Prepared in cooperation with the Ministry of Petroleum, Energy and Mines, Islamic Republic of Mauritania

# Second Projet de Renforcement Institutionnel du Secteur Minier de la République Islamique de Mauritanie (PRISM-II)

# Database of Mineral Deposits in the Islamic Republic of Mauritania:

# Phase V, Deliverables 90 and 91

By Erin E. Marsh and Eric D. Anderson

Open-File Report 2013–1280 Chapter S

**U.S. Department of the Interior**
**U.S. Geological Survey**

**U.S. Department of the Interior**
SALLY JEWELL, Secretary

**U.S. Geological Survey**
Suzette M. Kimball, Acting Director

U.S. Geological Survey, Reston, Virginia: 2015

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment—visit http://www.usgs.gov or call 1–888–ASK–USGS

For an overview of USGS information products, including maps, imagery, and publications, visit http://www.usgs.gov/pubprod

To order this and other USGS information products, visit http://store.usgs.gov

Suggested citation:
Marsh, E.E., and Anderson, E.D., 2015, Database of mineral deposits in the Islamic Republic of Mauritania (phase V, deliverables 90 and 91), chap. S *of* Taylor, C.D., ed., Second projet de renforcement institutionnel du secteur minier de la République Islamique de Mauritanie (PRISM-II): U.S. Geological Survey Open-File Report 2013–1280-S, 9 p., Access database, http://dx.doi.org/10.3133/ofr20131280. [In English and French.]



Multiple spellings are used in various literatures, and may be reflected in the text.

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or for stratigraphic nomenclature.

The report is being released in both English and French. In both versions, we use the French-language names for formal stratigraphic units

ISSN 2331-1258 (online)

.

# Contents



# Figure



# Table

# Conversion Factors

SI to Inch/Pound

| Multiply | By | To obtain |
|---|---|---|
| | Length | |
| centimeter (cm) | 0.3937 | inch (in.) |
| millimeter (mm) | 0.03937 | inch (in.) |
| decimeter (dm) | 0.32808 | foot (ft) |
| meter (m) | 3.281 | foot (ft) |
| kilometer (km) | 0.6214 | mile (mi) |
| | Area | |
| hectare (ha) | 2.471 | acre |
| square meter ($m^2$) | 0.0002471 | acre |
| square kilometer ($km^2$) | 0.3861 | square mile ($mi^2$) |
| | Volume | |
| cubic kilometer ($km^3$) | 0.2399 | cubic mile ($mi^3$) |
| | Mass | |
| gram (g) | 0.03527 | ounce, avoirdupois (oz) |
| kilogram (kg) | 2.205 | pound avoirdupois (lb) |
| megagram (Mg) | 1.102 | ton, short (2,000 lb) |
| megagram (Mg) | 0.9842 | ton, long (2,240 lb) |
| metric ton per day | 1.102 | ton per day (ton/d) |
| megagram per day (Mg/d) | 1.102 | ton per day (ton/d) |
| metric ton per year | 1.102 | ton per year (ton/yr) |
| | Pressure | |
| kilopascal (kPa) | 0.009869 | atmosphere, standard (atm) |
| kilopascal (kPa) | 0.01 | bar |
| | Energy | |
| joule (J) | 0.0000002 | kilowatt hour (kWh) |

ppm, parts per million; ppb, parts per billion; Ma, millions of years before present; m.y., millions of years; Ga, billions of years before present; 1 micron or micrometer (μor μm) = $1 \times 10^{-6}$ meters; Tesla (T) = the field intensity generating 1 Newton of force per ampere (A) of current per meter of conductor

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

°F=(1.8×°C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C=(°F-32)/1.8

Coordinate information is referenced to the World Geodetic System (WGS 84)

# Acronyms

| | |
|---|---|
| AMT | Audio-magnetotelluric |
| ASTER | Advanced Spaceborne Thermal Emission and Reflection Radiometer |
| AVIRIS | Airborne Visible/Infrared Imaging Spectrometer |
| BIF | Banded iron formation |
| BLEG | Bulk leach extractable gold |
| BGS | British Geological Survey |
| BRGM | Bureau de Recherches Géologiques et Minières (Mauritania) |
| BUMIFOM | The Bureau Minier de la France d'Outre-Mer |
| CAMP | Central Atlantic Magmatic Province |
| CGIAR-CSI | Consultative Group on International Agricultural Research-Consortium for Spatial Information |
| DEM | Digital Elevation Model |
| DMG | Direction des Mines et de la Géologie |
| EMPA | Electron Microprobe Analysis |
| EM | Electromagnetic (geophysical survey) |
| EOS | Earth Observing System |
| eU | Equivalent uranium |
| GGISA | General Gold International |
| GIF | Granular iron formation |
| GIFOV | Ground instantaneous field of view |
| GIS | Geographic Information System |
| HIF | High grade hematitic iron ores |
| IHS | Intensity/Hue/Saturation |
| IAEA | International Atomic Energy Agency |
| IOCG | Iron oxide copper-gold deposit |
| IP | Induced polarization (geophysical survey) |
| IRM | Islamic Republic of Mauritania |
| JICA | Japan International Cooperation Agency |
| JORC | Joint Ore Reserves Committee (Australasian) |
| LIP | Large Igneous Province |
| LOR | Lower limit of reporting |
| LREE | Light rare-earth element |
| METI | Ministry of Economy, Trade and Industry (Japan) |
| MICUMA | Société des Mines de Cuivre de Mauritanie |
| MORB | Mid-ocean ridge basalt |
| E-MORB | Enriched mid-ocean ridge basalt |
| N-MORB | Slightly enriched mid-ocean ridge basalt |
| T-MORB | Transitional mid-ocean ridge basalt |
| Moz | Million ounces |
| MVT | Mississippi Valley-type deposits |
| NASA | United States National Aeronautics and Space Administration |

| | |
|---|---|
| NLAPS | National Landsat Archive Processing System |
| OMRG | Mauritanian Office for Geological Research |
| ONUDI | (UNIDO) United Nations Industrial Development Organization |
| PRISM | Projet de Renforcement Institutionnel du Secteur Minier |
| PGE | Platinum-group elements |
| RC | Reverse circulation drilling |
| REE | Rare earth element |
| RGB | Red-green-blue color schema |
| RTP | Reduced-to-pole |
| SARL | Société à responsabilité limitée |
| SEDEX | Sedimentary exhalative deposits |
| SIMS | Secondary Ionization Mass Spectrometry |
| SNIM | Société National Industrielle et Minière (Mauritania) |
| SP | Self potential (geophysical survey) |
| SRTM | Shuttle Radar Topography Mission |
| SWIR | Shortwave infrared |
| TIMS | Thermal Ionization Mass Spectrometry |
| TISZ | Tacarat-Inemmaudene Shear Zone |
| TM | Landsat Thematic Mapper |
| UN | United Nations |
| UNDP | United Nations Development Program |
| US | United States |
| USA | United States of America |
| USGS | United States Geological Survey |
| UTM | Universal Transverse Mercator projection |
| VHMS | Volcanic-hosted massive sulfide |
| VisNIR | Visible near-infrared spectroscopy |
| VLF | Very low frequency (geophysical survey) |
| VMS | Volcanogenic massive sulfide deposit |
| WDS | Wavelength-dispersive spectroscopy |
| WGS | World Geodetic System |

# Second Projet de Renforcement Institutionnel du Secteur Minier de la République Islamique de Mauritanie (PRISM-II)

# Database of Mineral Deposits in the Islamic Republic of Mauritania:

# Phase V, Deliverables 90 and 91

By Erin E. Marsh[1] and Eric D. Anderson[1]

## Introduction

Three ore deposits databases from previous studies were evaluated and combined with new known mineral occurrences into one database, which can now be used to manage information about the known mineral occurrences of Mauritania. The Microsoft Access 2010 database opens with the list of tables and forms held within the database and a Switchboard control panel from which to easily navigate through the existing mineral deposit data and to enter data for new deposit locations. The database is a helpful tool for the organization of the basic information about the mineral occurrences of Mauritania. It is suggested the database be administered by a single operator in order to avoid data overlap and override that can result from shared real time data entry. It is proposed that the mineral occurrence database be used in concert with the geologic maps, geophysics and geochemistry datasets, as a publically advertised interface for the abundant geospatial information that the Mauritanian government can provide to interested parties.

[1]U.S. Geological Survey, Denver Federal Center, Denver Colorado, 80225 U.S.A.

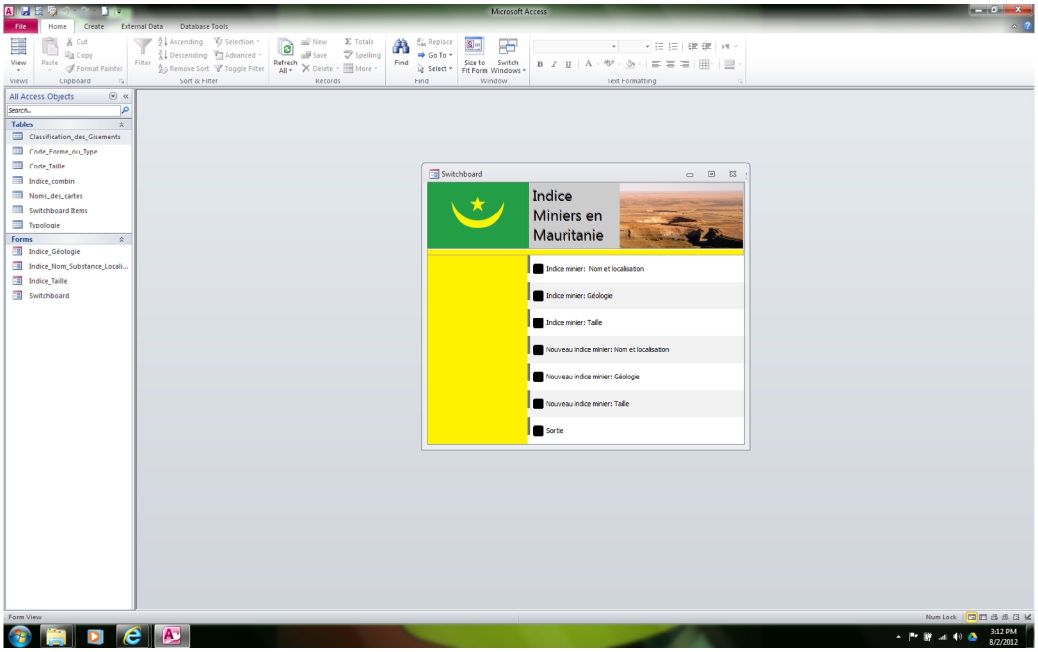



**Figure 1.** Screen shot of the database of mineral occurrences of Mauritania.

## Database Content

The tables include **Indice_combin**, **Classification_des_Gisements**, **Code_Forme_ou_Type**, **Code_Taille**, **Noms_des_cartes**, **Switchboard Items**, and **Typologie**. In this report, names of tables cited are in boldface; field names of tables are italicized; names of forms are both boldface and italicized. **Indice_combin** is the main data table for the mineral deposits database. This table is a compilation of mineral occurrence information found in three databases from previous studies: Base_Gitologie.mbd, Indice_2005.mbd, and Gitologie_Mauritanie_Nord.mbd. These tables were cross referenced to check for duplication and discrepancies. The tables were then combined into one table, **Indice_combin**. Commodities experts on the Deuxieme Projet de Renforcement Institutionnel du Secteur Minier de la Republique Islamique de Mauritanie (PRISM-II) team added field observations and company report information to existing mineral occurrence data sets and added new known mineral deposits to this table. The database is organized around the entries of ore deposits in **Indice_combin**. The most serious problem noticed during the compilation of the deposit occurrences were errors and inconsistencies in geospatial coordinates of the occurrence locations. In order to keep the locations consistent and easy to transfer to mapping software it is suggested using latitude and longitude in decimal degrees with the WGS 1984 datum.

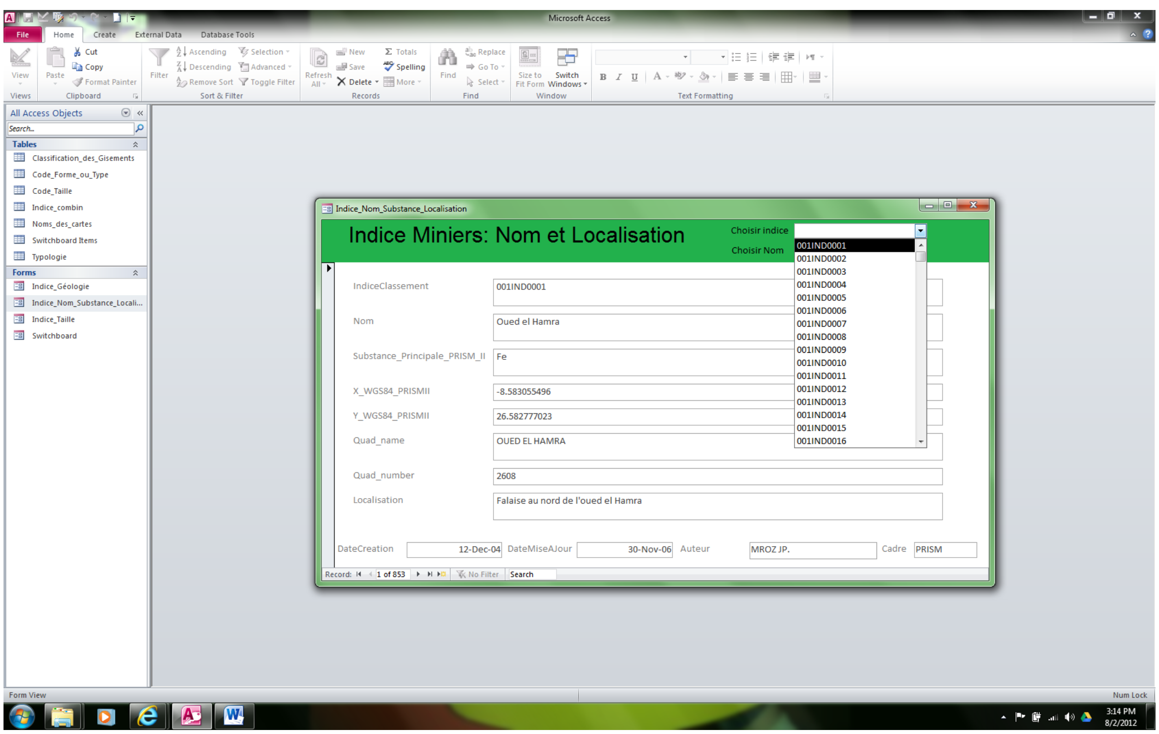
## Indice_combin Consists of the Following Fields of Data

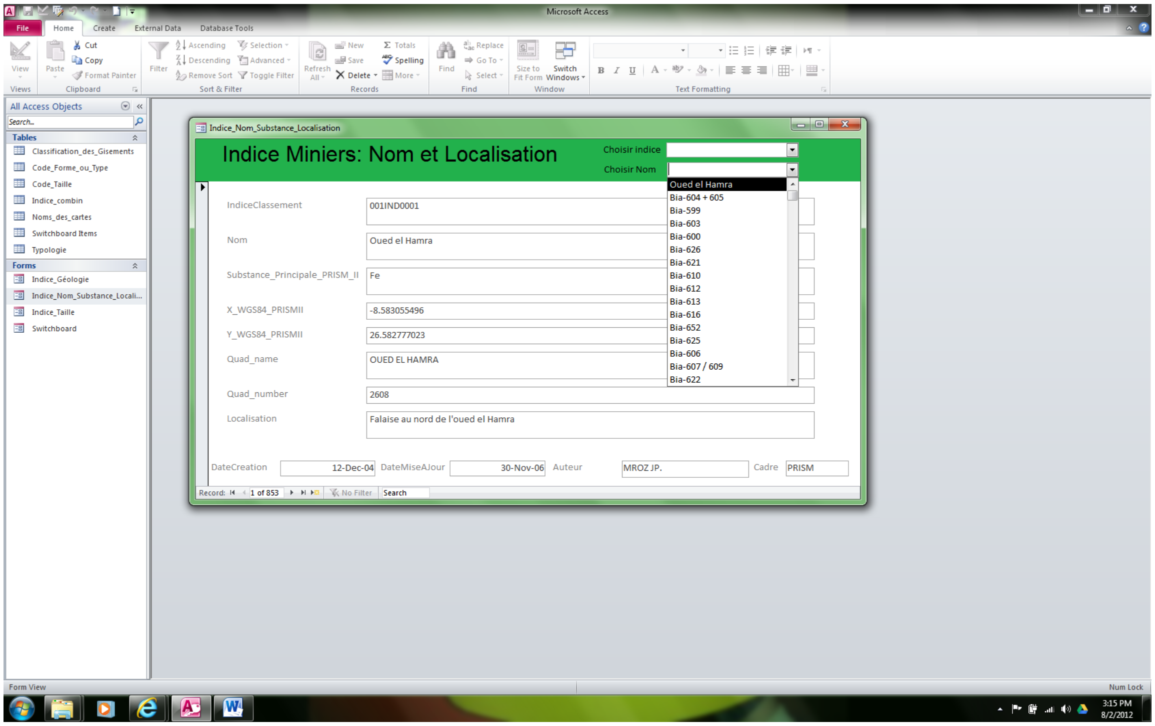
1. *IndiceClassement*: deposit or mineral occurrence identification number
2. *Nom*: documented name of the deposit or mineral occurrence
3. *Substance_Principale_PRISM_II*: principal commodity contained within the deposit or occurrence, compiled from the three databases and edited by the PRISM II team
4. *X_WGS84_PRISMII*: site longitude in degree decimal, WGS84 datum, either from field records or from crosschecked corrections to them
5. *Y_WGS84_PRISMII*: site latitude in degree decimal, WGS84 datum, either from field records or from crosschecked corrections to them
6. *Noms_des_Cartes*: name of the 1° square map in which the site is located. These map names are also listed in *NOMS_OFFICIELS* of Noms_des_cartes along with their associated map numbers in the column *No_Référence11*.
7. *Num_cartes*: the 1° quadrangle in which the site is located. This reference number includes the longitude and latitude degrees of the quadrangle's southeast corner as concatenated integers. The map numbers are listed in *No_Référence11* of Noms_des_cartes along with their associated map names (*NOMS_OFFICIELS*).
8. *Localisation*: regional context and district name.
9. *DegreMiseEnValeur*: extent of property development, from soil surveys to mine completion
10. *DateDecouverte*: year of discovery
11. *DateFinTravaux*: year of final exploitation
12. *OrganismeDecouv*: organization that first developed the property
13. *ContexteGéologique*: geologic context of the mineralization
14. *ContexteLitho*: lithologic context of the mineralization
15. *ContexteStrati*: stratigraphic context of the mineralization
16. *ContexteStructural*: structural characteristics of the mineralization
17. *Longueur*: length of the occurrence
18. *CommentaireLongueur*: notes on the length of the occurrence; units noted here when known
19. *Largeur*: width of the occurrence
20. *CommentaireLargeur*: notes on the width of the occurrence; units noted here when known
21. *Puissance*: thickness of the occurrence
22. *CommentairePuissance*: notes on the thickness of the occurrence; units noted here when known
23. *Commentaire*: comments on the deposit; not made by PRISM
24. *Commentaire_PRISM*: comments made by PRISM regarding the deposit
25. *DateCreation*: date of the creation of the deposit occurrence entry in the database
26. *DateMiseAJour*: date of the previous edit of the mineral occurrence entry in the database
27. *Auteur*: author who created or edited the mineral occurrence entry in the database
28. *Cadre*: agency at which the author of the mineral occurrence entry is associated
29. *Typologie*: deposit description, derived from source Base_Gitologie_03.dbf; deposit types are listed in Typologie
30. *Taille*: size of deposit or occurrence; terms for deposit size are listed in Code_Taille.
31. *Code_Taille*: code used to define the size of the mineral occurrence, derived from source Base_Gitologie_03.dbf; codes are defined in Code_Taille

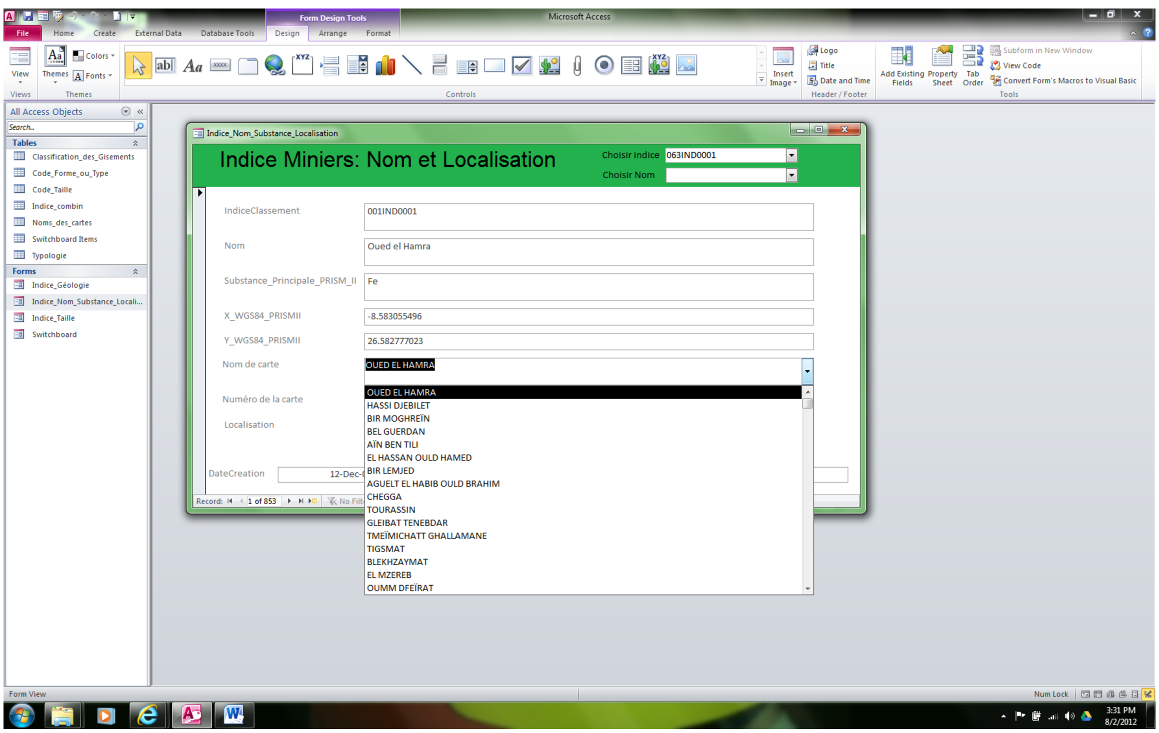
32. *ReferenceExterne*: external reference
33. *Code_Forme_ou_type*: code of deposit description, derived from definition in source Base_Gitologie_03.dbf; codes and their definitions are listed in Code_Forme_ou_Type
34. *Statue_2003_Prism*: whether or not the site was visited during 2003 PRISM project
35. *Paragenése_Terrain*: notes on mineralogical paragenesis, from source Gitologie_Mauritanie_Nord.mbd
36. *Commentaire_PRISM_II*: observations made by PRISM II staff
37. *Classification_des_Gisements*: classification of the ore deposit as defined by deposit models and defining papers in the literature; are listed in **Classification_des_Gisements**
38. *Auteur_PRISM_II*: author from PRISM II.
39. The other tables serve supportive roles to the management of each of the mineral occurrences in the main table Indice_combin. They provide definitions, references and associations for columns that occur in **Indice_combin**.

## Database Population and Searchability

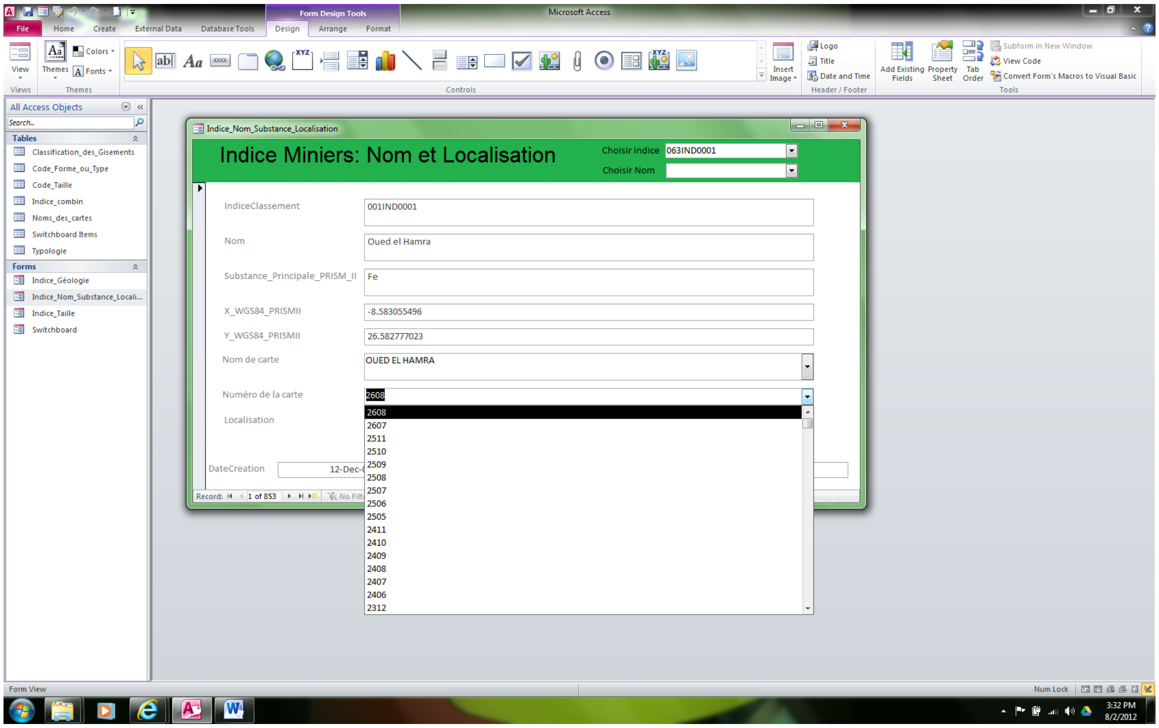
The database is searched or populated by the use of three forms: ***Indice_Nom_Substance_Localisation*** in which the mineral occurrence identification number, mineral occurrence name, principle commodity, coordinates, map name and number, regional context or district location can be edited or added; ***Indice_Geologie*** in which the descriptive characteristics of the occurrence can be added or edited; and ***Indice_Taille*** in which the size of the deposit can be added or edited. Each of the forms can be opened to add a new mineral occurrence to the database, or to view and edit existing occurrence entries.



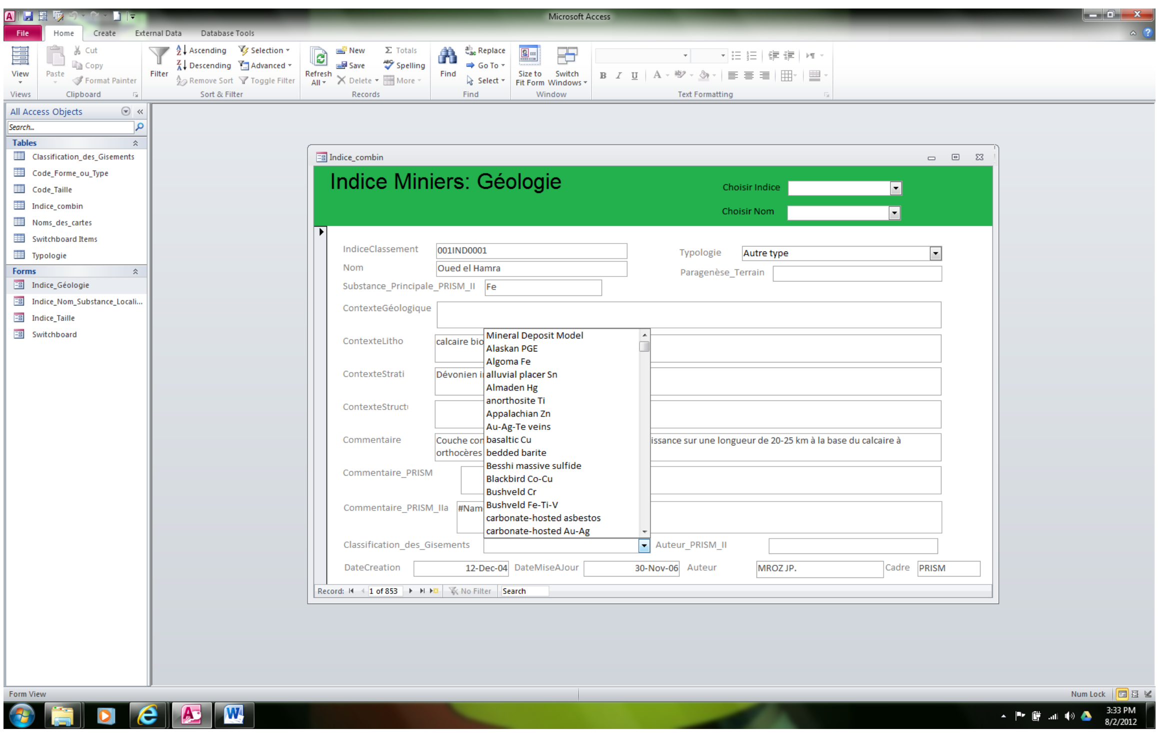


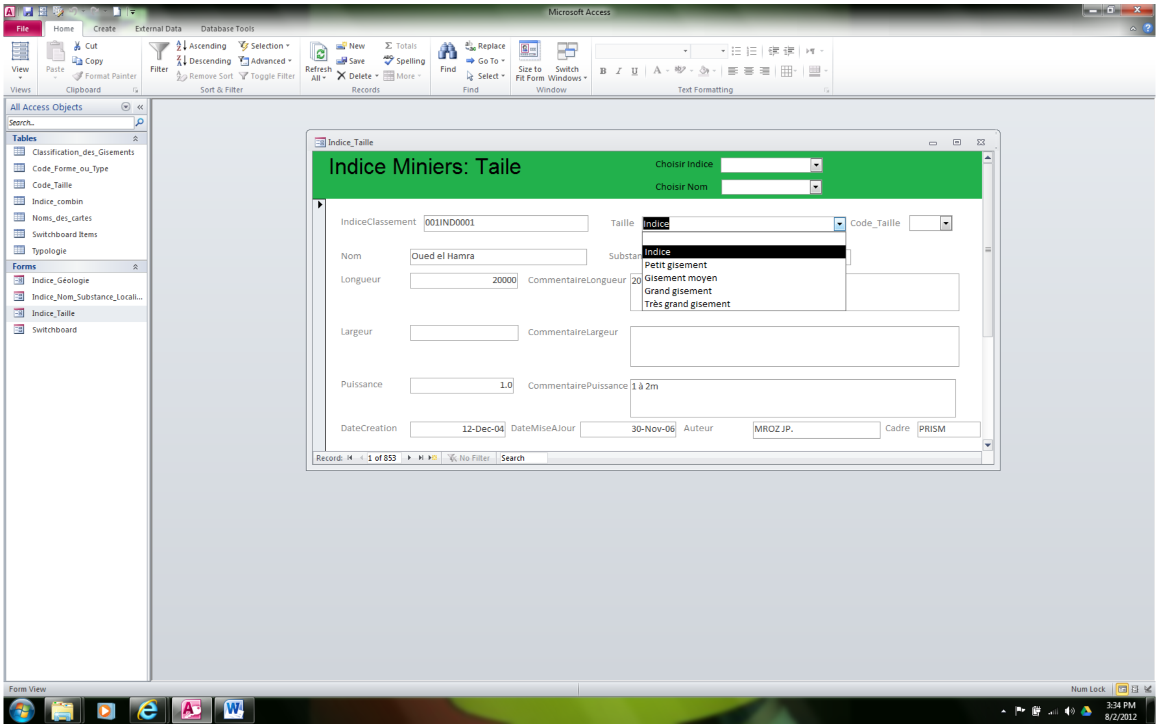

In each form there is the ability to choose a mineral occurrence entry by either the mineral occurrence identification number or name.

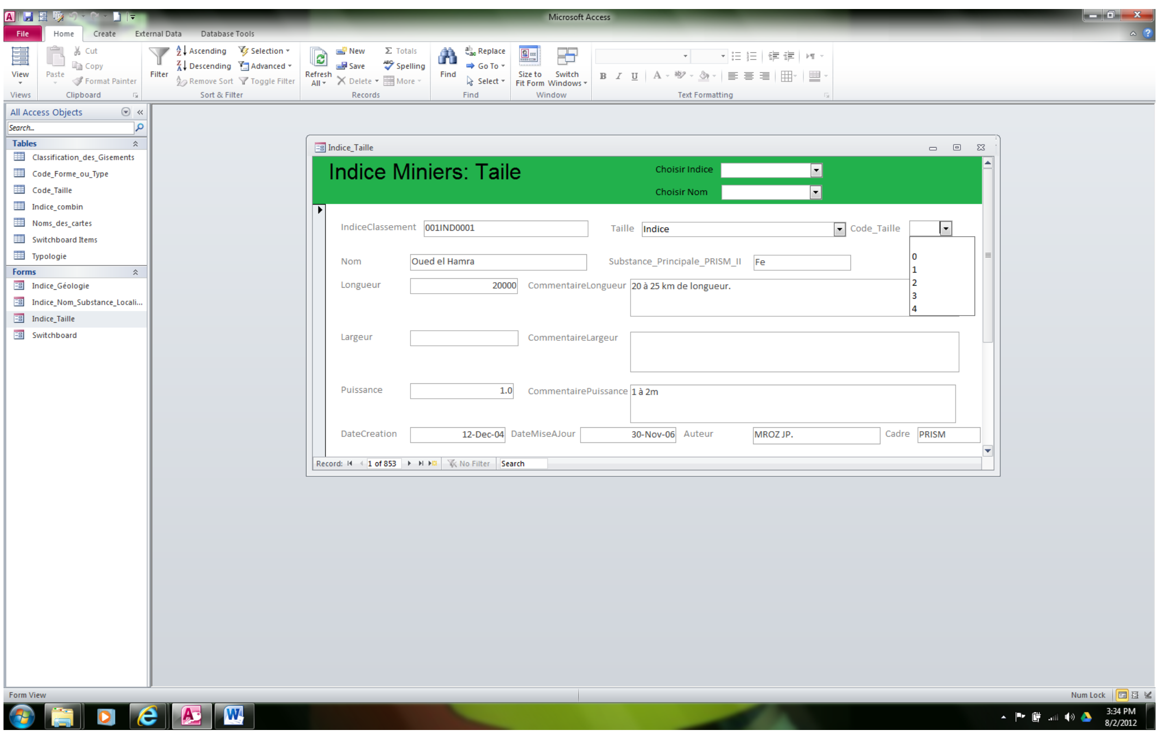



In ***Indice_Nom_Substance_Localisation*** the name and number of the map in which the occurrence is located can be chosen from a drop down menu.




In ***Indice_Geologie*** a mineral deposit model for each occurrence can be selected from the mineral deposits referenced in **Classification_des_Gisements**.




In **Indice_Taille** the deposit size and deposit size code can be chosen from a drop down menu linked to **Code Taille**.

## Proposed Use of the Mineral Deposit Database Indice_combin Table

Information relating to mineral resources is commonly distributed to the public by a country's geological survey. The information is generally contained within several databases and includes: mineral occurrences, geological maps, and geochemical and geophysical data sets. The databases provide a framework on which mineral resource companies can base their exploration programs. Such a framework can greatly facilitate and enhance an exploration program; therefore making the data sets readily available is crucial and can make a country more inviting to the exploration community. One way to make available such a vast amount of data to a broad user community is through Geographic Information Systems (GIS) and web mapping applications.

A GIS integrates hardware, software, and data so that information with a spatial component can be visualized, analyzed, and managed within a common environment. These systems can be scaled from a single desktop computer to a server-oriented enterprise database that distributes information to workstations within an organization, as well as to the public. Several options exist for both commercially available and free, open-source GIS packages (table 1). Many of these GIS packages can be used for maintaining country-wide mineral resource related information. Once the information is properly maintained within a GIS, the information can be distributed to the public using web mapping applications. Many of the available GIS packages include tools to build web mapping applications. However, stand-alone web mapping application products also exist.

A web mapping application takes the information contained within a GIS and makes it available via the World Wide Web. This eliminates the need for the end-user to have to build and maintain a GIS, but instead allows them to view the GIS through common web browsers. The spatial data contained within the GIS is viewed through a map window within a web browser. Such data can be queried allowing the user to highlight pertinent information. Pre-defined queries can be written by the administrator of the GIS to facilitate the process of locating relevant information. The web mapping application can be used to show the distribution of the data sets available. The web mapping application is a convenient way to advertise the available mineral resource related information to the mineral exploration community.

**Table 1.** Examples of commercially available and freely available open-source GIS software packages.

| | Company | Products | Website |
|---|---|---|---|
| **Commercial** | Autodesk | AutoCAD | www.autodesk.com |
| | Bentley Systems | MicroStation | www.bentley.com |
| | Environmental Systems Research Institute | ArcGIS | www.esri.com |
| | Pitney Bowes | MapInfo | www.pbinsight.com |
| **Open-source** | GRASS Development Team | GRASS | www.grass.osgeo.org |
| | QGIS Development Team | Quantum | www.qgis.org |
| | OpenLayers Development Team | OpenLayers | www.openlayers.org |

ISSN 2331-1258 (online)
http://dx.doi.org/10.3133/ofr20131280