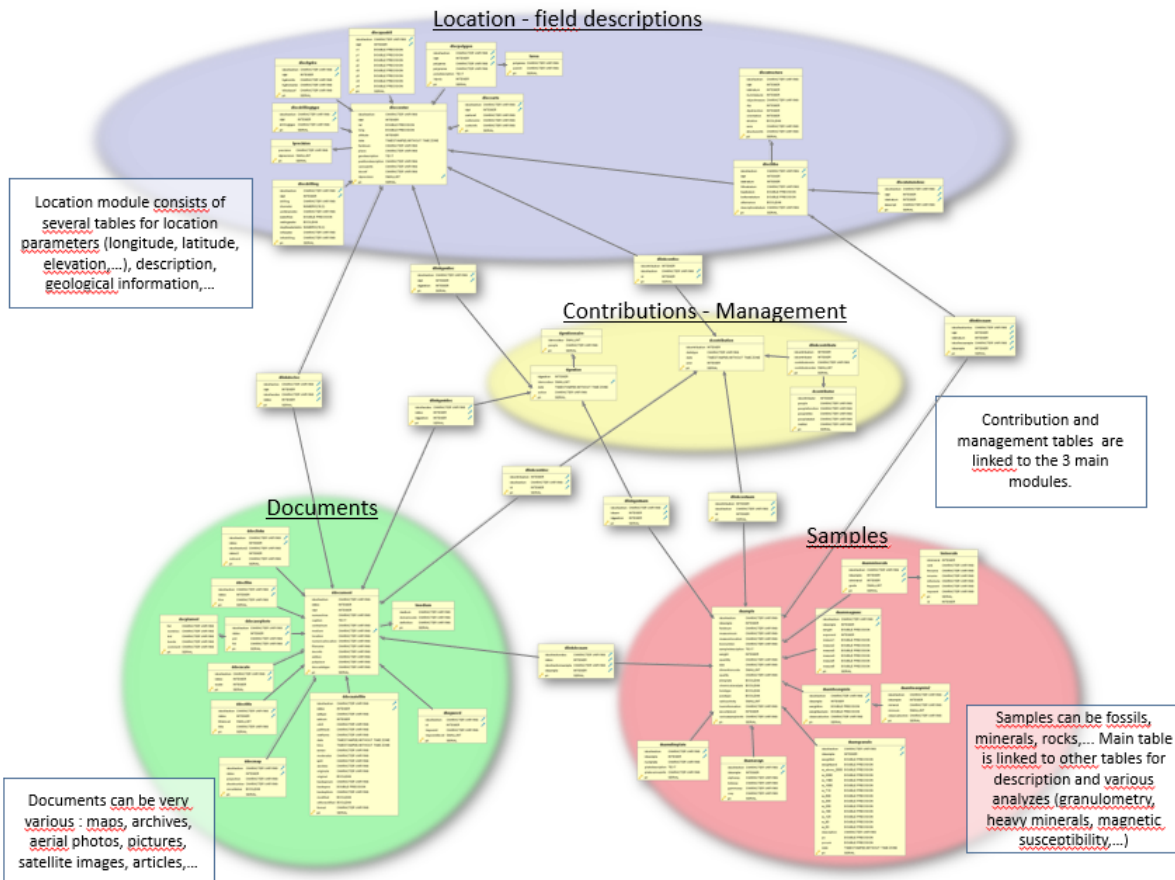


Figure 3. Detailed structure of the database.

This model in Microsoft Access has been tested for validity and translated into a PostgreSQL 9.5 database with the same structure, constraints and data relations with MDB tools and shell script (<http://mdbtools.sourceforge.net/>).

4.3 Web interface

As we already had the knowledge to work with Symfony, this framework has been chosen in version 3.4 to create the web interface.

The database structure has been created in Symfony (getters, setters, repositories,...), based on the structure in PostgreSQL.

Test data from Access were also transferred.

Web interface is still in development. The samples section and the contributions section are done as well as security (user management).

4.3.1 Welcome screen

The new website is intended to be used only by logged persons, so only the home page is visible, with a button to login.

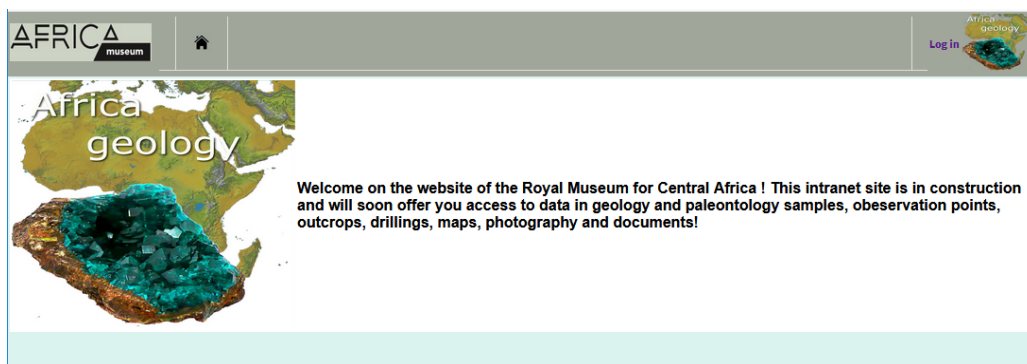


Figure 4. Welcome screen

Once the user is checked in, he gets access to the complete menu. His/her name is displayed on the right of the menu.

The menu contains 3 entries: Add, Search and Admin.

- Add contains up to now following entries: Contribution, Document/Image, Drilling, Observation points, Outcrop and Sample.
- Search menu contains the same entries and a Search in all sections.
- Admin entries are:
 - Add and Search a user,
 - Add and Search a collection,
 - Add and search a mineral.

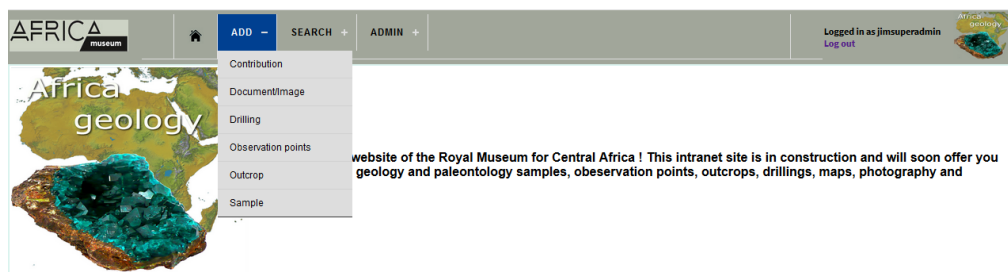


Figure 5. Welcome screen when used is logged in, with menu.

4.4 Mineral

4.4.1 Add a mineral

The smallest constituent of a sample, a mineral, can be created and edited in the menu Admin -> Add mineral.

As 2 nomenclatures are used at MRAC, possibility is given in the interface to enter a name in the 2 nomenclatures.

To each mineral is given an ID, a rank (class, group, mineral), a name, a parent and a formula

Figure 6. "Add a mineral" form.

4.4.2 Search a mineral

In the search for a mineral form, you can enter ID, class, group, parent, mineral or a constituent of the formula.

In figure 7, there is an example of a search of minerals containing silicium.

ID	Rank	Name	Name (Florias)	Parent	Parent (Florias)	Formula
515	mineral	bertrandite	bertrandite	sorosilicate	-	Be ₄ Si ₂ O ₇ (OH) ₂
516	mineral	beryl	beryl	cyclosilicate	beryl	Be ₃ Al ₂ Si ₆ O ₁₈
529	mineral	biotite	biotite	mica group	mica	K(Fe ²⁺ ,Mg) ₃ (AlSi ₃ O ₁₀ (OH) ₂
541	mineral	boltwoodite	boltwoodite	nesosilicate	-	(K,Na)(UO ₂)(SiO ₃ OH)·1,5H ₂ O
553	mineral	braunite	braunite	nesosilicate	-	Mn ²⁺ Mn ³⁺ ₈ O ₉ (SiO ₄)
570	mineral	cancrinite	cancrinite	framework silicate	-	(Na,Ca, ₁) ₈ (Al ₆ Si ₆)O ₂₄ (CO ₃ ,SO ₄) ₂ ·2H
573	mineral	carpholite	carpholite	orthopyroxene group	-	Mn ²⁺ Al ₂ Si ₂ O ₆ (OH) ₄
584	mineral	chabazite	chabazite	zeolite group	zeolites	Ca ₂ (Al ₄ Si ₈ O ₂₄ ·13H ₂ O
565	mineral	chalcedony	chalcedony	quartz	-	SiO ₂
592	mineral	chamosite	chamosite	chlorite group	chlorite	(Fe ²⁺ ,Mg,Al,Fe ³⁺) ₆ (Si,Al) ₄ O ₁₀ (OH) ₈
601	mineral	chloritoid	chloritoid	nesosilicate	-	Fe ²⁺ Al ₂ O(SiO ₄)(OH) ₂
606	mineral	chrysocolla	chrysocolla	clay mineral	-	(Cu ₂ ,Al) ₂ H ₂ ·xSi ₂ O ₅ (OH) ₄ ·nH ₂ O
607	mineral	chrysotile	chrysotile	asbestos	serpentine	Mg ₃ Si ₂ O ₅ (OH) ₄
615	mineral	clinocllore	clinocllore	chlorite group	chlorite	Mg ₂ Al(Si ₃ O ₁₀)(OH) ₈
617	mineral	clinohumite	clinohumite	humite group	-	Mg ₈ (SiO ₄) ₄ F ₂
618	mineral	clinoptilolite	clinoptilolite	zeolites	zeolites	K ₆ (Si ₃₀ Al ₆)O ₇₂ ·20H ₂ O
619	mineral	clinozoisite	clinozoisite	epidote group	epidote	Ca ₂ Al ₃ (Si ₂ O ₇)[SiO ₄]O(OH)
620	mineral	clintonite	clintonite	mica group	mica	CaAlMg ₂ (SiAl ₃ O ₁₀)(OH) ₂
626	mineral	coffinite	coffinite	nesosilicate	-	U(SiO ₄) ₂ ·2H ₂ O
635	mineral	cookeite	cookeite	chlorite group	-	(AlLi) ₂ Al ₂ (Si,Al) ₄ O ₁₀ (OH) ₈

Figure 7. Search for a mineral. Here, search for minerals containing Si.

4.5 Sample

4.5.1 Add a sample

The sample form is more complex and contains several subsections.

Up to now, there are 3 sections : Main info about the sample, Constituents and characteristics of the sample and Contributions.

- In the first section, info is given about identification of the sample : ID, localization, weight, size, description and some characteristics such as radioactivity, type, quality. This first section is the only one that appears when you create a sample. When you save it, other sections appear.

Figure 8. First section of the sample edit form.

- Second section contains a table with 5 tabulations : Mineralogy, Granulometry, Petrography, Magnetic susceptibility and Documentation. In Mineralogy, you can add minerals without limit. Heavy minerals can also be added.

Figure 9. Second section of the sample edit form. Tab “Mineralogy” with buttons to add minerals.

Click on buttons “Add a mineral” or “Add a heavy mineral” to enter data. Name of the mineral has to be entered and a grade (quantity). For heavy minerals, type, amount of grains and observation can be entered.

Figure 10. Second section of the sample edit form. Tab “Mineralogy” with fields to add minerals.

Each added mineral appears as a line in a table where grade can be modified. An example of a sample with heavy minerals is given in figure 11. Percentage of opaque and non-opaque minerals is automatically calculated.

Samples
 Sample ID: F 2001
 Sample number: jim002 Museum number:
 Box number: 18-b-3 Museum location: allemagne gst eifel Weight: Quantity: Size:
 Sample description: z
 Various sample info:
 Dimension code: 0 Loan information: Security level: 0
 Radioactivity: 2
 Holotype
 Paratype
 Chemical analysis
 Slim plate
 Quality: 0

Mineralogy Granulometry Petrography Magnetic susceptibility Documentation

ID	Name	Grade	Rank	Formula	Parent
423	acanthite	2	mineral	Ag ₂ S	sulfide_sulfides(FL)
425	adamite	2	mineral	Zn ₂ (AsO ₄)(OH)	arsenate_arsenates(FL)
431	agate	5	mineral	SiO ₂	quartz

Add a mineral

Heavy minerals			
Weight sample	54.000	Weight HM	12.000
Observation HM	test poids	Perc. HM:	22.222 %
Total:	38	21.05%	78.95%
opaque	8	100%	
staurotite	15		50.00%
tourmaline	11		36.67%
zircon	4		13.33%

Figure 11. Example of sample form filled with minerals.

Second tabulation is Granulometry : detailed info can be given about size of the grains

Samples
 Sample ID: F 2001
 Sample number: jim002 Museum number:
 Box number: 18-b-3 Museum location: allemagne gst eifel Weight: Quantity: Size:
 Sample description: z
 Various sample info:
 Dimension code: 0 Loan information: Security level: 0
 Radioactivity: 2
 Holotype
 Paratype
 Chemical analysis
 Slim plate
 Quality: 0

Mineralogy Granulometry Petrography Magnetic susceptibility Documentation

Weight tot.	Weight sand	>2000	<2000	<1400	<1000	<710	<500	<355	<250	<180	<125	<90	<63	Description	Date
32.25	12.36	0.00	0.00	14.14	25.30	14.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	test granulon dans F2001	01 / 30 / 2019

Figure 12. Second section of the sample edit form. Tab “Granulometry”

No data exists up to now in Petrography. Magnetic susceptibility data can be entered in the fourth tab. Some calculations as average are done automatically.

A last tab, Documentation, is still to be developed.

Samples
 Sample ID: F 2001
 Sample number: jim002 Museum number:
 Box number: 18-b-3 Museum location: allemagne gst eifel Weight: Quantity: Size:
 Sample description: z
 Various sample info:
 Dimension code: 0 Loan information: Security level: 0
 Radioactivity: 2
 Holotype
 Paratype
 Chemical analysis
 Slim plate
 Quality: 0

Mineralogy Granulometry Petrography Magnetic susceptibility Documentation

Weight	δ ±10	Average	Mesure 1	Mesure 2	Mesure 3	Mesure 4	Mesure 5	Mesure 6	Exponent
23.50	96.88	22.77	26.00	20.30	22.00	0.00	0.00	0.00	-5

Figure 13. Second section of the sample edit form. Tab “Magnetic susceptibility”

The third and last section is about contributions. You can here add a contribution by clicking on the “Add” button and choosing a type and a year. With that selection, a third field appears with a list of contribution ID already filtered by type and year. Choose an ID to add it to the sample.

Figure 14. First fields of the section Contributions of the sample edit form.

Figure 15. Fields for the section Contributions.

ID	Type	Date	Year	ID	Contributor	Role(order)	Function	Title	Status	Institute
7188	publication		2002	2646	anonymous		publisher(0)			Direction Générale des Mines et de la Géologie

Add a contribution

Figure 16. Section Contributions.

4.5.2 Search a sample

The Search sample form can make a search in the sample main info, in the minerals or heavy minerals. When you click on Search, the results are displayed below, with a pagination.

Results can be sorted by any column, by clicking on the column header and documents can be opened for viewing by clicking on one of the third first columns, and for editing by clicking on the icon of the last column.

The screenshot shows the search interface of the GeoDaRWIn module. At the top, there is a navigation bar with 'AFRICA museum' logo, 'ADD +', 'SEARCH +', and 'ADMIN +'. A user is logged in as 'jimsuperadmin' with a 'Log out' link. The main form is divided into several sections: 'General' (Collection: Mineralogy, Museum number, Sample ID, Museum location, Sample code, Box number, Radioactivity, Holotype, Slimplate, Paratype, Chemical analysis), 'Description' (white, Weight, Size, Dimension code, Quality), 'Minerals' (ID mineral, Grade, Class, Group, Mineral, Mineral formula), and 'Litho' (Heavy mineral, Nbr of min. grains, HM Weight, Granulom. data, Magnetic susceptib., Observation). Below the form, a search button and 'Results : 1013 records' are shown. A table displays search results with columns: Coll., ID, Code, Mineral, Heavy mineral, Formula, Sample description, HM Observation, Type, Magnet., Granul., and Loan info. The table lists 19 records for quartz, with various sample descriptions like 'vein debris, mixed ore', 'white block', and 'aggregates in vein quartz'. A pagination bar at the bottom shows '1 2 3 4 5 > >>'.

Figure 17. Form to search samples, with the results table.

The screenshot shows the 'Sample' view form for sample M 211. The top navigation bar is identical to Figure 17. The form displays sample details: Sample number: M 211, Museum number: 309, Box number, Dimension code: 3, Loan information, Weight, Security level: 0, Quantity: 3, Holotype: No, Paratype: No, Quality: 1, Size: 2, Radioactivity: 0, Chemical analysis: No, Slim plate: No. The 'Various sample info' section contains the description: 'garnet rhombododecahedrons (1 cm), black tourmaline needles'. Below this, there are tabs for 'Mineralogy', 'Granulometry', 'Petrography', 'Magnetic susceptibility', and 'Documentation'. The 'Mineralogy' tab is active, showing a table of minerals:

ID	Name	Grade	Rank	Formula	Parent
1229	tourmaline		mineral	-	cyclosilicate
772	garnet (Fl.)	2	mineral	(Ca,Fe,Mg,Mn) ₃ (Al,Fe,Mn,Cr,Ti,V) ₂ (SiO ₄) ₃	garnet (Fl.)

 A note 'No Heavy minerals' is present. Below the mineral table is a 'Contributions' section with a table:

ID	Type	Date	Year	ID	Contributor	Role(order)	Function	Title	Status	Institute
25526	Donation	17-11-2020	1912	1077	Henry	donor (0)				unknown

 An 'Edit sample' link is at the bottom left.

Figure 18. Example of sample in the view form.

4.6 Contribution

4.6.1 Add a contribution

Contributions can be very varied: it can be the publication of an article, the making of a map, the discovery of a sample,... This form gathers the type of contribution, a date and contributors (name, role, order in case of a publication). Click on “Add a contributor” to add people. In the table that appears, other info can be entered as the institution or function of the contributor.

Figure 19. “Add a contribution” form.

ID	Name	Role	Order	Function	Title	Statut	Institute
417	Cabrel, J.	author					unknown
835	Ferreiro da Silva, A.	author					unknown
1377	Luisa Ribeiro, M.	author					unknown
1857	Ribeiro, A.	author					unknown
3503	anonymous	publisher					Servicos Geologicos de P

Figure 20. “Add a contribution” form with a list of contributors.

4.6.2 Search a contribution

Contributions can be searched in the contribution or the contributors data. As for the samples, results are displayed below with pagination and documents can be opened for viewing or editing.

AFRICA museum

ADD + SEARCH + ADMIN +

Logged in as jimsuperadmin
Log out

Contribution

ID: Type: All Year: All Date: from to

Contributor

ID: Name: All

Role: All Order:

Function: All Title: All Status: All Institute: All

Search

Results : 50244 records Nbr of results by page: 20

ID contribution	Type	Date	Year	ID contributor	Name	Role	Function	Status	Institute
1	Donation		0	1045	Hanon,J.	donator			unknown
2	Donation		0	1226	Kazmin,J.	donator			unknown
3	Donation		0	2085	Talla Takan,F.	donator			Université de Yaoundé
4	Donation		0	2078	Tack,L.	donator			MRAC
5	Donation		0	809	Fabre,J.	donator			unknown
6	Donation		0	2078	Tack,L.	donator			MRAC
7	Donation		0	2078	Tack,L.	donator			MRAC
8	Donation	14-11-2019	2019	105	Anonymous	donator			Servide des Echanges
9	Donation		0	77	Anonymous	donator			GLCF
10	Donation		0	77	Anonymous	donator			GLCF
11	Donation		0	77	Anonymous	donator			GLCF
12	Donation		0	77	Anonymous	donator			GLCF
13	Donation		0	77	Anonymous	donator			GLCF
14	Donation		0	77	Anonymous	donator			GLCF
15	Donation		0	77	Anonymous	donator			GLCF
16	Donation		0	68	Anonymous	donator			DLRD-PAF
17	Donation		0	68	Anonymous	donator			DLRD-PAF
18	Donation		0	68	Anonymous	donator			DLRD-PAF
19	Donation		0	68	Anonymous	donator			DLRD-PAF
20	Donation		0	68	Anonymous	donator			DLRD-PAF

1 2 3 4 5 > >>

Figure 21. Search for contributions.

4.7 Search in all modules

Even if all modules have not yet been developed, a search in all modules has been developed. It has still to be improved and developed but a search can be done on samples, contributions, documents. Components of this big form come from each search form of the modules.



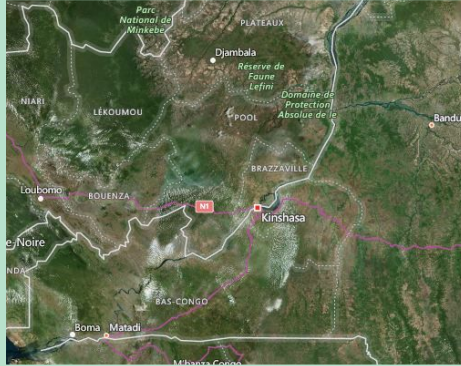

		ADD +		SEARCH +		ADMIN +		Logged in as jimsuperadmin Log out			
Samples											
Collection: <input type="text" value="All"/>			Museum number: <input type="text"/>			Radioactivity: <input type="text" value="All"/>			Holotype: <input type="checkbox"/>		
Sample ID: <input type="text"/>			Museum location: <input type="text"/>			Slimplate: <input type="checkbox"/>			Paratype: <input type="checkbox"/>		
Sample code: <input type="text"/>			Box number: <input type="text"/>			Chemical analysis: <input type="checkbox"/>					
Description: <input type="text"/>						Various info: <input type="text"/>					
Weight: <input type="text"/>			Size: <input type="text"/>			Security level: <input type="text" value="All"/>			Loan info: <input type="text"/>		
Dimension code: <input type="text" value="All"/>			Quality: <input type="text" value="All"/>								
Minerals						Litho					
ID mineral: <input type="text"/>			Grade: <input type="text" value="All"/>			Heavy mineral: <input type="text" value="All"/>			Nbr of min. grains: From <input type="text"/> to <input type="text"/>		
Class: <input type="text" value="All"/>			Group: <input type="text" value="All"/>			HM Weight: From <input type="text"/> to <input type="text"/>			Granulom. data: <input type="checkbox"/>		
Mineral: <input type="text" value="All"/>			Mineral formula: <input type="text"/>			Magnetic susceptib.: <input type="text" value="All"/>			Observation: <input type="text"/>		
Contribution											
ID: <input type="text"/>		Type: <input type="text" value="All"/>		Year: <input type="text" value="All"/>		Date: from <input type="text"/> to <input type="text"/>					
Contributor:											
ID: <input type="text"/>		Name: <input type="text" value="All"/>		Role: <input type="text" value="All"/>		Order: <input type="text"/>					
Function: <input type="text" value="All"/>		Title: <input type="text" value="All"/>		Status: <input type="text" value="All"/>		Institute: <input type="text" value="All"/>					
Documents											
ID: <input type="text"/>		Num Archive: <input type="text"/>		Central num.: <input type="text"/>		Medium: <input type="text" value="All"/>					
Filename: <input type="text"/>		DocInfo: <input type="text"/>				Doc cartotype: <input type="text" value="All"/>					
Locations											
ID: <input type="text"/>		Field number: <input type="text"/>		Place: <input type="text"/>		Doc reference: <input type="text"/>					
											
Latitude Between <input type="text"/> and <input type="text"/>											
Longitude <input type="text"/>											
Altitude Between <input type="text"/> and <input type="text"/>											
Aerial with labels <input type="text" value="v"/>											
<input type="text" value="Search"/>											

Figure 22. Form to search in all sections.

The different sections appear in the results : columns are grouped to show clearly the origin of the documents. For each section, main data are presented in the results table, with the ID and 2 or 3 more data. The edit icon in the last column will open the good document of the section.

Results : 17261 records Nbr of results by page: 20

Contributions				Samples						Documents			Locations				
ID	ID	Type	Date	Contributor	ID	Code	Mineral	Formula	Descr.	Type	ID	Medium	Info	ID	Lat.	Long.	Place
M	25310	Donation	17/11/2020	Cabra	1		quartz	SiO ₂	vein debris, mixed ore								
M	25311	Registration	15/09/1997	Cabra	2		quartz	SiO ₂	vein debris								
M	25312	Donation	17/11/2020	Cabra	2		quartz	SiO ₂	vein debris								
M	25313	Donation	17/11/2020	Cabra	3		- unspecified(FL)		fragments of indigenous bowl								
M	25314	Registration	15/09/1997	Cabra	3		- unspecified(FL)		fragments of indigenous bowl								
M	25315	Donation	17/11/2020	Cabra	4		quartz	SiO ₂	white block								
M	25316	Donation	17/11/2020	Cabra	5		quartz	SiO ₂	vein debris								
M	25317	Donation	17/11/2020	Cabra	6		copper	Cu	plates from a foundry								
M	25318	Donation	17/11/2020	Cabra	7		hematite	Fe ₂ O ₃	pyrite aggregates in microcrystalline hematite								
M	25318	Donation	17/11/2020	Cabra	7		pyrite	FeS ₂	pyrite aggregates in microcrystalline hematite								
M	25319	Donation	17/11/2020	Cabra	8		hematite	Fe ₂ O ₃	pyrite crystals and aggregates in iron oxide matri...								
M	25319	Donation	17/11/2020	Cabra	8		pyrite	FeS ₂	pyrite crystals and aggregates in iron oxide matri...								

Figure 23. Results of a search in all forms.

4.8 Admin – Add a user

Each section of the database will be accessed with different rights. A user will get access to the samples for example but no access or read access to the documents. Access will be defined by roles given for each user.

In each collection, other roles will be attributed to users to refine access: curator, validator, encoder, viewer, collection manager.

A user form contains the following fields:

- ID,
- username,
- first and last name,
- email,
- password role
- a checkbox to enable or disable the user.

Figure 24. Form to add a user.

Users will be presented in a table to get an overview of their rights, as shown in figure 25.

ID	First name	Last name	Username	Email	Roles in collections	Last login	Password requested at	Enabled
1	jim	User	jimherp	jimuser@hotmail.com	ROLE_USER	05-12-2019 12:09:41		Yes
2	jim	admin	jimadmin	jimadmin@hotmail.com	ROLE_ADMIN	05-12-2019 11:26:31		Yes
3	jim	superadmin	jimsuperadmin	jimsuperadmin@hotmail.com	ROLE_SUPER_ADMIN	05-03-2020 09:49:46		Yes
4	Aimé	Luboya	Aluboya	luboya.aim@africamuseum.be	ROLE_USER	05-03-2020 10:11:21		No
5	Pascale	Lahogue	plahogue	pascale.lahogue@africamuseum.be	ROLE_SUPER_ADMIN	06-01-2020 11:15:57		Yes
6	Evelyne	Gilles	egilles	evelyne.gilles@africamuseum.be	ROLE_ADMIN	05-03-2020 10:11:21		Yes
7	Nathalie	Andries	nandries	nathalie.andries@africamuseum.be	ROLE_ADMIN	05-03-2020 10:11:21		Yes
8	Florias	Mees	fmees	florias.mees@africamuseum.be	ROLE_ADMIN	05-03-2020 10:11:21		Yes

Figure 25. Listing of users

4.9 Add a collection

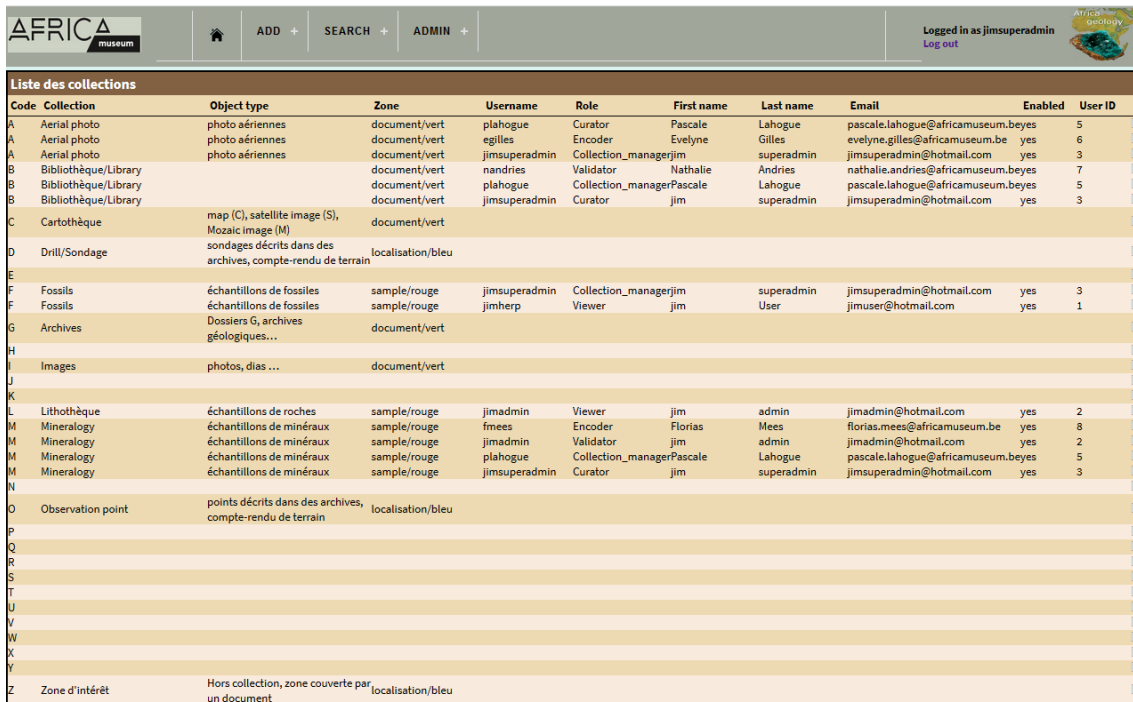
A simple form allows one to create a collection, with related persons and their rights.

Figure 26. "Add a collection" form.

ID	Username	First name	Last name	Email	Enabled	Role
3	jimsuperadmin	jim	superadmin	jimsuperadmin@hotmail.com	yes	Collection_manager
6	egilles	Evelyne	Gilles	evelyne.gilles@africamuseum.be	yes	Encoder
5	plahogue	Pascale	Lahogue	pascale.lahogue@africamuseum.be	yes	Curator

Figure 27. "Add a collection" form with responsables.

A list of collections will summarize all info about each collection.



Code	Collection	Object type	Zone	Username	Role	First name	Last name	Email	Enabled	User ID
A	Aerial photo	photo aériennes	document/vert	plahogue	Curator	Pascale	Lahogue	pascale.lahogue@africamuseum.be	yes	5
A	Aerial photo	photo aériennes	document/vert	egilles	Encoder	Evelyne	Gilles	evelyne.gilles@africamuseum.be	yes	6
A	Aerial photo	photo aériennes	document/vert	jimsuperadmin	Collection_manager	jim	superadmin	jimsuperadmin@hotmail.com	yes	3
B	Bibliothèque/Library		document/vert	nandries	Validator	Nathalie	Andries	nathalie.andries@africamuseum.be	yes	7
B	Bibliothèque/Library		document/vert	plahogue	Collection_manager	Pascale	Lahogue	pascale.lahogue@africamuseum.be	yes	5
B	Bibliothèque/Library		document/vert	jimsuperadmin	Curator	jim	superadmin	jimsuperadmin@hotmail.com	yes	3
C	Cartothèque	map (C), satellite image (S), Mozaic image (M)	document/vert							
D	Drill/Sondage	sondages décrits dans des archives, compte-rendu de terrain	localisation/bleu							
E										
F	Fossils	échantillons de fossiles	sample/rouge	jimsuperadmin	Collection_manager	jim	superadmin	jimsuperadmin@hotmail.com	yes	3
F	Fossils	échantillons de fossiles	sample/rouge	jimherp	Viewer	jim	User	jimuser@hotmail.com	yes	1
G	Archives	Dossiers G, archives géologiques...	document/vert							
H										
I	Images	photos, dias ...	document/vert							
J										
K										
L	Lithothèque	échantillons de roches	sample/rouge	jimadmin	Viewer	jim	admin	jimadmin@hotmail.com	yes	2
M	Mineralogy	échantillons de minéraux	sample/rouge	fmees	Encoder	Florias	Mees	florias.mees@africamuseum.be	yes	8
M	Mineralogy	échantillons de minéraux	sample/rouge	jimadmin	Validator	jim	admin	jimadmin@hotmail.com	yes	2
M	Mineralogy	échantillons de minéraux	sample/rouge	plahogue	Collection_manager	Pascale	Lahogue	pascale.lahogue@africamuseum.be	yes	5
M	Mineralogy	échantillons de minéraux	sample/rouge	jimsuperadmin	Curator	jim	superadmin	jimsuperadmin@hotmail.com	yes	3
N										
O	Observation point	points décrits dans des archives, compte-rendu de terrain	localisation/bleu							
P										
Q										
R										
S										
T										
U										
V										
W										
X										
Y										
Z	Zone d'intérêt	Hors collection, zone couverte par un document	localisation/bleu							

Figure 28. Listing of the collections.

5. DISSEMINATION AND VALORISATION

This new database has been presented to scientists at the international conference Biodiversity Next organized mainly by Biodiversity Information standards (TDWG), Consortium of European Taxonomic Facilities (CETAF), Distributed System of Scientific Collections (DISSCo), Global Biodiversity Information Facility (GBIF), Naturalis Biodiversity Center of Leiden.


A poster has been presented during the 4 days of the conference in Leiden, The Netherlands, from 22 to 25 of October 2019. The conference gathered more than 700 scientists in biodiversity, coming from 77 countries.

GeoDarWIN, an Open-Source Geological Data Management Tool

Pascale Lahogue, Jean-Marc Hergers, Franck Theeten, Didier Van den Spiegel, Max Fernandez-Alonso
 Royal Museum for Central Africa (RMCA), Leuvensesteenweg 13, B-3080 Tervuren, Belgium
 Contact: Jean-Marc.Hergers@africamuseum.be


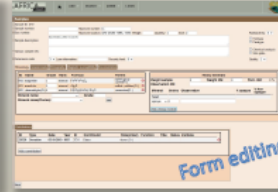

Royal Museum for Central Africa

- One of the largest world collections of geological samples and documents about Central Africa
- 16000 minerals, 300000 rocks, 21500 fossils, and 30000 maps
- Archives include field notes, reports, books, maps and serial photography




What is GeoDarWIN ?


- GeoDarWIN (GEOlogical Data Research Warehouse Information Network) is an "in-house" system solution developed by RMCA to manage geological collections online.
- It consists of 3 modules of collections (samples, documents, field data) linked to each other. All collections share common modules for contribution and management. So, a search can retrieve results from the different collections.
- Development began in 2018 and is still ongoing. Around 12000 samples, 19000 documents and 30500 locations are already in the prototype database.
- It's a contribution to the Natural Heritage project, a common research portal for natural history collections, developed by the Royal Belgian Institute of Natural Sciences, the Royal Museum for Central Africa and Meise Botanical Garden (<http://www.naturalheritage.be>).


Web interface
Symfony 3.4




PostgreSQL 9.5
+ PostGIS
database



MS Access
Initial local
database




Location - field descriptions



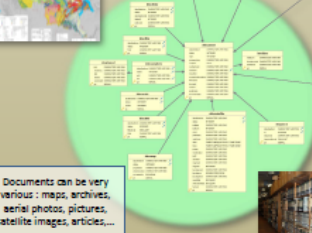
Location module consists of several tables for location parameters (longitude, latitude, elevation,...), description, geological information,...

Contributions - Management



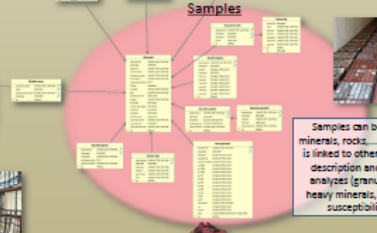
Contribution and management tables are linked to the 3 main modules.

Documents



Documents can be very various : maps, archives, serial photos, pictures, satellite images, articles,...

Samples



Samples can be fossils, minerals, rocks, ... Main table is linked to other tables for description and various analyses (granulometry, heavy minerals, magnetic susceptibility,...)

Connection to the external world ?

- Github : https://github.com/naturalsciences/natural_heritage_geology
- Some data have been mapped to GeosciML/INSPIRE, with Hale studio and App-schema extension of Geoserver 2.8 → GML file used on the web with WFS
- Possible link with SESAR which operates as a registry distributing the International Geo Sample Number IGSN (<http://www.geosamples.org/>)
- Some data can already now be consulted on other websites as www.drcmining.org, geokivu.africamuseum.be, www.cartesius.be.






Figure 29. Poster presented at Biodiversity Next in Leiden, 22-25 October 2019

6. PUBLICATIONS

A publication has been done after the conference Biodiversity Next, on basis of the poster of GeoDarwin presented during the conference : "GeoDarwin, an Open-Source Geological Data Management Tool", with authors Pascale Lahogue , Jean-Marc Hergers , Franck Theeten , Didier Van den Spiegel. It has been done in the Biodiversity Information Science and Standards 3: e35946. <https://doi.org/10.3897/biss.3.35946>

Authors : Jean-Marc Hergers & Pascale Lahogue, Franck Theeten and Didier Van den Spiegel