EUROVOLC

European Network of
Observatories and Research Infrastructure for Volcanology

Deliverable Report

D6.4 : Opening Krafla DP

Work Package:	*Networking volcano observations of sub-surface processes and initiating access to observations from the Krafla Volcano Laboratory*	
Work Package number:	*WP6*	
Work Package leader:	*Freysteinn Sigmundsson*	
Task (Activity) name:	*Platform for access to multi-disciplinary data from the Krafla Volcano laboratory*	
Task number:	*Subtask 6.2.2*	
Responsible Activity leader:	*Ásgrímur Guðmundsson*	
Lead beneficiary:	*Landvirkjun*	
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Programme: H2020
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Contents

Summary

Landsvirkjun is making data from the Krafla volcano available in line with the EUROVOLC grant agreement. Due to company security reasons, access to parts of the data sets is available through a contact person at Landsvirkjun. The data sets can be classified into four groups: seismic data, geodetic data, geological maps, and borehole data.

Introduction

Subtask 6.2.2 of EUROVOLC was to create a platform for access to multi-disciplinary data from the Krafla Volcano laboratory. The management of the associated database, as well as other data belonging to Landsvirkjun, is in the hands of an identified contact person within Landsvirkjun. This deliverable report describes the data available.

Overview

The open access to data resources of the Krafla Volcano laboratory is divided into four categories:

1. Seismic network and database:

Available at (in Icelandic and English):

http://birtingur.isor.is/Landsvirkjun/en/

http://lv.isor.is

Supported by ÍSOR (Iceland Geosurvey)

2. Geodetic measurements (GNSS, Global Navigation and Satellite System):

Available at:

http://www.icelandsupersite.hi.is/gps/ts/NVZ.html

Supported by the University of Iceland.

3. Geological and geothermal maps:

Accessible/available at Landsvirkjun through a contact person and at ÍSOR (Iceland Geosurvey):

https://en.isor.is/geological-maps-geological-web-map

4. Borehole data:

Available from a designated internal site at Landsvirkjun, through a contact person.

Seismic network and database

Landsvirkjun, in collaboration with ÍSOR, operates a local seismic network at Krafla. ÍSOR (Iceland Geosurvey) runs a dense network of seismometers for Landsvirkjun (The National Power Company) due to energy production and research on the high temperature areas of Krafla, Námafjall and Theistareykir. The network also makes use of Veðurstofa Íslands‘ (The Meteorological Office of Iceland) countrywide network. The objective is to gather information on the infrastructure of the geothermal areas and how production affects them, especially with regard to stimulated earthquakes.

The seismometers are equipped to send constant information by telecommunications to ÍSOR where the data is automatically handled, and earthquakes located and information published in real time. ÍSOR uses SeisComp3 software from GDZ/Gempa in Germany for that purpose. On weekdays the locations determined automatically are checked, and improved if necessary and wrong recordings corrected. In maps that show earthquake locations they are marked with a circle in different colours where each colour represents a certain depth interval. The size of the circles indicates the size of the earthquakes. Earthquake recording stations are marked with triangles.

Results from this network are available at web sites in English and Icelandic:
http://lv.isor.is
http://birtingur.isor.is/Landsvirkjun/en/

If one visits the Icelandic site, there is the possibility to select English version at the bottom of the page. Alternatively, one can directly visit the English site. The opening page reveals the structure of the website including an instructions tab, where one can get the information of the structure.

Earthquakes in Krafla, Námafjall and Theistareykir

ÍSOR (Iceland Geosurvey) runs a dense network of seismometerss for Landsvirkjun (The National Power Company) due to energy production and research on the high temperature areas of Krafla, Námafjall and Theistareykir. The network also makes use of Veðurstofa Íslands' (The Meteorological Office of Iceland) countrywide network. The objective is to gather information on the infrastructure of the geothermal areas and how production affects them., especially with regard to stimulated earthquakes. The system is not installed as a warning system for natural risks like Veðurstofa Íslands' seismometer system.

The seismometers are equipped to send constant information by telecommunications to ÍSOR where the data is automatically handled and earthquakes located and information published in real time. Ísor uses SeisComp3 software from GDZ/Gempa in Germany for that purpose. On weekdays the locations determined automatically are checked, and improved if necessary and wrong recordings corrected. In maps that show earthquake locations they are marked with a circle in different colours where each colour represents a certain depth interval. The size of the circles indicates the size of the earthquakes. Earthquake recording stations are marked with triangles.

This website is under construction and will be changed soon according to the needs of Landsvirkjun. Note! The website is best operated in a Chrome browser.

Earthquake view | Real-time data | Stationview

Maps and sections | Event browser | Link to VÍ

Disclaimer | Instructions

***Figure 1**. Opening web page of English version of web portal for results from the local seismic network at Krafla operated by Landsvirkjun and ÍSOR.*

The following information is accessible through the different tabs:

Earthquake view: Earthquakes in last seven days, displayed on a map. With a click on each epicentre location, a table appears with magnitude, depth, time, location, eventID, status, phases and streaming data.

Real-time data: Real time data from seismic stations is shown. Specific station in the network can be selected. Then select „Show data“, and information on recording from the station in real time.

Station view: by clicking on selected station a list will appear, which shows quality parameters and grounds motion.

Maps and sections: Map of seismicity and earthquakes depth during previous two weeks. See example in Figure 2.

Event browser: QuakeLink. Allows to pick an earthquake by date.

Link to VÍ: Link to Icelandic Met Office

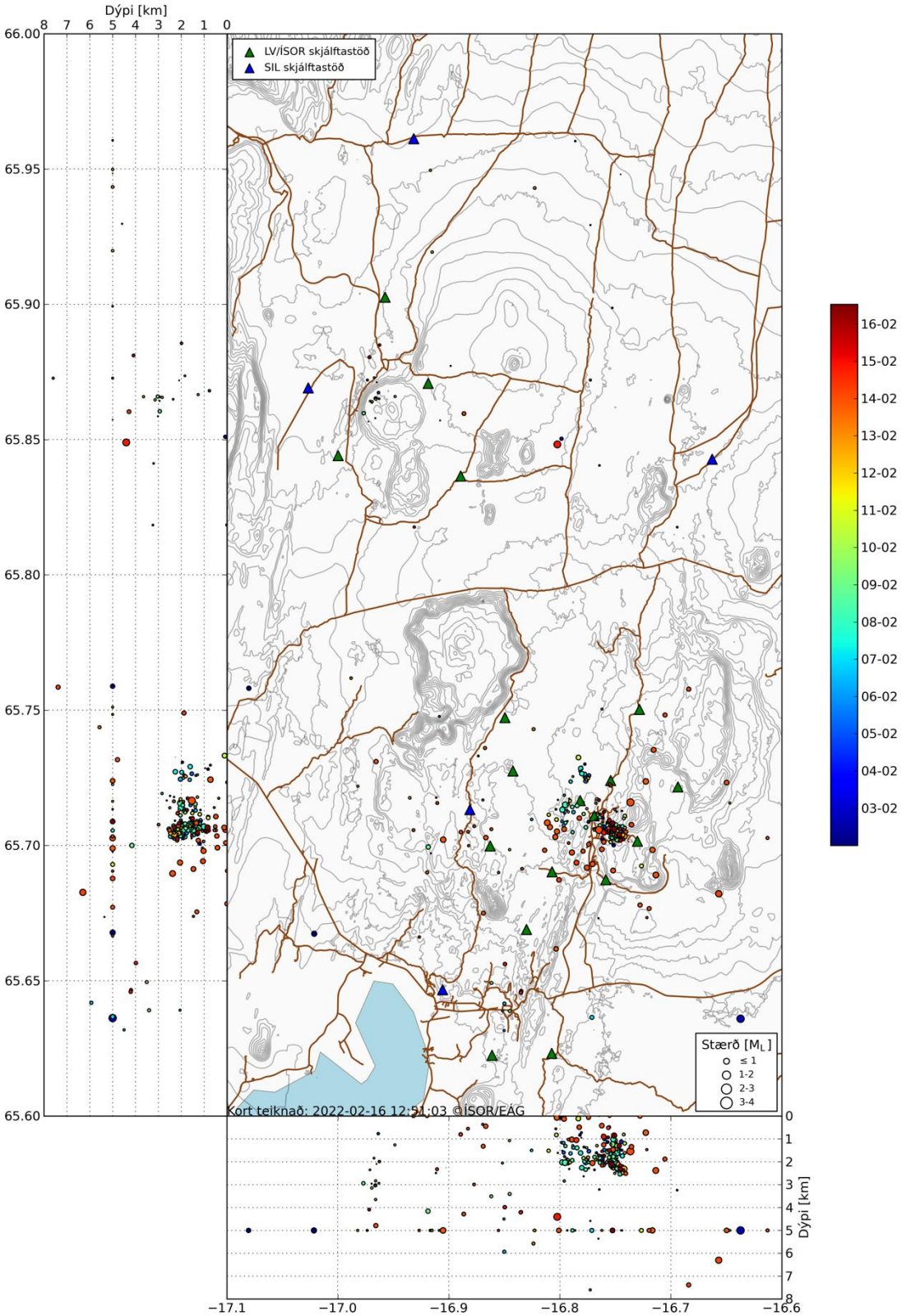


Figure 2. *Example of map of seismicity and earthquakes depth colour, coded according to time (two-week period, right panel indicates date in 2022).*

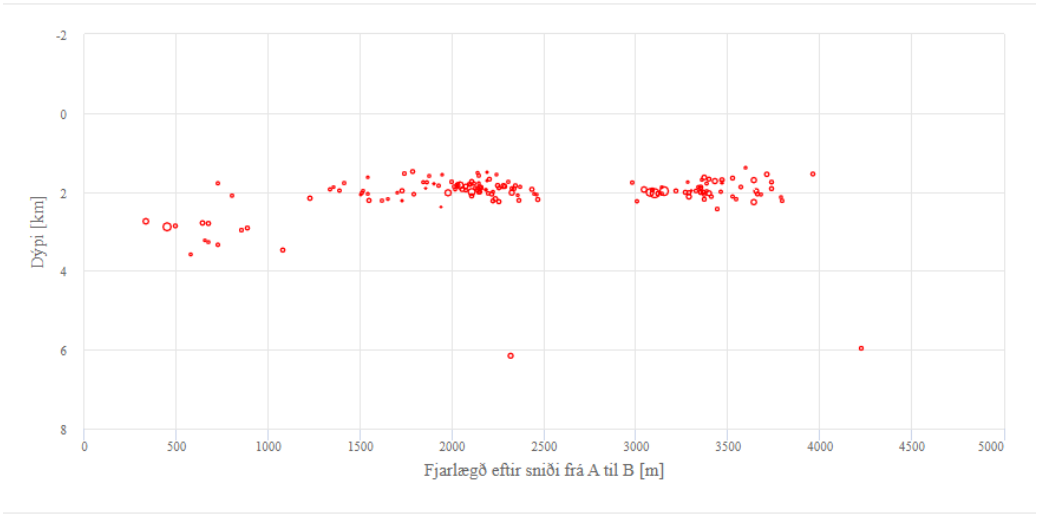


***Figure 3**. Example of a cross-section of seismicity at Krafla from south (A) to north (B).*

Streaming data from the seismic network is not available through the website. If researchers are interested to get access to raw data, they need to contact a person at Landsvirkjun:

Bjarni Pálsson: email: Bjarni.Palsson@landsvirkjun.is

Geodetic measurements (GNSS, Global Navigation and Satellite System)

Global Positioning System (GPS) data and graphic examples are supported through UI (University of Iceland) website; the opening web page is shown in Figure 4. Contact person for any further information is Freysteinn Sigmundsson at University of Iceland (email: fs@hi.is).

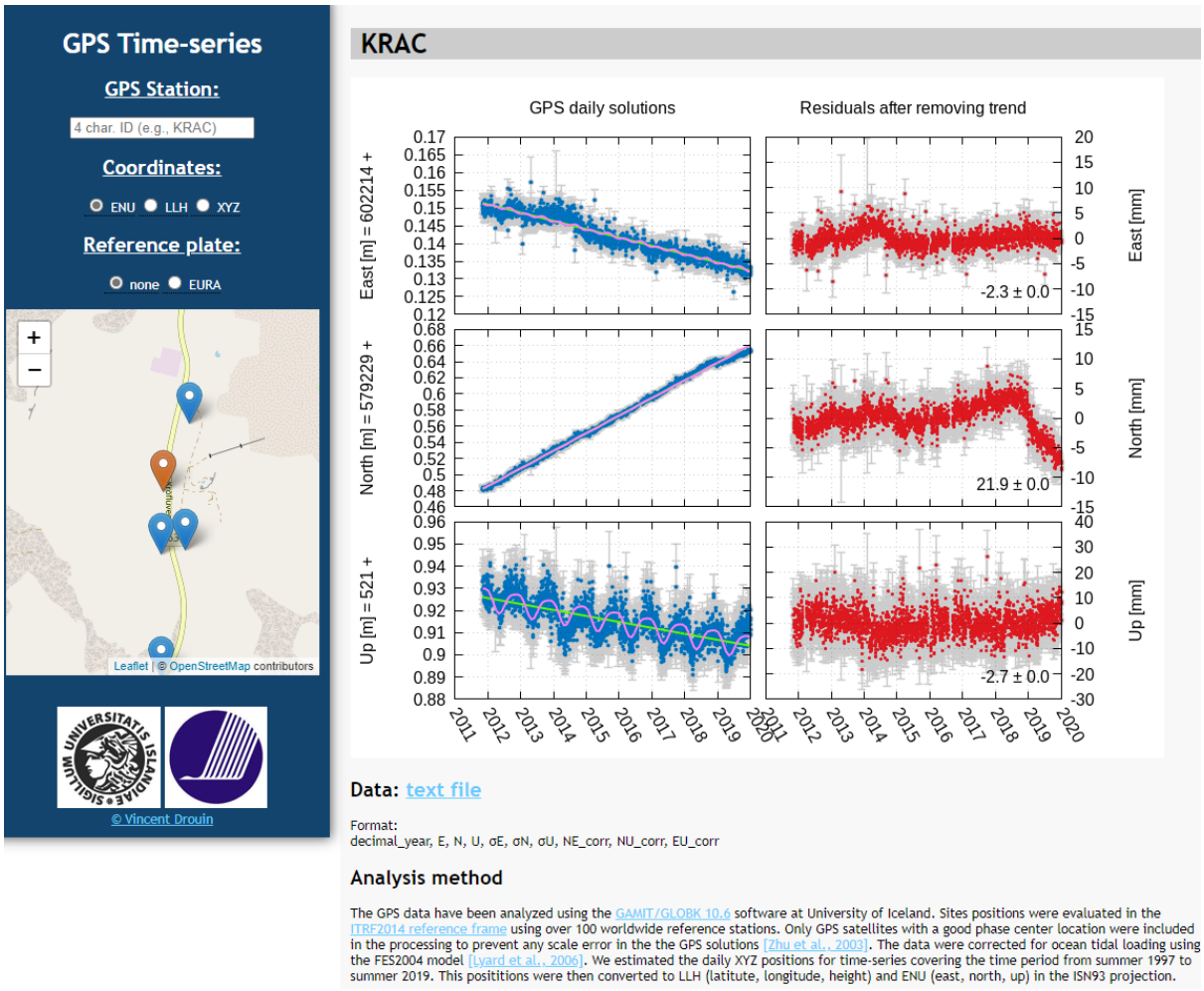


***Figure 4**. Example of GNSS data from Krafla volcano.*

Data files may be downloaded from the website by selecting „Data: textfile“. This provides time series of displacements.

The GPS data have been analysed using the GAMIT/GLOBK 10.6 software (Herring et al., 2010a; Herring et al., 2010b) at University of Iceland. Sites positions have been evaluated in the ITRF2014 reference frame (Altamimi et al., 2016) using over 100 worldwide reference stations.

Geological and geothermal maps

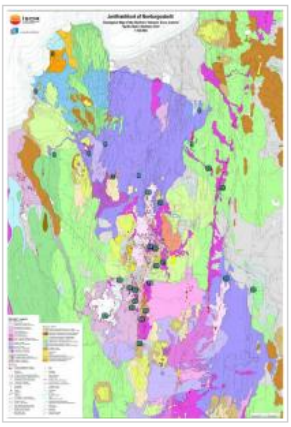
Several geological and geothermal maps are available covering Krafla. Information on a map in scale 1:100.000 covering Krafla and the northern part of the Northern Volcanic Zone of Iceland is available at website (Figure 5):

https://en.isor.is/geological-maps-geological-web-map

Geological Map of the Northern Volcanic Zone, Iceland 1:100 000

The geological map covers the area from Öxarfjörður in the north to Fremrinámar in the south. The map shows the main geological features, the oldest being of Miocene age and the youngest from the Krafla fires in 1975-1984. The key tectonic features are shown along with the main deglaciational structures of the area. The map includes a total of 61 lava flows, which have been divided into 7 age groups with the aid of tephrochronology.
This map is the product of several previous maps in larger scales created by ÍSOR and its´ predecessor, for various customers but also applying simplified maps in smaller scales. These data were revised, and new data aquired in the field added.

On the reverse there are descriptions and photographs of the most important geological wonders of the area. View the selected sites also on the Geological Web Map.



Scale: 1:100 000
Refer to this map: Sæmundsson, K., Hjartarson, Á., Kaldal, I., Sigurgeirsson, M. Á., Kristinsson, S. G. and Víkingsson, S. (2012). Geological Map of Northern Volcanic Zone, Iceland. Northern Part. 1:100 000. Reykjavík: Iceland GeoSurvey and Landsvirkjun.
Prepared in: ArcGIS
Project manager: Ingibjörg Kaldal
Cartography: Guðrún Sigríður Jónsdóttir
Publishers: Iceland GeoSurvey and Landsvirkjun
Copyright: © Iceland GeoSurvey. 1st edition, 2012
Printing: Oddi Printing ltd.
Map projection: Lambert Conformal Conic (ISN93). Contour interval 20 m
Datum: ISN93. Lambert coordinates are shown with black lines and numbers, and latitude and longitude degrees and minutes are shown in gray on the frame.

Topography is from the National Land Survey of Iceland, 1:50 000 (IS50V) along with other data.
Isobaths are from
The Icelandic Coast Guard, Icelandic Hydrographic Service (sea), Icelandic Meteorological Office and Mývatn Research Station (lakes)

Text: Icelandic and English

Referemces to the Map

Order or buy the map on line. The link is to the webpage by bookseller Eymundsson.

Figure 5. *Description of a geological map covering Krafla and the northern part of the Northern Volcanic Zone of Iceland.*

Geological maps in higher resolution as well as geothermal maps showing the high-temperature areas (geothermal distribution) are available through a shared online folder. To get access to the folder contact Bjarni Pálsson at Landsvirkjun (Bjarni.Palsson@landsvirkjun.is).

Borehole data

Data from a number of boreholes in the Krafla area (Figure 6) are available.

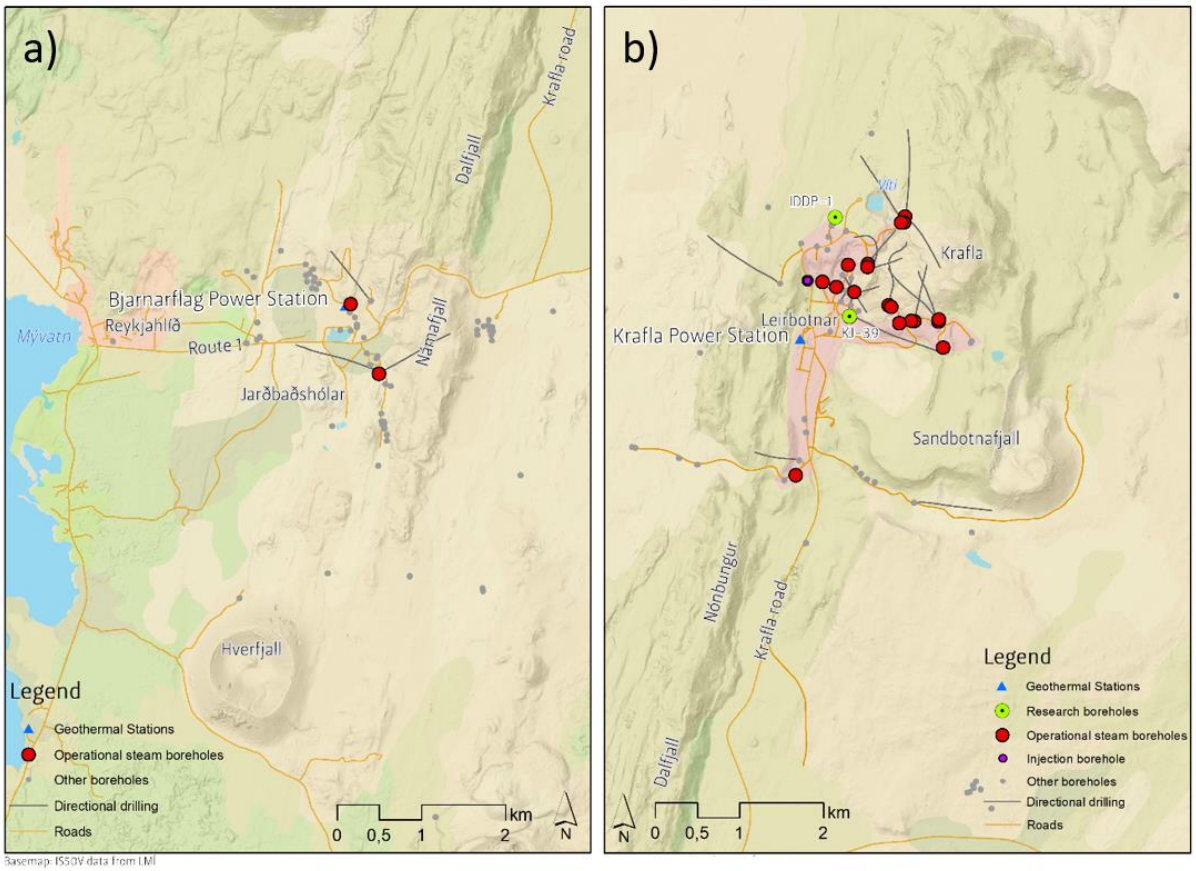


***Figure 6**. Location of wells, well paths and power plants in the Krafla and Bjarnarflag geothermal areas. Green dots show the location of the IDDP-1 and KJ-39 wells where magma has been intersected. See legends for other features.*

The data is available in a shared online folder. To get access to the folder contact Bjarni Pálsson at Landsvirkjun (Bjarni.Palsson@landsvirkjun.is).

Data includes coordinates for depth values of the wells, as many wells are deviated. The following data is then available:

- Formation temperature: x,y,z, and temperature value
- Pressure: x,y,z, and pressure value (in bars)
- Caliper logs: x,y,z (in cm or mm)
- Lithological logs, x,y,z, value

  Resistivity: 16” and 64” (ohm)

Neutron-Neutron (API-units)

Gamma ray (API-units)

Lithology: Figures (jpg, ping, pdf)

Distribution of alteration minerals: Figures (jpeg, ping, pdf)

Cuttings from all exploration and productions wells, and occasionally cores from shallow exploration wells, exist as well.

References

Altamimi, Z., P. Rebischung, L. Métivier,and X. Collilieux (2016). ITRF2014:A new release of the InternationalTerrestrial Reference Frame modelingnonlinear station motions,J. Geophys.Res. Solid Earth,121, 6109–6131,doi:10.1002/2016JB013098.

Herring, T. and McClusky, S. (2009). GAMIT/GLOBK MATLAB TOOLS. From: http://wwwgpsg.mit.edu/~tah/GGMatlab/#_tsview.

Herring, T., R. King, and S. McClusky (2010). Introduction to gamit/globk, Massachusetts. Institute of Technology, Cambridge, Massachusetts. https://geo.gob.bo/portal/IMG/pdf/intro_gg_1_.pdf.