

Field Interdisciplinary mission in central Afar, Ethiopia November 28th - December 19th 2018

The first interdisciplinary (archeology, geomorphology and paleoclimatology) field mission of the VAPOR-Afar project took place between November 28th and December 19th, 2018, in central Afar of Ethiopia. This region is located at the level of the Afar depression of the East African Rift, within the territory of the Afars, a semi-nomadic people. This region corresponds to the lower valley of the Awash River, which rises at Addis-Abeba (2500 m) and ends in lakes Gamari, Afambo and Abhé (330 m) at the end of a 1200 km trail. The VAPOR-Afar project initiated in 2014 in the Lower Awash valley is directed by Lamya Khalidi (Cepam). This mission was funded by the CLIMAFAR¹ project (IDEX of UCAJEDI, academie 5) codirected by L. Khalidi and M. Revel, and by the BQR- NilAfar project (M. Revel) of OCA (Observatory of Cote d'Azur). This project aims to reconstruct hydrological changes from the fluvial-lacustrine archives and their impact on human adaptation over the last 20,000 years in central Afar, Ethiopia.



View of Lake Gamari

The main results of this mission are:

- Team 1: Continuation of archaeological excavations to complete the VAPOR-Afar and CLIMAFAR projects directed by L. Khalidi (for details see <https://cfee.hypotheses.org/2759> & <http://www.cepam.cnrs.fr/contact/lamya-khalidi/>).
- Team 2: Continuation of geomorphology study started 15 months ago in the context of the Climafar project, as part of the IDEX-UCA thesis of Carlo Mogni directed by M. Revel & L. Khalidi (<https://cfee.hypotheses.org/2516>). 7 stromatolite samples and 100 sedimentary formation samples were collected.
- Team 3: The researchers of paleoclimate, for the first time, have conducted seismic reflection measurements in Lake Gamari and the sampling of 8 sedimentary cores from Lake Gamari and 2 cores from the deepest part of Lake Afambo.

¹ http://univ-cotedazur.fr/fr/idx/academies/human-societies-ideas-and-environments/contents/projects/climafar-ladadaptation-humaine-face-aux-changements-climatiques-dans-les-regions-du-nil-et-de-lafar-de-25-000-ans-a-aujourd2019hui/@highlight_view#.XECbt1VKiYk

Team 3: Paleoclimate: coring and seismic reflection of lakes Gamari & Afambo

1- Scientific context:

During the Pleistocene, tropical Africa has been affected by climatic oscillations of humid and arid periods, which are driven by the variability of the African monsoon (controlled by the position of the Earth in relation to the sun, mainly the precession, Gasse 2000). The African Humid Period (AHP) was the last period of heavier rainfall than today, dated between 14 and 6 ka cal BP. In the Afar region, the succession of humid, arid periods and hyper-arid events over the past 20,000 years both provided favorable ecosystems that may have facilitated societal development, but also arid environments that may have restricted human exploitation of the landscape. In this region, paleoclimate knowledge is mainly based on the work of F. Gasse, conducted in the 1970s. A 6 to 50 m deep continuous core borehole was drilled along the eastern shoreline of the current Lake Abhé shoreline in 1971 by BRGM. The dates of this survey revealed that the 50 m covers 70,000 years (Gasse, 1977). The study of sedimentation facies coupled with the recognition of the different species of diatoms has led to the reconstruction of fluctuations in arid phases (low lake levels) and wet phases (high lake level) Gasse, 1977. In the CLIMAFAR project and the ANR NILAFAR (under evaluation), we propose to reconstruct the paleo-hydrological regime of the Awash River from multi-proxy studies of sediments from Lakes Gamari and Afambo and from climate modelling. These lakes, formed within the northernmost half-graben basin of the East African Rift System are chosen for their location in the eastern end of the Sahel zone (at 11°N) and for the presence of numerous archaeological sites. Thus, the sediments of these lakes, accumulated since ~4 MA, are valuable witnesses to major environmental and paleoclimate changes in tropical latitudes.

2- Organization of the field mission in Afar:

Observations of Landsat satellite images have shown that there is no road or even track to the shores of Lake Afambo. This lake is surrounded by inaccessible and dangerous swamps due to the presence of hippos. Only a 20-km track from Assaita provides access to the southwestern shores of Lake Gamari. Satellite image data indicate that Lake Afambo did not dry up on a historical scale while Lake Gamari partially dried up in the 1980s. Thus, one of the challenges of this mission was to collect sediment in Lake Afambo.



Swamps between lakes Gamari (on left) and Afambo

900 kg of material was transported in 4 boxes from La Rochelle (seismic material 325 kg) and Chambéry (core drilling material 540 kg) to Addis-Abeba, the capital of Ethiopia. This part of the transport was organized by the Ulisse organization of the CNRS. Customs clearance at

Addis Ababa airport and authorizations to leave the sediment cores (~100 kgs) was managed by the CFEE, ARCCH and ministry of Mines.

In order to best secure this mission, a generator and a medium zodiac (3 m long and weighing 90 kg) were purchased by the University of La Rochelle (Labo. LIENSs) and Chambéry (Labo. Edytem), respectively. In addition, for safety reasons, two outboard motors were systematically taken on a single zodiac.

December 7: 9am departure of 4 people on the large zodiac with the Uwitec corer for the coring of Lake Afambo. Séko, our Afar guard accompanied by Ahmed, are on hand. **Successful sampling of two cores from the deepest part of Lake Afambo from two cores (AFA1801 1.31 m & AFA1802 1.81 m).**

→ Opening of the cores and measurement of major elements distribution every mm by the XRF core scanner at the EDYTEM is planned for early March.

Plate 1: Illustration of seismic reflection and coring (responsibility Laboratory UMR 7266 LIENSs and Edytem, respectively). Photo from Eric Chaumillon (LIENSs).

