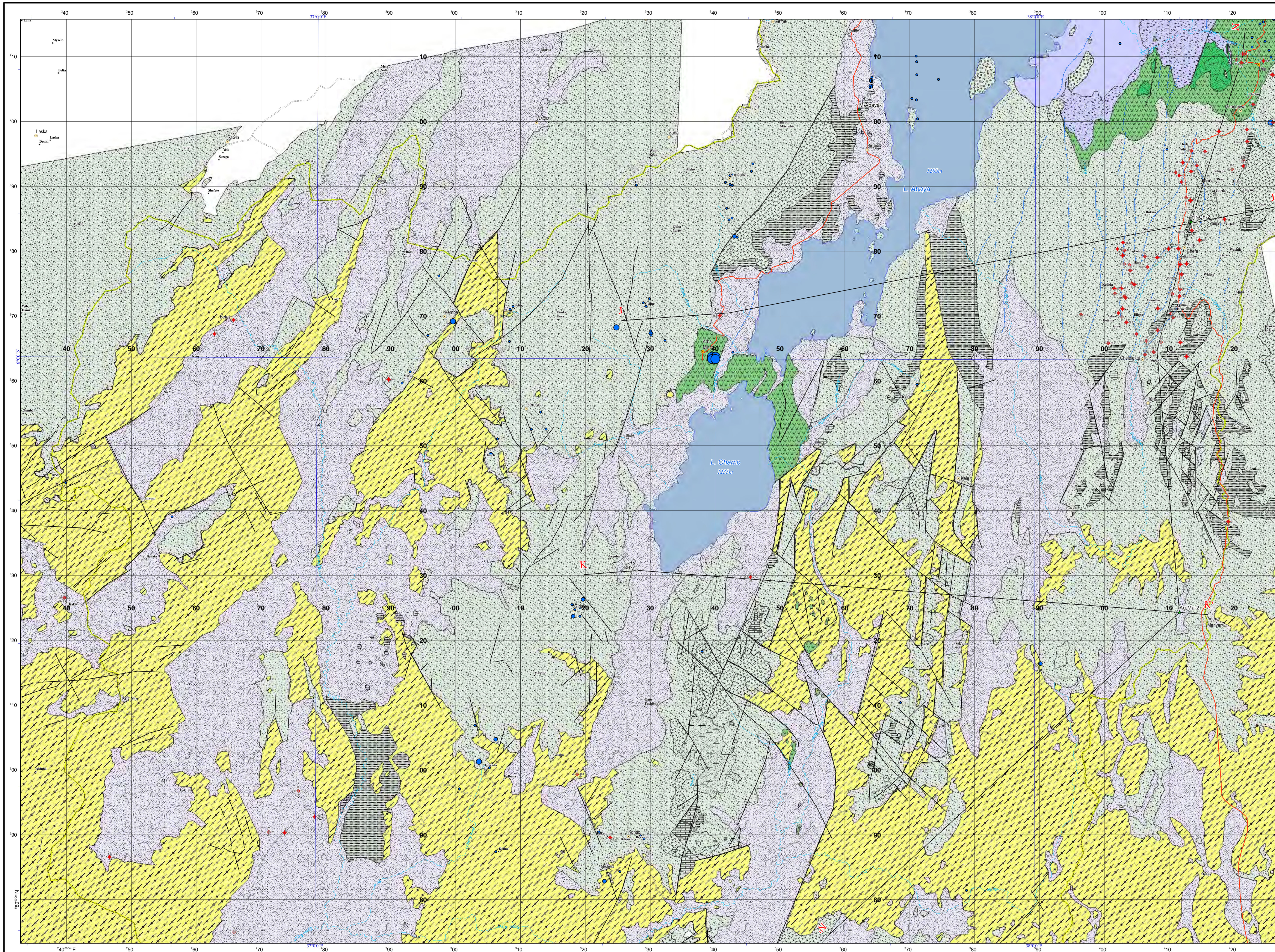


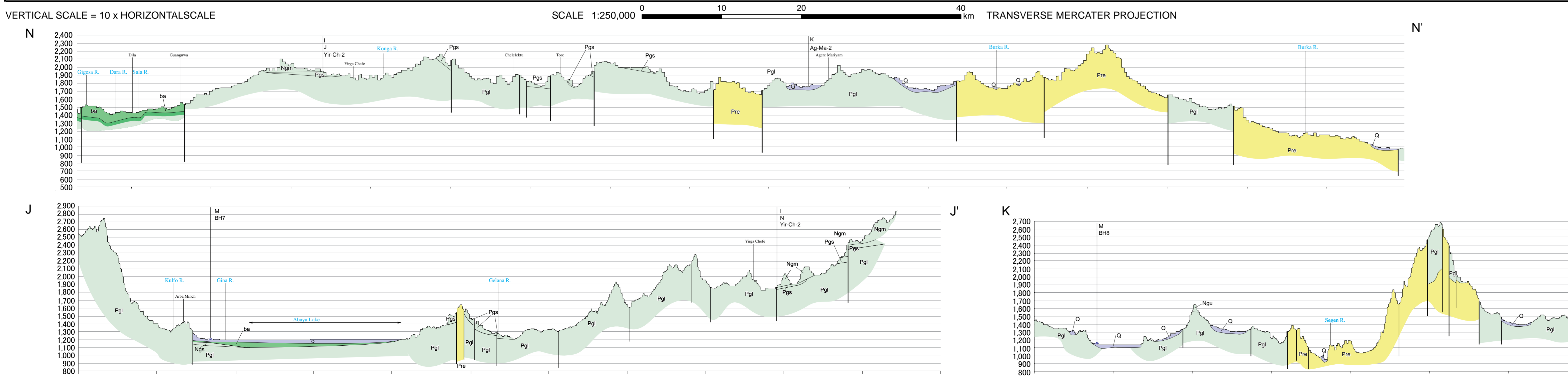
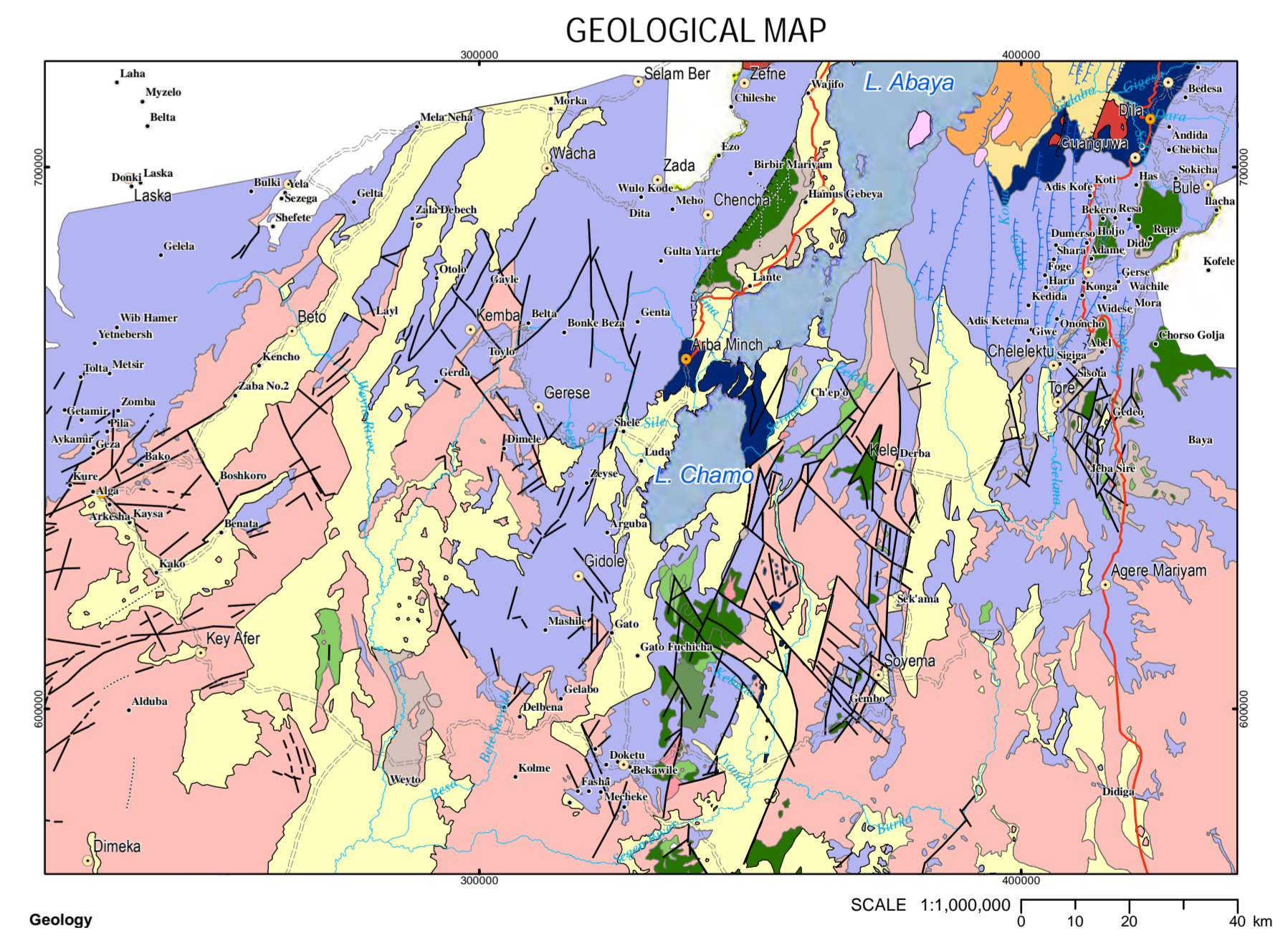
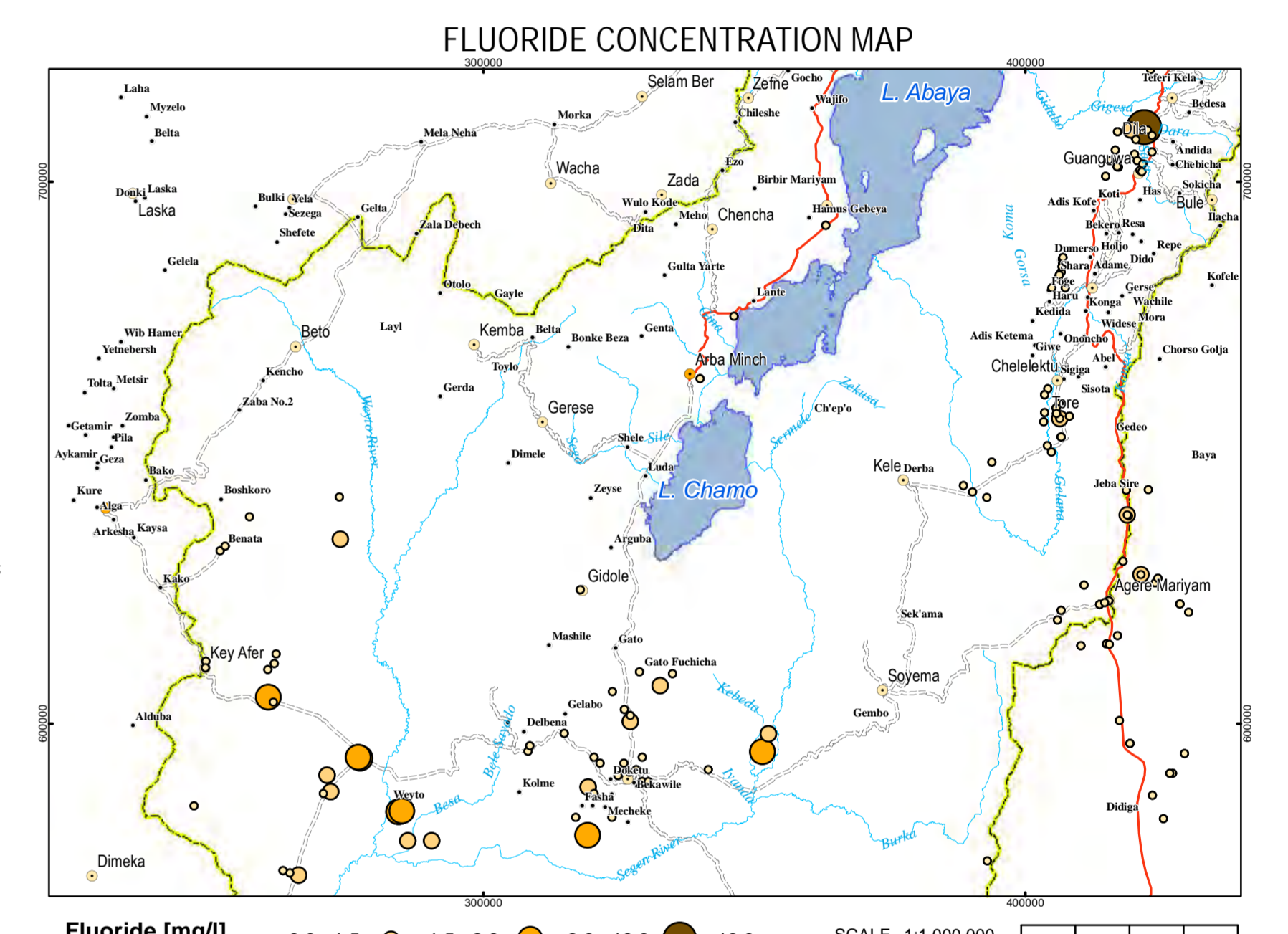
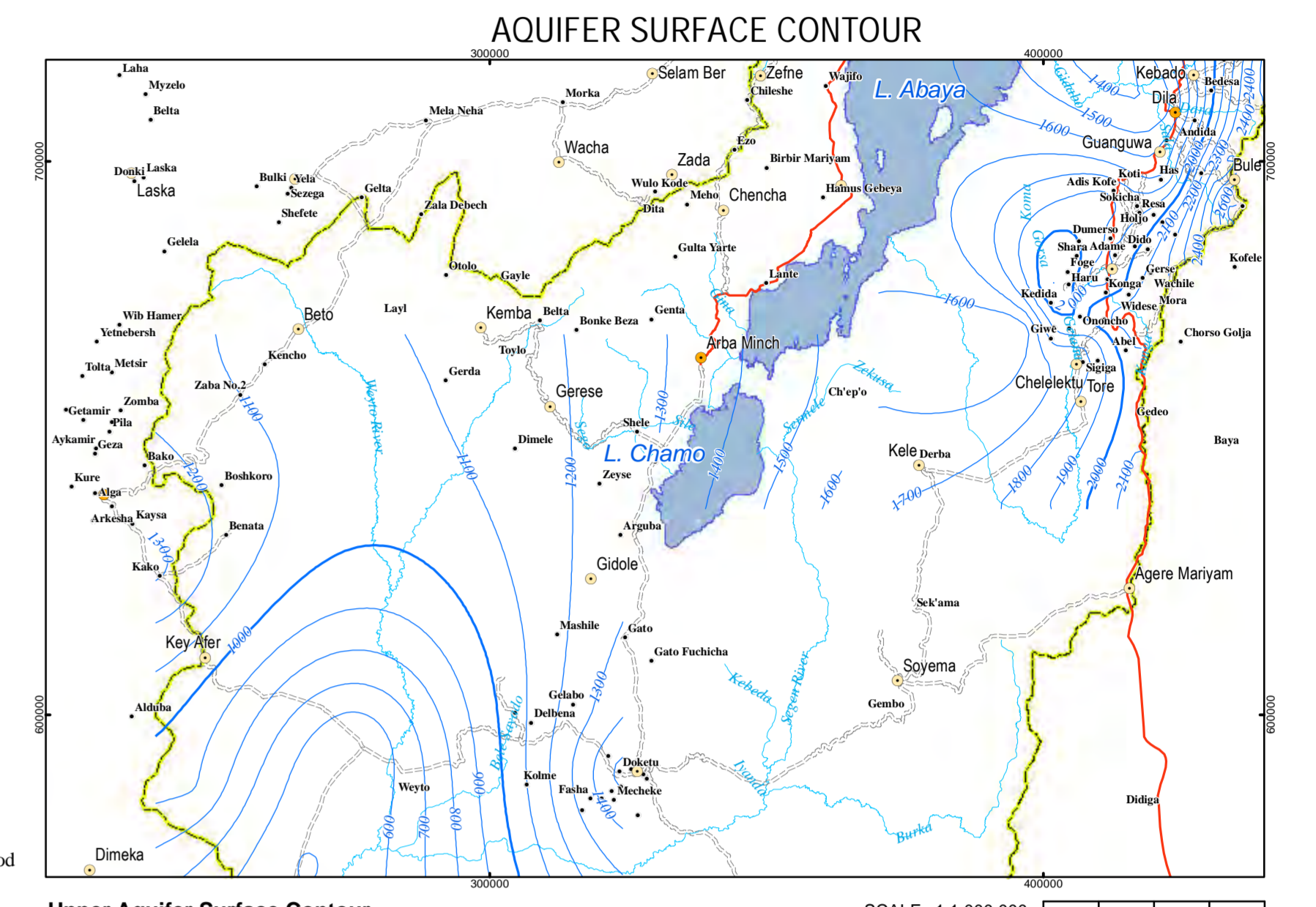
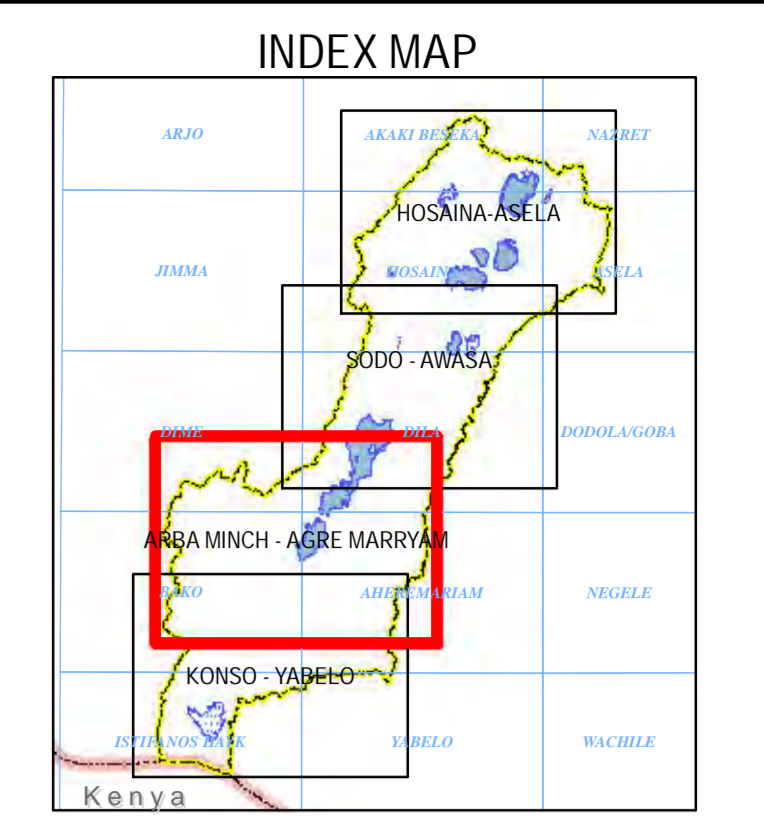
HYDROGEOLOGICAL MAP OF ARBA MINCH - AGRE MARRYAM AREA



- 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, downthrown shown
 - Normal fault
 - Inferred fault, downthrown shown
 - Inferred fault
 - Major fault, downthrown shown, by satellite images
 - Major fault, by satellite images
 - Normal fault, downthrown 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 [m]
 - 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**
- Alluvium, Fine sand - mud
 - Unclassified Fluvial Deposits, Sandy gravel-mud
 - Bulbha Lacustrine Deposits, Lake deposits such as gravel, sand and mud
 - Corbetti Pumice Flow & Fall Deposits, Pumice falls and pumice flow deposits
 - Corbetti Rhyolitic Volcanics, Rhyolite lava flows and Obsidian lava flows
 - Butajira Recent Basalt, Basalt lava and reddish brown basaltic scoria
 - Meki Lacustrine Deposits, Lake deposits such as poorly-sorted gravel, sand, pumice, tuff, and volcanic sand
- Pleistocene**
- Langano Poorly Welded Puncosic Pyroclastics, Yellowish white rhyolitic pumice tuff
 - Kulumsa Highly Welded Tuff, Rhyolite to andesitic welded tuff
 - Ketar River Acidic Volcanic Sedimentary Rocks, Rhyolitic tuffs and pumice tuffs
 - Gondole Strongly Green Welded Tuff, Rhyolite to andesitic welded tuff
 - Adami Tulu Basaltic Pyroclastics, Basaltic tuff breccias and lapilli tuffs
 - Ogokhe Pleistocene Basalt, Massive basalt lava
 - Lekambo Lacustrine Deposits, Lake deposits such as sand stone and alternate layer
- Plio-Pleistocene**
- Galadema Rhyolite, Rhyolite lava flows and rhyolitic tuffs
 - N2b Basalt, Basalt lava and basaltic pyroclastics
 - NQs Rhyolite, Rhyolitic tuffs
- Pliocene**
- N1, 2a Rhyolitic Volcanics, Plagioclase rhyolite tuff and rhyolite lava flows containing obsidian
 - N1, 2b Rhyolitic Tuff, Plagioclase rhyolite tuff, pumice tuff and crystal tuff
 - N1a Basalt, Anchor Basalt
 - N1ar Rhyolite, Rhyolite
- Miocene**
- Sharenga Rhyolite, Rhyolite piles and necks
 - Upper Basalt, Porous basalt lavas
 - Beyana Tuff, Lapilli tuff with minor laminated tuff
 - Middle Basalt, Porphyritic basalt lavas
- Eocene-Oligocene**
- Shale Welded Tuff, Densely welded rhyolite welded tuff
 - Lower Basalt, Porphyritic basalt lavas
- MESOZOIC**
- Adigras Sandstone, Anson Limestone, Sandstone, Shale and Limestone
- PRECAMBRIAN**
- Botite Gneiss, Pegmatite, Basalt Gneiss, Granite, Botite Metagranite

No.	Description	Lithology	Productivity Classes
1	Extensive aquifer with intergranular permeability	Unconsolidated sediments, siltstone, claystone, lacustrine 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, quartz, evaporite marble	High, moderate, low (A, B, C) (Note: Not applicable in this map)
3	Extensive aquifers with fracture permeability	Volcanic rocks, basalts, rhyolites, trachytes, agmatites	A High B Moderate C Low
4	Localized aquifers with fracture and intergranular permeability	Non-carbonate metamorphic rocks, granitic intrusives/dolerites	D Poor
5	Main geothermal areas	Meliorated or high productivity in fractured volcanic rocks and subvolcanic unconsolidated sediments	Common occurrence of thermal groundwater in fractured volcanic rocks and subvolcanic unconsolidated sediments (Note: Not applicable in this map)



Hydrogeological Map **March 2012**

THE STUDY ON GROUNDWATER RESOURCES ASSESSMENT IN THE RIFT VALLEY LAKES BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

(The hydrogeological map is based on the following references: ...)