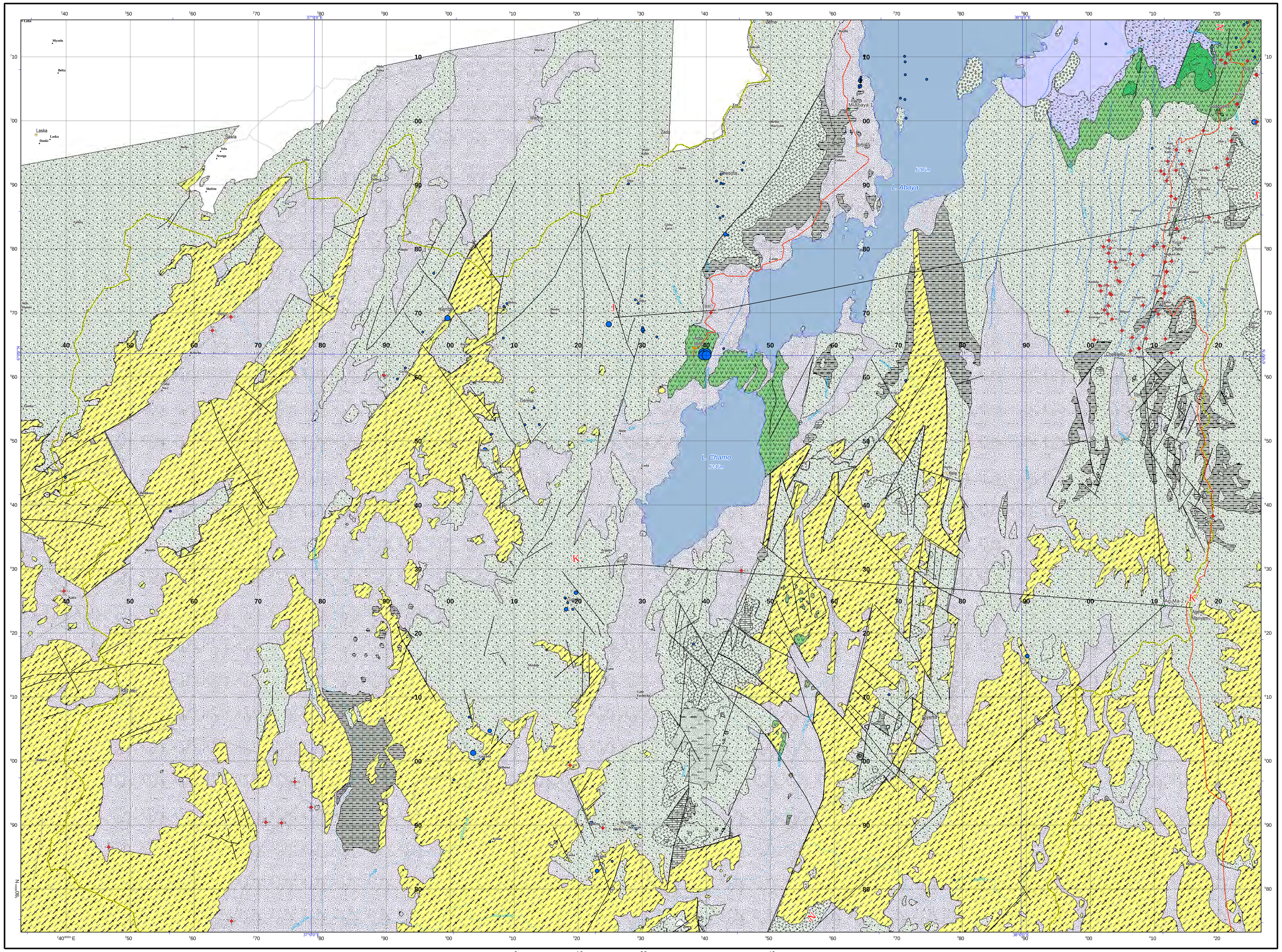
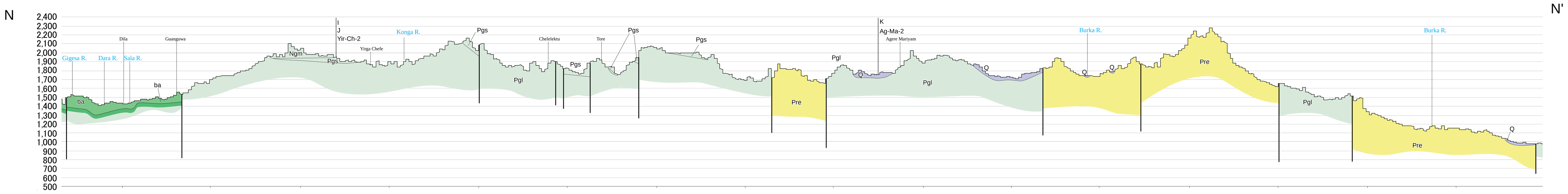
# HYDROGEOLOGICAL MAP OF ARBA MINCH - AGRE MARRYAM AREA

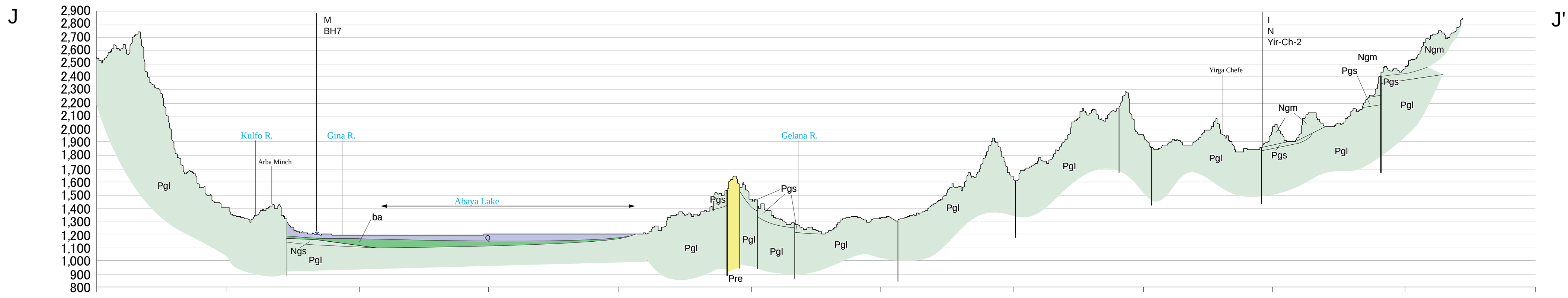


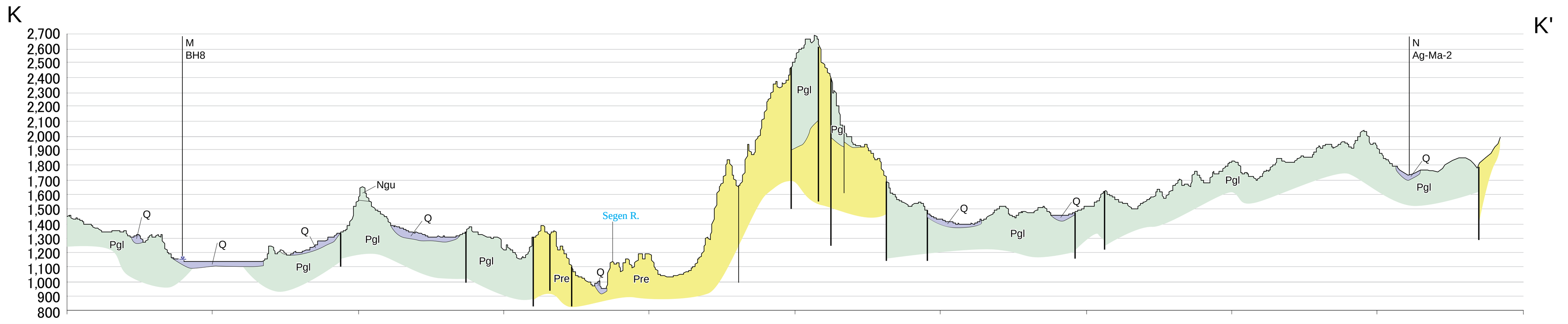

VERTICAL SCALE = 10 x HORIZONTALSCALE

SCALE 1:250,000 (0 – 10 – 20 – 40 km)

TRANSVERSE MERCATER PROJECTION




**Towns**
- Region Capital
- Zone Capital
- Woreda Capital
- Developed Area

**Roads**
- Asphalt
- Gravel

**Rivers**
- Major Rivers

**Lakes**
- Swamp
- Lake

**Boundaries**
- Basin Boundary
- National Boundary

**Spring Discharge [l/s]**
- 0.01 - 0.75
- 0.75 - 2.50
- 2.50 - 6.00
- 6.00 - 16.00
- 16.00 -

**Geological Structure**
- Major fault, downthrown shown
- Major fault
- Normal fault, downthrow shown
- Normal fault
- Inferred fault, downthrown shown
- Inferred fault
- Major fault, downthrown shown, by satellite images
- Major fault, by satellite images
- Normal fault, downthrow shown, by satellite images
- Normal fault, by satellite images
- Inferred fault, downthrown shown, by satellite images
- Inferred fault, by satellite images
- Geology boundary
- Inferred geology boundary
- Caldera edge
- Volcano / Volcanic Cone

**Borehole (Well)**

Total depth [mbgl]
Specific capacity [l/min/m] — Static water level [m]
Draw down [m]

- JICA Well

**TEM**
- Survey Point of Transient-phenomenon (or Time-domain) Electromagnetic Exploration Method

## Geology

**Holocene**
- Al — Alluvium; *Fine sand - mud*
- Q — Unclassified Fluvial Deposits; *Sandy gravel-mud*
- lac2 — Bulbla Lacstrine Deposits; *Lake deposits such as gravel, sand and mud*
- Pm — Corbetti Pumice Flow & Fall Deposits; *Pumice falls and pumice flow deposits*
- Vol — Corbetti Rhyolitic Volcanics; *Rhyolite lava flows and Obsidian lava flows*
- rb — Butajira Recent Basalt; *Basalt lavas and reddish brown basaltic scoria*
- lac1 — Meki Lacustrine Deposits; *Lake deposits such as poorly-sorted gravel, sand, pumice, tuff, and volcanic sand*

**Pleistocene**
- Y — Langano Poorly Welded Pumiceous Pyroclastics; *Yellowish white rhyolitic pumice tuff*
- ob — Kulumusa Highly Welded Tuff; *Rhyolitic to andestic welded tuff*
- W — Ketar River Acidic Volcanic Sedimentary Rocks; *Rhyolitic tuffs and pumice tuffs*
- G — Gonde Strongly Green Welded Tuff; *Rhyolitic to andestic welded tuff*
- tb — Adami Tulu Basaltic Pyroclastics; *Basaltic tuff breccias and lapilli tuffs*
- ba — Ogolche Pleistocene Basalt; *Massive basalt lavas*
- lake — Lekansho Lacustrine Deposits; *Lake deposits such as sand stone and alternate layer*

**Plio-Pleistocene**
- rh — Gademotta Rhyolite; *Rhyolite lava flows and rhyolitic tuffs*
- N2b — N2b Basalt; *Basalt lavas and basaltic pyroclastics*
- NQs — NQs Rhyolite; *Rhyolitic tuffs*

**Pliocene**
- rht — N1_2n Rhyolitic Volcanics; *Plagiocrase rhyolite tuff and rhyolite lava flows containing obsidian*
- N1_2n — N1_2n Rhyolitic Tuff; *Plagiocrase rhyolitic tuff, pumice tuff and crystal tuff*
- N1n — N1n Basalt; *Anchar Basalt*
- N1ar — N1ar Rhyolite; *Rhyolite*

**Miocene**
- Ngs — Sharenga Rhyolite; *Rhyolite piles and necks*
- Ngu — Upper Basalt; *Porous basalt lavas*
- Ngb — Beyana Tuff; *Lapilli tuff with minor laminated tuff*
- Ngm — Middle Basalt; *Porphyritic basalt lavas*

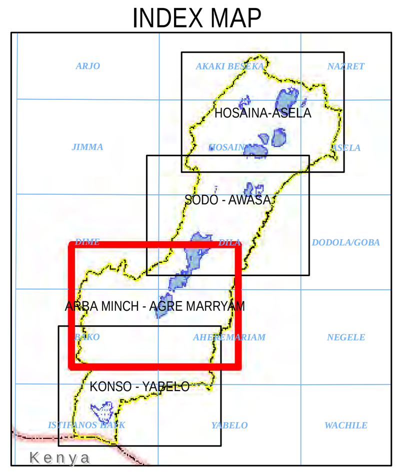
**Eocene-Oligocene**
- Pgs — Shole Welded Tuff; *Densely-welded rhyolitic welded tuff*
- Pgl — Lower Basalt; *Porphyritic basalt lavas*

**MESOZOIC**
- Mes — Adigrat Sandstone, Antaro Limestone; *Sandstone, Shale and Limestone*

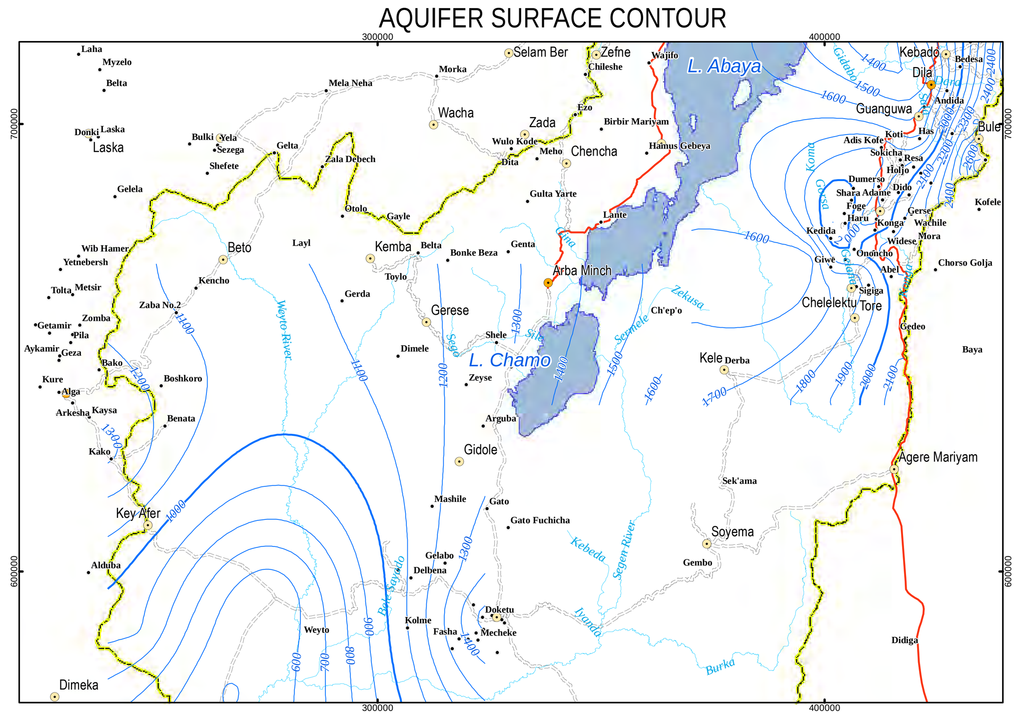
**PRECAMBRIAN**
- Pre — Biotite Gneiss, Pegmatite; *Biotite Gneiss, Granite, Biotite Metagranite*

| No. | Description | Lithology | Productivity Classes | |
|---|---|---|---|---|
| 1 | Extensive aquifer with intergranular permeability | Unconsolidated sediments, alluvium, elluvium, colluvium, lacstrine sediments, poorly cemented sandstone | A | High |
| | | | B | Moderate |
| | | | C | Low |
| 2 | Extensive aquifers with fracture and/or karstic permeability | Consolidated sediments and metamorphosed carbonate; Limestone, sandstone, shale, marl, evaporate marble | High, moderate, low (A, B, C) (Note: Not applicable in this map) | |
| 3 | Extensive aquifers with fracture permeability | Volcanic rocks, basalts, rhyolites, trachytes, ignimbrites | A | High |
| | | | B | Moderate |
| | | | C | Low |
| 4 | Localized aquifers with fracture and intergranular permeability | Non carbonate metamorphic rocks, granitic intrusives,dolerites | C | Low |
| | | | D | Poor |
| 5 | Main geothermal areas | Common occurrence of thermal groundwater in fractured volcanic rocks and subordinate unconsolidated sediments | Moderate or high productivity (A,B) (Note: Not applicable in this map) | |

## INDEX MAP

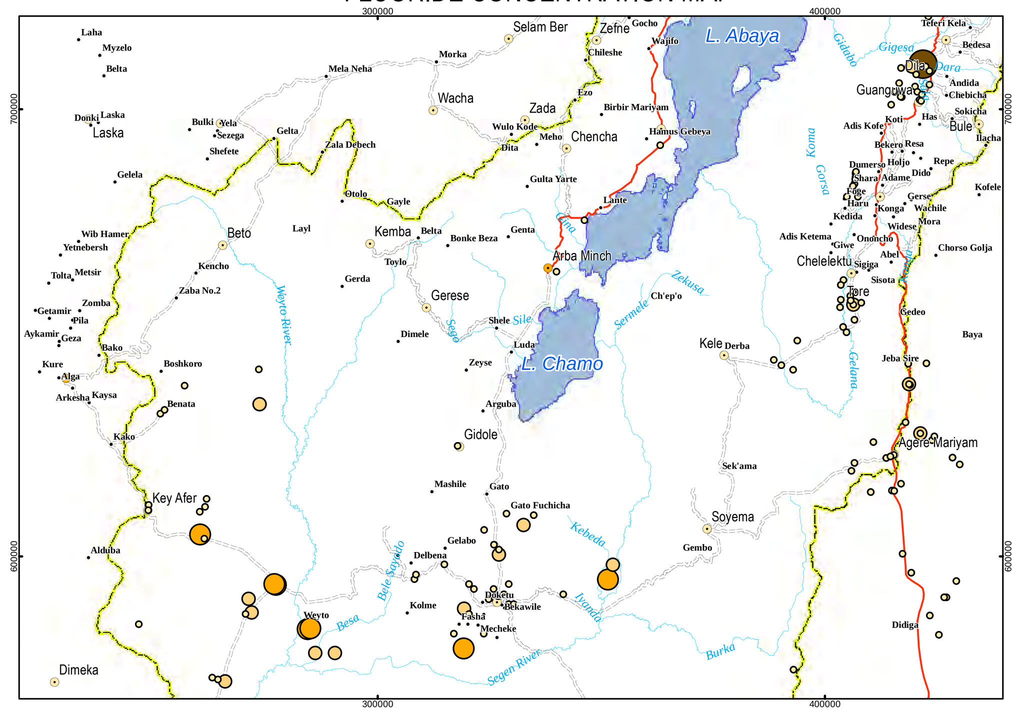



## AQUIFER SURFACE CONTOUR



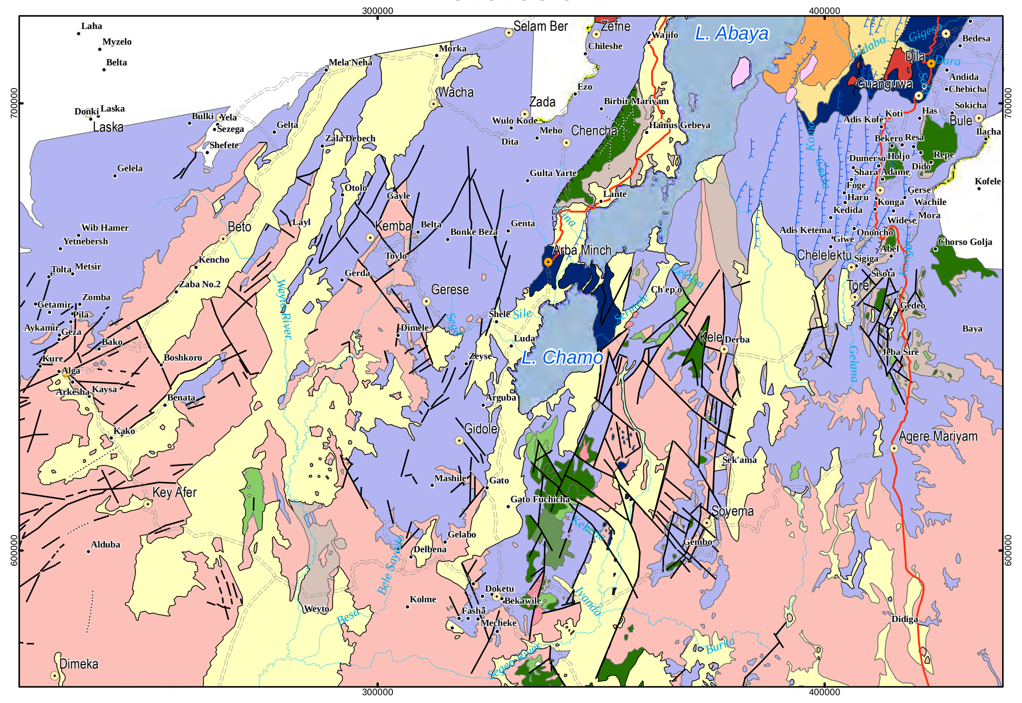

**Upper Aquifer Surface Contour** — 100m interval — 1000m interval — SCALE 1:1,000,000 (0 10 20 40 km)

## FLUORIDE CONCENTRATION MAP




**Fluoride [mg/l]** 0.0 - 1.5 — 1.5 - 3.0 — 3.0 - 10.0 — 10.0 - SCALE 1:1,000,000 (0 10 20 40 km)

## GEOLOGICAL MAP

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The topographical map is based on Ethiopian Mapping Agency (EMA), 1979, 1994, 1995 and 1997
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| Hydrogeological Map | March 2012 |
|---|---|
| THE STUDY ON GROUNDWATER RESOURCES ASSESSMENT IN THE RIFT VALLEY LAKES BASIN | |
| JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | |