Report on fieldwork - First investigation on the site of Wakarida (March 21st - April 2nd 2011)

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French-Ethiopian project
of archaeological and epigraphic investigations
in Tigrai region, Ethiopia

Pre-Aksumite and Aksumite period
(8^{th} c. BC-AD 7^{th} c.)

REPORT ON FIELDWORK

FIRST INVESTIGATION
ON THE SITE OF WAKARIDA
(March 21^{st} - April 2^{nd} 2011)

presented by

Dr Iwona Gajda,
Dr Fabienne Dugast
& the team

TO THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF YOUTH, SPORT, AND CULTURE

AUTHORITY FOR RESEARCH AND CONSERVATION
OF CULTURAL HERITAGE

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31 May 2011

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Heads of mission:

Dr Iwona GAJDA, Epigraphist and Historian, specialist in pre-islamic epigraphy and Arabian history, and Dr Fabienne DUGAST, Archaeologist, both from the Centre national de la recherche scientifique in Paris (France).

Title of project:

Archaeological and epigraphic investigations in Tigrai region, Ethiopia (Pre-Aksumite and Aksumite period)

Dates of fieldwork:

March 21st-April 2nd, 2011

Field of research:

Historical, archaeological and epigraphic investigations

List of field team members:

Name	Specialty	Institution	Degree
Dr Iwona GAJDA	*Epigraphy and History*	CNRS / France	PhD
Dr Fabienne DUGAST	*Archaeology*	CNRS / France	PhD
Dr Vittoria BUFFA	*Archaeology*	Italian Mission to Oman / Univeristà di Pisa / Italy	PhD
Dr Christian CAMERLYNCK	*Geophysics*	Université Pierre & Marie Curie, Paris / France	PhD
Quentin VITALE	*Geophysics*	Université Pierre & Marie Curie, Paris / France	PhD *to be submitted in 2014*
Xavier CRAPERI	*Survey*	ALTEA Surveyors, Lyon / France	MA
Yohannes GEBRE SELLASSIE	*History of Aksumite period*	University of Paris-Sorbonne	PhD *to be submitted in 2011*
Tekle HAGOS	*Archaeology*	University of Addis Ababa	MA
Amare STETOTANE	*driver*	French Centre for Ethiopian Studies, Addis Ababa	-
Simeneh BACHA	*driver*	French Centre for Ethiopian Studies, Addis Ababa	-
Sisay GETHEWE	*cooker*	French Centre for Ethiopian Studies, Addis Ababa	-

Official representative:

Haylay TEKLAY, Bureau of Culture and Tourism of the Regional State of Tigrai, Wukro.

INTRODUCTION & BACKGROUND

Several sites of the so called "Pre-Aksumite" civilization have been established in Tigrai region between the 8th and the 5th century BC. This civilization had significant contacts with South Arabia. Script, architecture, and cult of several deities have been brought by Sabaean immigrants in the first half of the Ist millennium BC. Recent excavations at Maqabər Gaˀəwa (near Wukro) revealed, for example, the remains of a temple of Almaqah, whose cult existed in the kingdom of Saba (see I. Gajda *et alii* 2009). As for the history of the kingdom of Aksum, between the end of the 2nd and the end of the 6th century AD, it is only known by a few various sources.

Even if South Arabian influence is obvious in economy, trade, and social structures in both "Pre-Aksumite" and Aksumite civilization, the history of Ethiopia is still misunderstood.

The objectives of our research in the region of Tigrai are therefore, both a contribution to the periodisation of the Antiquity in Ethiopia (no chronological classification of any artefact has been yet established for Ancient Ethiopia), and a study of the evolution of Ancient Ethiopian civilisation and its contacts with other countries, from the Mediterranean Sea to India.

In this very context, three main axes of research have been defined for the next four years:

1/ A comparative study will be carried out especially on potteries coming from various sites, but also on different types of construction, and artefacts.

2/ A study of local tradition, both written and oral. The aim of this study is to try to localize other antiquities, to identify the toponyms, to trace modern and ancient roads, to search for the historical information in the local tradition, to study the inscriptions in their archaeological context.

3/ A work on the periodisation of the Ancient Ethiopian history based on the available data and on the results obtained by our mission.

The site of Wakarida

In agreement with Ato Kebede Amare Belay, General Manager of the Tigrai Culture and Tourism Agency at Mekelle, a preliminary mission, which took place in March 2010, has been concentrated on documenting several sites first surveyed by the Ethiopian team in the region of Atsbi-Dera, East of Mekelle (see I. Gajda & F. Dugast 2010). Further to this first mission, the site of Wakarida, in the *Tobia* / district of Sawena, eastern Tigrai (**fig. 1**), has been chosen to start systematic archaeological investigations to achieve our major aims.

The choice of this site is due on one hand to its geographic situation (even if distant of the main axes of circulation already known, it is turned towards the Red Sea), on the other hand to an important chronological sequence that may be obtained according to the already collected pottery on surface.

Implementation

The main tasks in 2011 were to initiate archaeological excavations and research at Wakarida to be proceeded in the following years. In this purpose, our mission made a **geophysical survey** on the site, as well as **test excavations**, and initiated a **provisional typology** of the pottery.

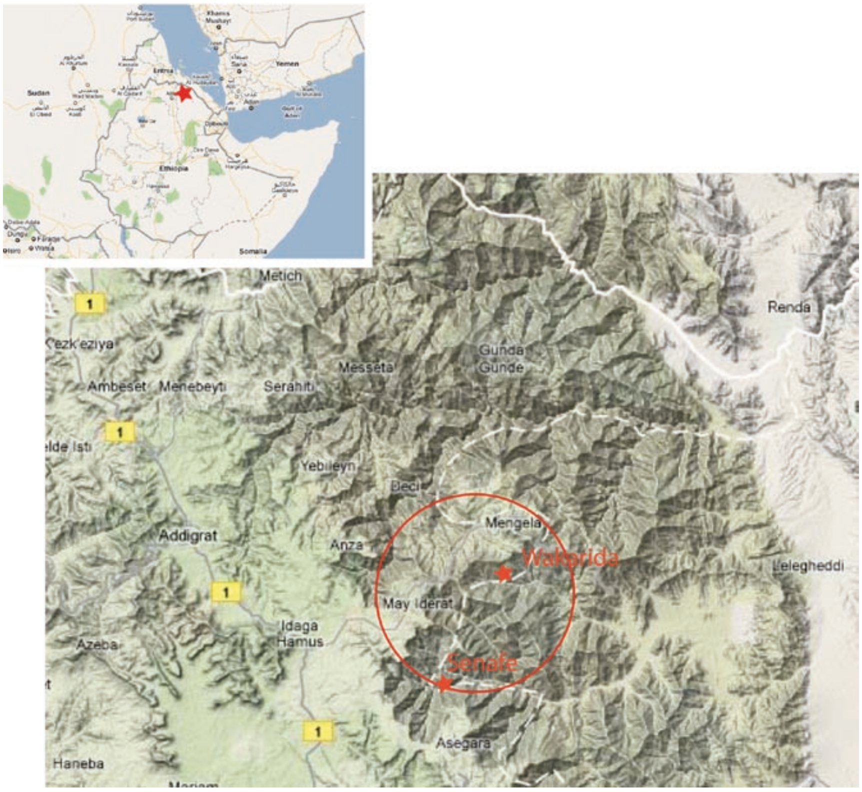


Figure 1: Localisation of the site of Wakarida, Eastern Tigrai (FD 2011).

Before an extensive excavation, our priority was in fact to estimate and evaluate the archaeological potential of the site, its area and organization. Specific fieldwork objectives were to implement a sampling design which employed geomantic techniques including GPS (Global Positioning System) and GIS (Geographic Information System) (see II), to initiate a more systematic survey which employed specific techniques including geophysical methods.

This point has been achieved thanks to an electromagnetic survey which consisted on electrodes resistivity and reflectometry measurements – taking into account the nature of the soil (see III).

Beside, three test excavations consisting on soundings have been opened on the top of the hill as well as in the eastern and northern parts of it, one of which near a cleared out building (see IV). Besides, a few pedestrian surveys have been carried out around the site, in order to recognize the real expansion of the archaeological area, and even other settlements nearby (see IV).

As "Pre-Aksumite" and Aksumite artefacts are still not well known, the fieldwork objectives were as well to implement a sampling of each type of ceramics in order to produce a new typology with, as far as possible, dating references. A systematic collection of artefacts with a systematic register and stratigraphic localization, has been initiated and developed into the basis of a preliminary typological study and chronological markers (see V).

Running and team

Our project is based on the collaboration of specialists of several domains. At this stage though, only geophysicists, archaeologists and a surveyor were needed. It involved anyway Ethiopian scholars: Yohannes Gebre Sellassie is part of the mission since the very beginning, and Tekle Hagos since 2011 even though he could not participate in March 2011. And of course, we were helped by the French Centre for Ethiopian Studies, and the Bureau of Culture and Tourism of the Regional State of Tigrai, as well as the *Tabia*'s administrator and officials from Sawena, and the local people who were very cooperative and concerned to the investigations.

The investigations were directed by Dr Iwona Gajda and Dr Fabienne Dugast, from the Centre national de la recherche scientifique (CNRS) in Paris, and team members included:

- Dr Vittoria Buffa, archaeologist (Italy), working besides in the Italian Mission to Oman,
- Dr Christian Camerlynck, geophysicist from the University Pierre & Marie Curie in Paris (France),
- Quentin Vitale, student, geophysicist from the University Pierre & Marie Curie in Paris (France),
- Xavier Crapery, surveyor from ALTEA Surveyors in Lyon (France),
- Yohannes Gebre Sellassie, historian of Aksumite period, Mekelle (Ethiopia),
- Haylay Teklay, from the Bureau of Culture and Tourism of the Regional State of Tigrai in Wukro (Ethiopia),
- Ato Tadesse, the *Tabia*'s administrator from Sawena (Ethiopia),
- Amare Stetotane, Simeneh Bacha and Sisay Gethewe, from the French Centre for Ethiopian Studies, in Addis Ababa (Ethiopia),
- Abraha Hailu, Hailu Abera, Woldu Tesfeare, Fitsum Gebru, and Lamlam Woldu, from Wakarida (Ethiopia).

During this very first campaign, we have got in touch with two scholars from the University of Mekelle – Yohannes Aytenew and Hiruy Daniel –, who paid a short visit to the site and showed an interest in helping the mission.

I. THE SITE OF WAKARIDA

Y. Gebre Selassie, I. Gajda & F. Dugast

The archaeological site of Wakarida (formerly known as ʾAribara) is situated about 70 kms North Wukro, 2 hours trail from Edaga Hamus, East and near Sawena, 14°16'56"4 N / 39°43'31"9 E (altitude 2,343 m).

It is dependent on Saʾese Tseʾda Emba administrative *Woreda* / region, in the *Tabia* / district of Sawena.

The site has been established on a rocky outcrop, which overlooks a large valley surrounded by chain of mountains, respectively from North to East and South to West: Daima, Afedadae, Dagaraebe and Arebata (**fig. 2**). From now on, the place is made up of cultivated lands and farm houses, which belong to four heads of family: Ato Haile Maryam, Ato Hagos, Ato Hailu and Ato Woldu.

Figure 2: The site of Wakarida, from South (FD 2011).

Preliminary survey

The site has been surveyed in 2004 by Tekle Hagos, from Addis Ababa University, and Habtamu Mekonnen, from the Tourism and Culture Commission of Tigrai Regional State at Mekelle (report, 2004: 16-18).

A complex has been found on the north-eastern side of the hill, consisting of 4 adjoining rooms, somewhat 3 x 3,50 m square each, arranged 2 by 2. In the middle of one of the rooms was a pillar like wall, actually destroyed by the inhabitants. More structures arose on both sides of the complex, consisting as well of regular groups of adjoining rooms. Actually, local people use the stones as building material for their own houses, which are erected mostly on ancient structures.

More structures were visible nearby, from top to mid-slope of the hill. The area seemed to cover some 5 ha, looking North and East, on the valley. Trails open North and East in the Red Sea direction.

Ethno-historical investigations

During our stay at Wakarida, with the help of Hailay Teklay, representative of the Bureau, Yohannes Gebre Sellassie has been able to record oral history and legend relating to the site. He discussed with three informants: Ato Gebre Selassie Tesfay, Ato Hailu Abera, and Ato Qashe Aberha.

– **According to the legend**, the earliest settlers of Wakarida were the people of Hamädä and Dobʾa. These people, says the legend, came from South Arabia, and settled in the highland part of Tigrai. When they came to Wakarida, they were Tigrigna speakers.

During the epoch of Dobʾa, there was a recurrent famine, due to lack of rain for straight 7 years, and continuous attacks waged by a powerful king called Tobas. This Tobas, says the legend, was reigning in South Arabia and some parts of Tigrai. Because of the recurrent famine and war, the local historians say that the settlers of Sawena were forced to leave their homeland. Before leaving, the elders say that the inhabitants buried their goods.

– **According to Ato Gebre Selassie Tesfay**, the first migrants from South Arabia settled at Raʾelä, not far from Sawena. The evidence of their settlement, he says, is the existence of dam structures visible to this day. From Raʾelä, they settled at Sawena, after Sawena they moved to Aksum. Ato Gebre Selassie says that agriculture and irrigation started in Raʾelä and Sawena. The structures we see in Sawena belong to these early settlers.

– **According to Ato Hailu Abera**, long ago there were two tribes who settled at Sawena, and the surrounding areas. These two early settlers were Dobʾa and Hamedo. When Hamedo was reigning (they call him Zemene Hamedo), there were innumerable settlers in the area. *Hamed* in Tigrigna means "earth" or "soil". During this time, because of overpopulation, there was scarcity of arable land and fertile soil. Ato Hailu told us that even dowry (endowment provided during marriage ceremony) was with soil:

> Just before the marriage ceremony, the family of the bride-groom builds a platform, and the family of the bride endows them with soil. The newly married couple cultivates sorghum (*mashila*), and subsists the whole year with the cereal.

The structure we see at Sawena, according to Ato Hailu Abera, belongs to the ancient urban settlement of the early settlers, Hamedo and Dobʾa.

– After the introduction of Christianity into Aksum, Ato Hailu claims that Maryam Sawena was constructed at Sawena. Emperor Zera Yakob (1434-1468), who learnt about the greatness of Maryam Sawena, is said to have donated a guild land to the church. **Ato Qashe Aberha** adds that when the cathedral of Aksum Tseyon was pillaged and burnt by the army of Gragn Ahemed (1527-1543) and Gaʾewa, the Tabot of Tseyon Maryam took refuge at Sawena.

II. TOPOGRAPHY

X. Craperi

Before beginning any geophysical and archaeological work on the site of Wakarida, it was necessary to set up geo-referenced points and grid, as well as a topographical mapping of the site.

Implementation

Wakarida's area is located on a rocky outcrop. Considering the constructions and the ground evolution, it was necessary to make a polygonal (many-sided land survey).

Because of the kind of soil – compact and stony, rocky outcrop –, the stations have been first located with plastic stakes (bought in France), which suited to the ground, and were sufficient. Four perennial geodesic markers (bronze nails into concrete blocks) have been set up on the area, placed in line in order to make each of them visible from the others.

A reference grid was necessary before making any geophysical measurement. In agreement with the geophysicists, we chose 50 meters squares turned towards North (see III).

On the first two days, we made a rough land-survey, marked the boundary of area, and placed the existing constructions.

Measures & calculations

Measures and calculations have been made thanks to a closed polygonal of 8 stations (1000 to 1007). Each of them measures two other stations, which were taken with a total station Leica Flexline TS06 (**fig. 3**). The polygonal has been calculated on Covadis Calcul software, in an independent system.

We chose the station number 1004 as the starting point, as it was the lowest (so that it makes altitudes easy to understand), considering X=1000, Y=2000, Z=100. Station number 1004's horizontal angle was established at 0, pointing magnetic North (quite close to the geographical North there) in order to get a plan already positioned towards North, to simplify the reference grid.

The reference grid has been superimposed on the drawing on Autocad, to make the stake out easier. Those points have been then converted into a GIS file for the Leica total station.

Figure 3: Total station Leica Flexline TS06 (IG 2011).

Stake out & drawing

Stake out has been set up thanks to the two usual methods: orientation and triangulation.

Thanks to the referenced grid, the geophysicist's magnetic cards and the topographic plan could be superimposed, and completed. Finally, we completed the land survey, noting down each detail in the area, about every 10 meters, in order to draw the level lines (**fig. 4**).

All these information enable to draw geodesic markers index card with description and pictures of the references, in order to have an orientation for each marker even if it is not possible to see another ST (destruction, new building between both of them, vegetation...).

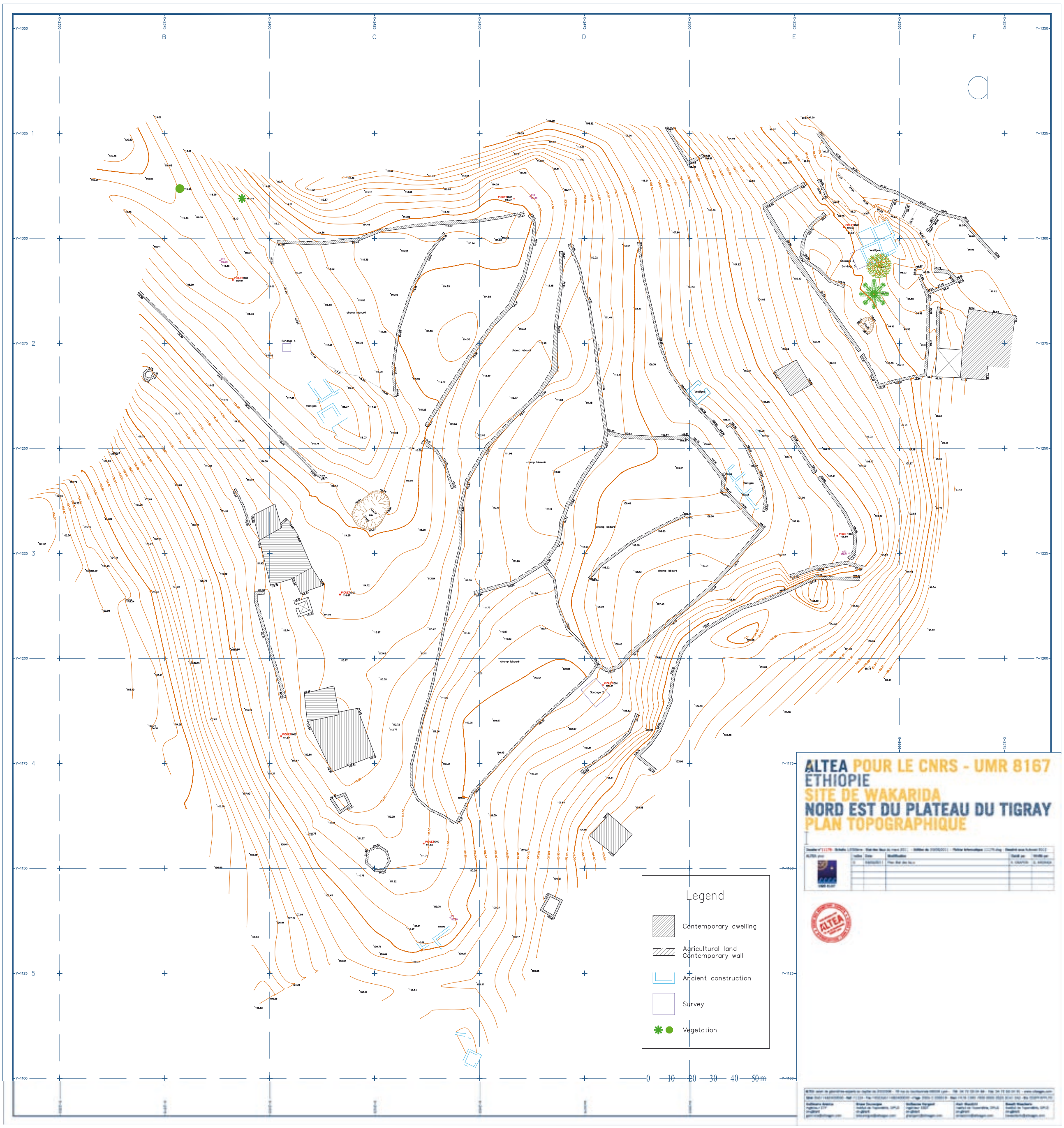
Landscape

The outcrop shows up a kind of round or even oval-shaped, stony ground, looking South-East to some 250 m long.

The hill reaches 2,360 m at its highest point, on the north-western part, and 2,340 m at its lower point, next to the valley. It slopes down steeply on the North, on the way to Sawena, but far more gently on the South to the valley, on a quite fertile soil.

Actually, two modern houses have been set up on the western side of the hill (Ato Woldu) and one on the eastern side (Ato Hagos). The south-eastern slope is divided into few parcels of land, delimited with drystone walls. Several other houses have been built up in the valley – and even on top of the surrounding hills –, to farm the land nearby.

Figure 4: Topography of the site of Wakarida (XC 2011).



III. GEOPHYSICAL SURVEY

Chr. Camerlynck & Q. Vitale

The aim of the geophysical survey was to estimate and evaluate the expansion and the organization of the site of Wakarida before any extensive excavation.

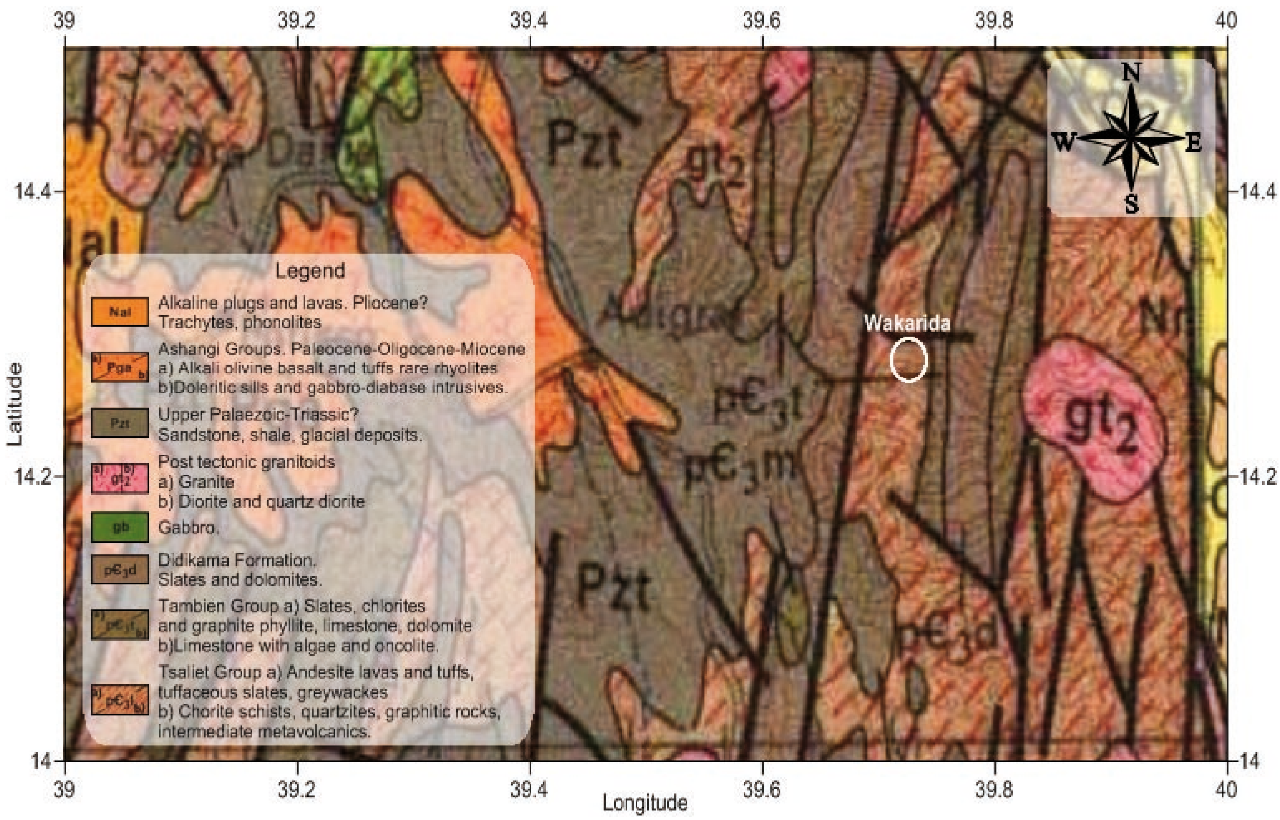
Geological context

Based on the Geological Map of Ethiopia and observations on the field, it seems that the site of Wakarida is formed of the Tsaliet Group formation (**fig. 5**). It is a late Precambrian unit (upper proterozoic) that is mainly composed of low-grade metamorphic and metavolcanic rocks. Chlorite schist outcrops are visible down on the north-western slope of the site, and metamorphic sandstones outcrops are located on the top of Wakarida hill. The whole site is covered with decametric rock blocs composed of the surroundings outcrops, and almost all the Tsaliet Group rocks are hence represented on the site.

Choice of the methods

In an archaeological context, the most common geophysical survey methods are the electric, the magnetic, the Ground Penetrating Radar (GPR) and the electromagnetic (EM) ones. Each of them has of course advantages and drawbacks. The choice of a particular method depends on the type of archaeological structures we expect to find (size, material, etc.), and the local geological background. The available time on the field is also a constraint that has to be taken into account in the choice of the method.

Figure 5: Main geological formations of the site of Wakarida and its surroundings. [Extract from the Geological Map of Ethiopia*, 1/2 000 000, 1972]*



Based on the previous 2010 survey performed at Wakarida, the site was expected to be quite rocky and was assumed to be electrically very resistant. It has hence be decided to use preferentially a method which does not need direct contact with the ground to take measurements (electrical survey for instance, needs metal electrodes to be pushed into the ground, therefore if the ground is too rocky or too resistant, not enough current can be sent into it, and the results might not be significant).

Considering the very short time available to perform this first geophysical survey, we decided to use a method which is easy and fast to set up on the field, and allows us to cover as much ground as possible. We choose the **magnetic method**, as it requires less equipment, and can be set up more easily than GPR. It also generally allows covering more ground.

Because of the natural geomagnetic field orientation at those latitudes (close to the magnetic equator, the inclination of the geomagnetic field is only 14°), and the potential presence of volcanic rocks on the site, we were not sure that the magnetic contrast between geologic and archaeological structures would be at the maximum. We therefore brought a resistivity meter in case the ground would be soft enough to perform an electrical survey.

Equipment and Survey

• Magnetic survey

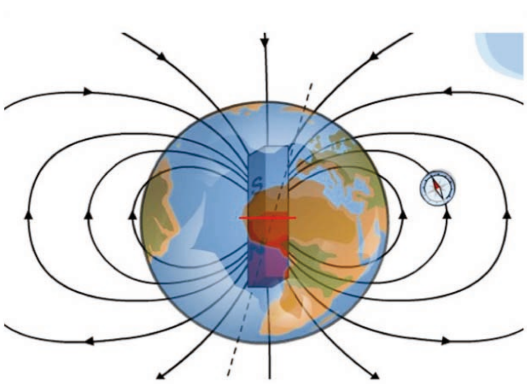
The Earth natural magnetic field (geomagnetic field) can be approximate by a magnetic dipole with its magnetic south pole close to the geographic North Pole and its magnetic north pole close to the geographic South Pole. This field mainly originates from the Earth liquid outer core movements (internal magnetic field), but also in a smaller part from the interferences between solar winds and the upper layer of the atmosphere (external magnetic field).

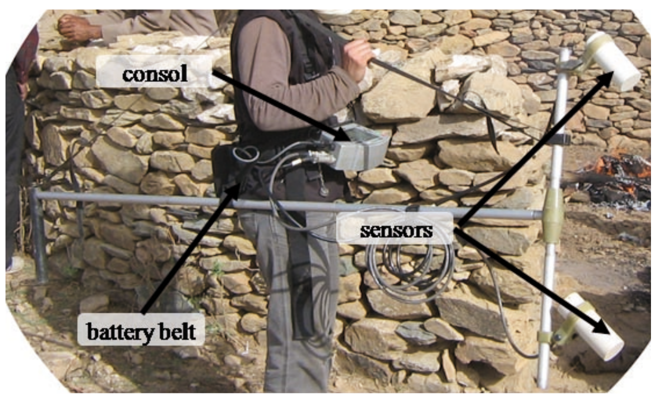
The geomagnetic field intensity varies with the geographical position at the surface (internal field), and also with time (the external field varies on a day scale for instance). The geomagnetic field intensity is ranging from 20 000 nT (nano Tesla) in South America to over 60 000 nT near the magnetic poles.

More locally, on an archaeological survey scale, variations of the magnetic field can also be caused by the magnetic properties of soils and rocks. Those local variations (referred to as "anomalies") can either originates from natural heterogeneities or from human activities (fire place, brick walls, etc.).

To get rid of the natural daily variations we are using two sensors one on top of the other. This technique called gradiometer also allows us to get rid of the deep geological low frequency variations and enhances the weak shallow variations that might originate from archaeological structures. Since the signal of both sensors is record we can still study each signal independently.

Figure 6: Magnetometre G-858 MagMapper from Geometrics.





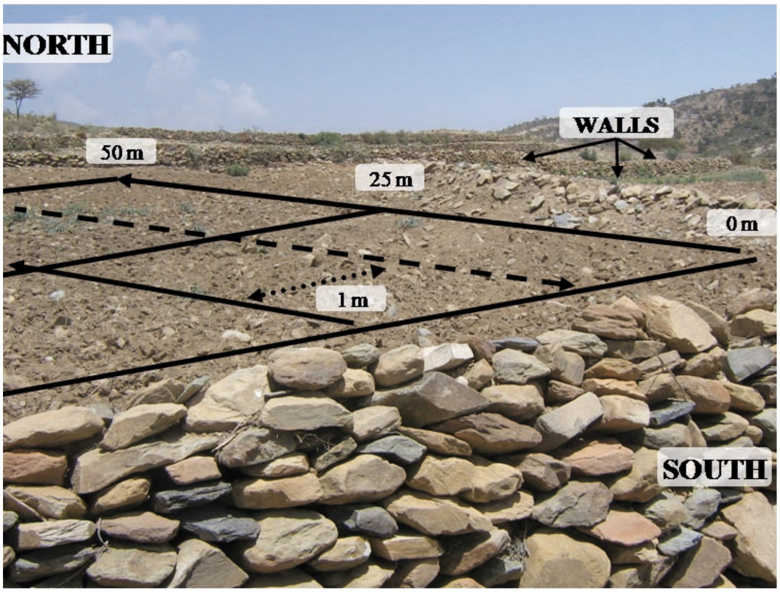


Figure 7: Prospection grid on the field.

Mapping the magnetic gradient on the field reveals magnetic anomalies that can then be interpreted as human-made or natural structures depending on their organization, their geometry and other clues.

The magnetometer used on the field is a G-858 MagMapper from Geometrics. It is composed of two magnetic sensors, one on top of the other, and an acquisition consol, all fixed to an aluminium carrying structure. The power supply is ensured by a simple battery belt (**fig. 6**). The operator carries the whole equipment on his shoulders and belt, and walks across the prospecting areas to survey.

The survey was originally cut up in 50 x 50 m squares areas, spread over the site. The survey is performed along 50 m long profiles, separated from each other by 1 m (**fig. 7**). In order to maximize the magnetic signal received by the sensors at these latitudes, they must be tilted at an angle of roughly 45° with the ground, and the profiles must be oriented in the North-South direction. In the field we actually performed our profiles with a slightly shifted direction (N 166°).

The measurements are recorded continuously (every 0.1 s) along each profile. The measurements positioning is done automatically, assuming that the operator walks regularly along a profile, to reduce positioning errors.

The survey area is materialized on the ground by pulling 50 m-tapes on each side of the square. All the profiles are not materialized on the ground but a mark is placed on the tape on the other side of the square at the corresponding position, and then displaced of 1 m to the next position…

This way of operating allows us, in good conditions, to cover over 2 ha a day. At Wakarida, because of the presence of lots of walls (**fig. 7**), the 50 x 50 m areas were actually cut up in smaller pieces, slowing down the survey efficiency.

The map of the local magnetic field is then obtained by interpolating the field between each profile. Because of the survey gridsize resolution (1 m between each profile), we could not detect small structures with this procedure, as but their magnetic response may be very strong (fire place, etc.). On the other hand, large enough structures such as houses' walls are generally well detected.

• Electric survey

The electrical survey is based on the measure of the soil's electrical resistivity. This resistivity is defined as the property of a rock (or soil) to oppose the flow of an electrical current passing through it. The resistivity naturally varies from 1 to 10^6 Ω.m, and depends on the soil's constitution, porosity and water content. Basically, when a soil is porous and well wet, it will be less resistive than a dry and dense soil.

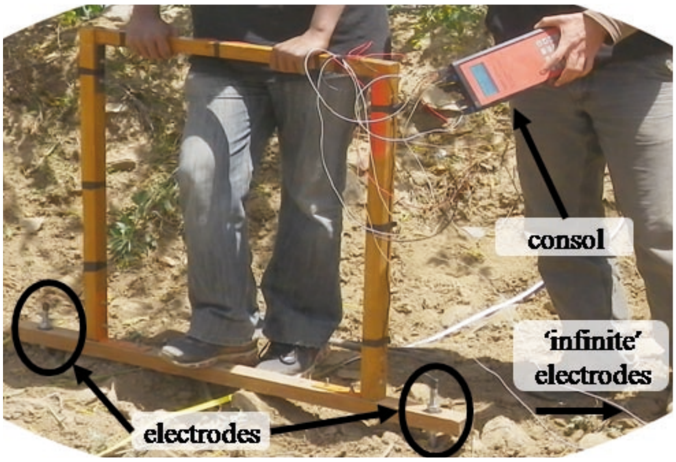


Figure 8: Pole-Pole electrical configuration used on field.

Using four electrodes pushed into the ground, two injecting an electrical current (called A and B), we can measure the resistivity of the volume of ground contained in between the two others electrodes (called M and N).

Collecting the value of resistivity of the whole prospected area, we obtain a map of the soil electrical resistivity. If there is a buried archaeological structure, such as a wall, and that a significant resistivity contrast exists between the structure surroundings, the archaeological structure will hence be enlightened in the obtained map. For instance, a wall is generally denser than the surrounding soil and less water can therefore penetrate in the wall porosity. This will make the buried wall appears as a resistive "anomaly" compare to the rest of the soil.

A small electric survey was performed in a plowed plot which appeared to be soft enough to push the electrodes into the ground. The resistivitymeter used was a *4point light 10W* from Lippman. It has to be connected to four electrodes: two are injecting an electrical current into the ground, and the other two are measuring the induced tension.

We used a Pole-Pole configuration, that is to say that two electrodes are placed far away from measured point. This configuration allows us to move only two electrodes (called probe electrodes) instead of four during the survey (**fig. 8**), which increases the area covered by the survey. The position of the measured point is defined as the middle of the two probe electrodes, and we consider that the depth of investigation is roughly equal to the electrode separation. In our case that corresponds approximately to one meter.

The survey is basically performed likewise the magnetic one, but with this method, there is no need for a special orientation of the profiles. We did continue to use North-South profiles anyway.

The measures are not recorded continuously, but one point is taken every meter (the measured gridsize is therefore 1 x 1 m). The position is then read on a tape which basically has to be displaced for each profile. The way of proceeding is hence slower that the magnetic survey, but the electrical contrast do not suffer from the metavolcanic nature of the geological background.

<u>**Interpretation**</u>

• Interpretation basics [Magnetic survey] (fig. 9)

To read the map properly, one has to keep in mind that magnetic anomalies are generally composed of two visible parts: a negative and a positive one. We generally consider that the real corresponding buried structure is basically centred on the negative-positive transition. The boundaries of the real structure are not those of the visible magnetic anomaly (which extension depends on the depth). Due to the low inclination of the geomagnetic field, magnetic anomalies may look spread, in comparison with similar anomaly acquired at mid latitudes with a more vertical geomagnetic field. Therefore anomalies may look broader, little clear and thus difficult to understand, making the map difficult to "read".

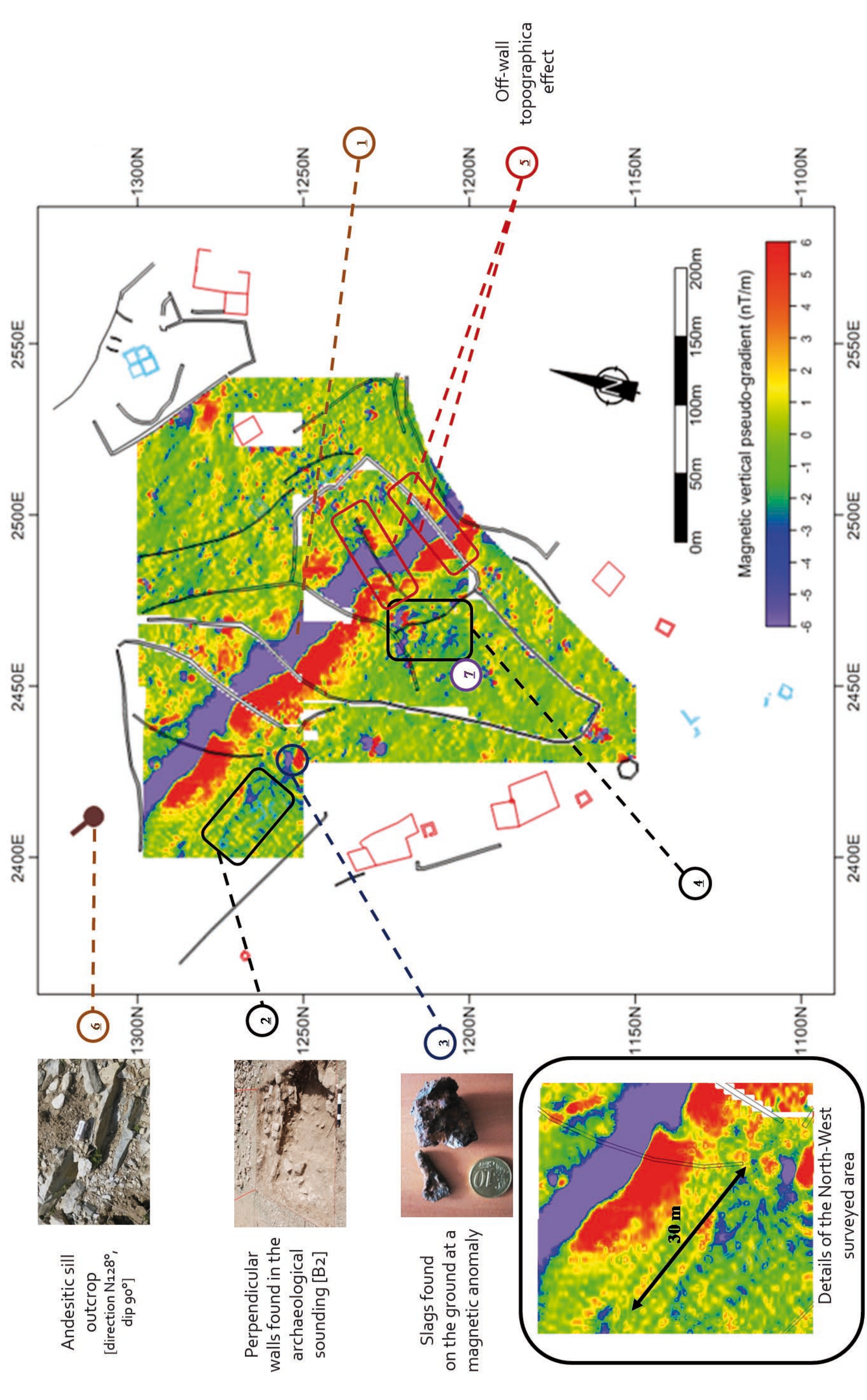


Figure 9: Magnetic survey map (CC & Q V 2011).

The magnetic field intensity has to be considered algebraically, that is to say high values of magnetic field, either negative or positive, correspond to highly magnetic bodies. Likewise, small magnetic intensities, either negative or positive, will correspond to poorly magnetic bodies.

– The first remarkable magnetic anomaly (**1**) goes from the north-western corner to the south-eastern corner of the map. Considering its size (over 300 m long and 10 m width) and its magnetic intensity, it corresponds to a deep geologic perturbation. The direction of the anomaly (roughly N 128°) can be correlated with an Andesitic-sill outcrop (**6**), with vertical dip, pinpointed on the map. Logically, we suppose that the visible magnetic anomaly corresponds to the underground extension of that sill that goes across the site. Events highlighted in (**5**) represent off-wall topographic effect.

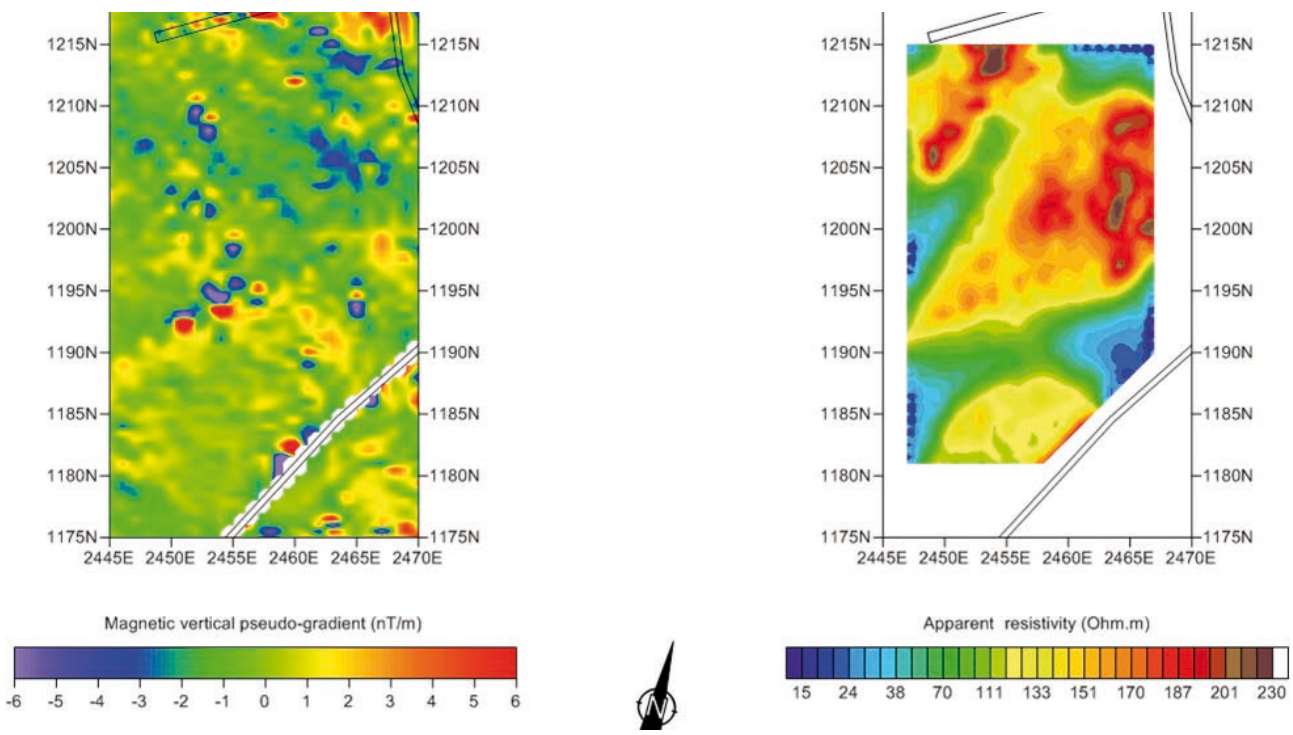
  Unfortunately, this huge geological anomaly hides every archaeological magnetic signature that might overlay it.

– The global magnetic signature of the rest of the map is way lower. Some punctual high-intensity anomalies are visible (see for instance **3**) and might correspond to fireplace associated to blacksmith activities. This last hypothesis is supported by slag found on the surface of one of these anomalies. Unfortunately, interpretation only based on the magnetic map is not enough to assess the age of the corresponding structures.

– At the bottom of the top north-western corner we can see an alignment of low-intensity anomalies in the N 315 direction (circled in **2** and detail in **fig. 17**). This anomaly could correspond to several walls alignments. The top corner of this anomaly was dug and perpendicular walls were found as expected (see the archaeological description in **IV**). This shows that the expansion of the habitation area in top of the hill is bigger than the houses visible at first time.

  This also shows that the magnetic answer of walls on the site is weak. This is explained by the fact that houses are built with the same materials as the geological surroundings, which does not provide a strong magnetic contrast. Anyway, the presence of andesitic rocks in the foundation makes them visible on the magnetic map.

Figure 10: Comparison of Magnetic and Electrical survey on a small parcel (CC & QV 2011).



– The anomaly circled in **4** (North to the excavated house) has the same type of magnetic answer as (**2**), and might also be due to houses foundations.

• Electrical survey (fig. 10)

Just a small area (40 x 20 m), in the very South of the site (see **7** in **fig. 9**), has been electrically surveyed in a plowed plot. Contrarily to what we first expect, the soil turns out to be reasonably resistive and even surprisingly conductive in some places.

– We can see three resistive zones in yellow (above 150 Ω.m) surrounded by conductive ground (roughly 50 Ω.m). This organization corresponds to a visible topographic step.

– Another interesting feature is the presence of two very resistive (< 200 Ω.m) area in the north-eastern corner of the middle platform and the north-western corner of the prospected areas. This resistive area corresponds to visible sandstone outcrops, and thus to removal of soil material. It seems that the electrical survey in that plot does not yet provide archaeological information but gives clues to the geological substratum vicinity.

Conclusion

The short magnetic surveys performed show that the settlement previously studied in 2010 might be bigger than just the already visible remains. First of all because the expansion of the habitation zone in the north-western area (**2**, **fig. 9**) is bigger than initially visible. Then because there are other anomalies of the same type on the site (**4**, **fig. 9**, etc.) which might mean other buried buildings. Moreover, punctual anomalies (such as **3**, **fig. 9**) are visible and might be associated with the presence of ancient fireplaces.

There are lots of other anomalies which are visible, but it is very difficult to assess their origin (either anthropic or geologic) be of the nature of the magnetic signal (weakness of the contrast between structures and geological surroundings).

Furthermore, a part of the prospected areas is under the influence of a massive geological anomaly (**1**, **fig. 9**) hiding every magnetic structures that might overlay it.

The use of the electrical resistivity method on a small area shows that instead of what was expected, the ground resistivity is not too high to prevent prospecting with this technique. Furthermore, the electric contrast between archaeological structure and the surrounding soil seems to be bigger than the magnetic contrast (soil more conductive than expected), which lets assume that mapping the electrical conductivity of the whole site might allow us to detect more structures.

...and Prospective

Based on this previous survey of the site of Wakarida, we would like to improve our geophysical knowledge of the site by using other geophysical methods.

We have seen that the electrical properties of the soil and archaeological structure might be convenient to map the conductivity of the site with good results. The electromagnetic technique will allow mapping the conductivity of the site without any need of pushing electrodes into the ground. This will permit the survey even in the rockiest part of the site. Nevertheless a systematic electrical survey should be considered over the area. We will also be able to investigate the part of the site under the influence of the big geologic magnetic anomaly without suffering from it. The use of Ground Penetrating Radar is also to take into consideration for precise localization of potential structures and direct information about depth.

IV. SOUNDING & SURVEY

V. Buffa & F. Dugast

Together with the geophysical survey, three soundings have been opened, still on the outcrop, in three opposite places – North-West / B2, North-East / D2, and South / C4 (**fig. 11**) –, to help insuring both magnetic and resistive "anomalies", and the presence of ancient structures. One of them (the last one), next to the complex unearthed in 2008 (D2), aimed at establishing a first stratigraphic sequence, taking into account the important elevation owing to the accumulated sediments.

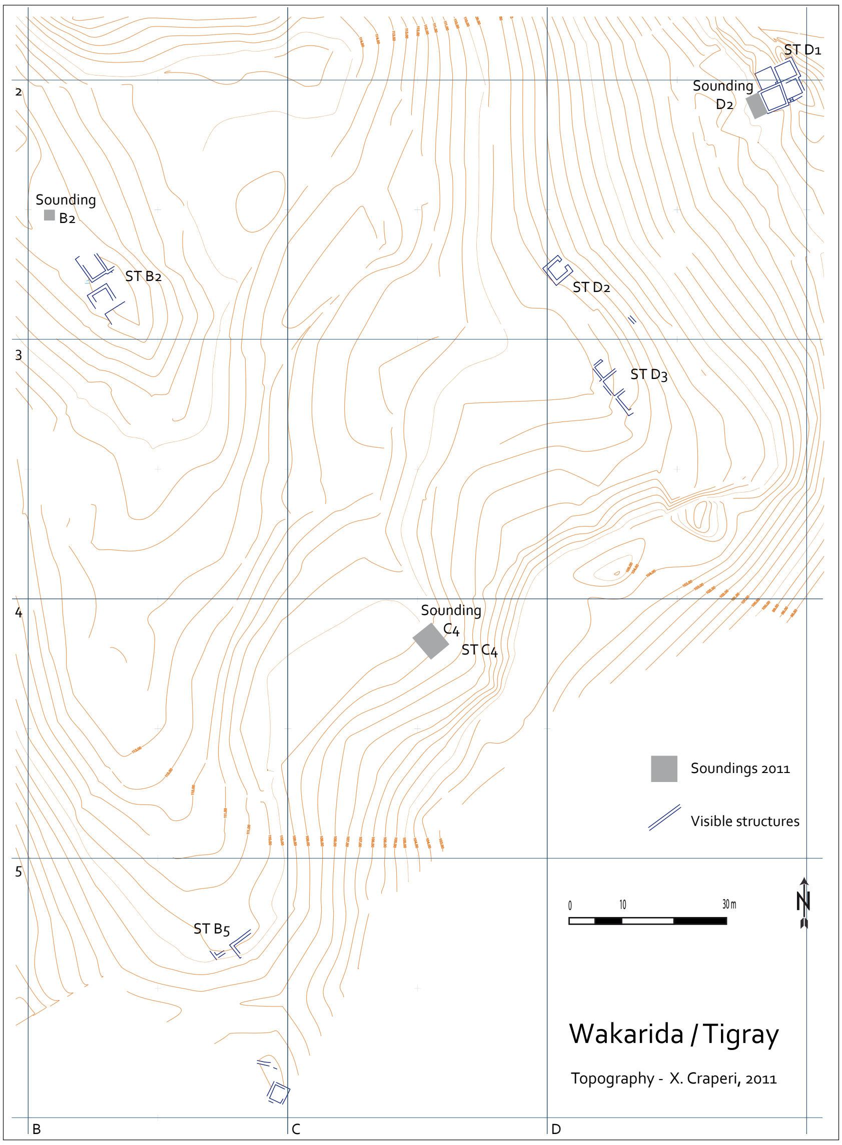


Figure 11: Localisation of the three soundings 2011 and the visible structures (XC 2011).

Sounding in square B2

This area, on the upper part of the site, was chosen because of few anomalies showed by the geomagnetic survey. A square 2 x 2 m wide was opened to check if one of the anomalies corresponded to a structure (**fig. 11**).

The top soil, US2, was removed. It consisted of reddish brown loam, fine, loose. It incorporated some stones and some animal bones. Underneath a layer of stones was present. The stones have been removed in half of the trench. Another layer of brown loam was present; in it an area of ashes.

A wall was indeed present, on about 2 m long, running nearly West-East in the northern part of the trench (**fig. 12**). It seems that the wall was built on the bedrock, and here it consisted of only one row of irregular blocks. The bedrock appeared in the form of whitish crumbling blocks.

The wall may be in chronological connection, though not in the same direction, with other structures next to it, some of them cleared out by local inhabitants on the south-eastern part of the same square and still on the top of the hill (**St B2**, **fig. 11**, **fig. 13, 14**).

Figure 12: Sounding in square B2 – US3 (FD 2011).

Figure 13: Next to the sounding in square B2, 2 walls in right angles cleared out by the inhabitants (FD 2011).

Figure 14: Next to the sounding in square B2, several structures at right angles visible on the surface (FD 2011).

Sounding in square C4

Another small sounding was performed around a visible structure in square C4 on the eastern slope of the site (**fig. 11**).

US1 was removed. It consisted of fine, reddish brown loam, hard packed on surface, softer underneath. It incorporated some medium size stones. Very few pottery shards were recovered, and also some animal bones. Under about 10 cm, some yellowish and whitish stones of small and medium size begin to appear.

Two walls have been cleared out, at right angles (**fig. 15**). They are about 0,50 m thick, and made of rubble-stone. They may be in chronological connection with other walls immediately next to them, on the eastern part of the same square (**St C4**, **fig. 11**).

Figure 15: Sounding in square C4, two walls at right angles (FD 2011).

Sounding in square D2

A few years ago, a structure located on the northern slope of the hill had been cleared out by local inhabitants (**ST D1**, **fig. 11**). The construction technique of the walls and the pottery yielded by these excavations, and showed to the members of the French team during the visit in 2010, had proved the structure to belong to the Aksumite period (I. Gajda & F. Dugast 2010: 14-15).

Figure 16: Sounding in square D2 – US3 (FD 2011).

In order to check the depth of the anthropic deposit on the site, and hopefully of a long stratigraphic sequence, a sounding has been performed the last two days along the southern wall of the structure. The sounding is located in square D2 (**fig. 11**).

A trench 2,60 x 6,50 m was opened. Here it was necessary to remove the soil recently put to level the area (used now as a barnyard). No finds were recovered from the modern surface. Under the top soil a collapse of large stone blocks was unearthed. It was probably in relation with the modern digging of the structure. No finds were recovered in the collapse.

Figure 17: Sounding in square D2 – US4 (VB 2011).

The layer underneath was named US3. It consisted in loose brown loam of fine structure, incorporating medium size stones. Also US3 can be put into relation with modern activities (**fig. 16**).

US4 was the layer underneath and the first ancient anthropic deposit. It consisted in fine brown loam with some medium size stones (**fig. 17**). It yielded

Figure 18: Sounding in square D2 – The aksumite wall (VB 2011).

Figure 19: Sounding in square D2 – US6 (VB 2011).

some vessels, mainly jars, in large fragments. US5 was excavated for a small stretch under US4. It consisted of the same loam, but did not contain any stones.

A wall is running West-East parallel to the wall of the first excavated structure, roughly 2 m from it. Another wall, forming a corner with the previous one is closing the space to the North-East (**fig. 16**). The walls unearthed during this campaign, like the ones already exposed, show the typical Aksumite technique in the alternation of blocks dressed only on the external side and horizontal long slabs (**fig. 18**), which can be compared with the so called "Palace of Dongur" near Aksum.

The top soil (US6) was then cleared out to the West of the trench to join the wall unearthed in past years. Here a threshold going into the room previously excavated was cleared out. It consisted of a well arranged line of stone slabs (**fig. 19**).

Survey in surrounding

In other parts of the site, some tidying of the area has been performed in order to clear out parts of walls visible on the surface. The 2010's survey had located a few of them on the eastern side of the hill (I. Gajda & F. Dugast 2010: 13), consisting on a regular suite of adjoining rooms, somewhat 3 m square, along the slope (**ST D3**, **fig. 11**).

Apart from the northern and eastern structures – that is on the top of the hill, next to B2 sounding (ST B2), down on the north-eastern side of the slope (**ST D1**), along the slope on the eastern part of the site (**ST D2** and **ST D3**), and on the southern side of the slope (**ST C4**) –, a few others, very similar, have been detected on the very southern side of the hill (**ST B5**, **fig. 11 & 20**). Moreover, the survey has shown more structures and artefacts down in the valley, expecting now a larger expansion of the site.

Figure 20: Structures detected in square B5 (FD 2011).

Another survey has been set up on a small hill South-East of Wakarida to find out ancient settlements the inhabitants mentioned to the team – with no real results. But extensive survey may be more successful.

Conclusion

Several structures have been detected all along the hill, only a few unearthed. If no chronological connection can be absolutely insured today between these structures, one has to notice the same direction of the buildings – roughly South-West to North-East –, bordering the slope.

The amount and closeness of structures induce one to think about a grouped settlement rather than a scattered one, set up by an organized community whose leader or head may have lived in the D2 building. The latter reminds in fact a kind of if not public at least monumental building because of its technical construction.

The expansion of this maybe urban or at least rural community seems to be broader than expected in 2010. Considering the presence of artefacts and structures down to the valley, it may reach almost 10 ha, even more.

V. POTTERY

V. Buffa

A systematic collection of artefacts, with a systematic register and stratigraphic localization, has been developed into the basis of a preliminary typological study and chronological markers. A digital database will help sorting them by type (either ware, slip, decorations, and forms restored from type of rims, bottoms or/and handles), and survey area in order to establish a first classification reference and chronometry.

In fact, in the present state of research, the identification of pottery is still conjectural. Its study is based on an typology which is even now imprecise due to the lack of stratigraphic and technical data. No distinction of production has thus been established, either at the regional or territorial scale, or even at the import one. No question has been asked on the methods of production that seem to continue until today.

Implementation

The ceramic assemblage from the site of Wakarida comprises:

1/ **WAKA11, S** – 349 pottery shards collected randomly on the surface all over the site.

2/ **WAKA11, US1** – 11 pottery shards from the cleaning of some structures visible on the surface in square C4.

3/ **WAKA11, US2** – 21 pottery shards from the cleaning of some structures visible on the surface in square B2.

4/ **WAKA11, US4** – 16 large fragments of vessels from the sounding in square D2.

5/ **WAKA11, US5 and US6** – several pottery shards from the last sounding, in square D2, not studied yet.

All the shards have been numbered with subsequent number, US by US (US3 in D2 sounding has not yielded any pottery shards). At the end of the mission the collecting has been stored in plastic wrap and plastic boxes with mention of the origin. The samples have been left at the Tourism and Culture Commission of Tigrai Regional State at Wukro.

During the short campaign it has been possible to make a first assessment of the assemblage. This has been done on the site itself. No drawings have been made, but the majority of shards have been photographed, except the one yielded in the last sounding D2.

The shards have been studied US by Us, but no significant difference could be appreciated, in fabric or shape in the different US. The observations that will be made below are therefore valid for all the layers, except from the very last one, that is US5 and US6.

General characteristics

First of all the pottery has been divided according to the fabrics. In doing so it could be observed that the assemblage of Wakarida shows a broad division in orange, brown and grey/black fabrics. It seems possible that the division corresponds to the one mentioned by Munro-Hay in his account of the research done by N. Chittick in Aksum in 1972-1974: "Red Axumite ware", "Brown Axumite ware" and "Grey and Black Axumite ware" (Munro-Hay 1989). This assumption needs further verification also because the assemblage gathered in Wakarida shows a more complex variety of fabrics that at first noticed.

Fabric

All the shards under study are handmade. Six type of fabric can be noticed:

a. Fine or compact bright orange paste with a quantity of mica and some tiny mineral grits, usually white; surfaces always carefully burnished. In few cases black core. This fabric is probably the most common on the surface of the site.

b. Compact orange paste, coarser that the previous one, with some mica and mineral grits; surfaces burnished; sometimes black core.

c. Compact paste, black thick core and orange surfaces. The orange surfaces do not seem to have been obtained by a slip, and the black inside does not seem to be the result of firing in a reduced atmosphere. Surfaces burnished. Further investigation is needed.

d. Rather compact brown paste with steatite temper; surfaces burnished.

e. Compact black paste with steatite temper; surfaces burnished.

f. Compact reddish yellow paste with mica (possibly a variation of fabric b); surfaces burnished.

Decoration

Incised and impress decoration with geometric patterns are the most common (**fig. 21**). Some painted decoration on fine vessels are present (**fig. 22**).

Figure 21: Incised and impress decoration (IG 2011).

Figure 22: Painted decoration (IG 2011).

Function

As to the function of vessels, it has been noticed the predominance of table vessels, and the almost absence of storage vessels. It has been observed that in modern time containers other than ceramics are used for storing goods; it could have happened the same thing in the Aksumite times. It is most probable that the steatite tempered vessels were used for cooking.

Provisional typology

• **Type 1.** Shallow ledge-rim bowl on foot. Reddish compact or fine paste with white mineral grits and some mica, sometimes black core; surfaces slipped or plain; both surfaces burnished; incised or impress decoration on rim. [S295, 261, 5, 267, 321, 278, 332, 145, 71, 249, 291, 292, 259, 70, 11, 154; US4, 15.] • **Type 2.** Some ring bases probably belonging to type 1 – See Munro-Hay 1989: 253, fig. 16, 137, 119. [S180, 181, 287, 328, 269, 283, 188, 43, 310, 264, 265.]	
• **Type 3.** Shallow bowl with everted rim. Reddish compact paste with white grits, some black and mica, grey core; both surfaces burnished – See Munro-Hay 1989: 260, fig. 16, 170. [S19, 34, 153, 94, 35, 285, 286, 33, 283, 158.]	

• **Type 4.** Large plate with everted, rounded or thinned rim, slightly convex profile. Reddish compact paste with white grits and mica; both surfaces burnished – See Munro-Hay 1989: 270, fig. 16,232. [S326, 177, 184, 41, 158, 59, 13, 174, 173, 161, 336, 198, 46, 172, 157, 159, 187, 197, 149, 280, 255, 156, 165, 178, 188, 44, 272, 290, 292, 294, 33, 186, 185, 10, 47, 170, 171, 142, 169, 164, 143, 175, 4, 337.]	
• **Type 6.** Cylindrical beaker, incised and painted decoration. Fine orange paste with mica, both surfaces burnish. Decoration of curved triangular incised lines, filled with black paint – See Munro-Hay 1989: 242, fig. 16. [S1, 320, 319, 313.]	
• **Type 7.** Cylindrical beaker, painted decoration. Fine or compact orange paste with mica or some white grits; surfaces burnished. Purple paint, horizontal band on rim and vertical lines on body – See Munro-Hay 1989: 311, fig. 16, 455, 458. [S248, 308, 102, 125.]	
• **Type 8.** Convex profile bowl, painted decoration. Buff or orange , fine paste with no visible temper, surfaces burnished, horizontal lines with inscribed triangles in brown paint. [S239, S120.]	
• **Type 9.** Cylindrical beaker, incised and painted decoration. Fine orange paste with white grits and mica; inner surface smoothed, external surface burnished. Purple painted lines pending from two horizontal incised lines. [S2.]	
• **Type 10.** Cylindrical bowl? Very compact orange paste with white grits and mica; surfaces burnished. Ovoid knob below the thinned rim; horizontal painted band on rim. [S293.]	
• **Type 11.** Convex profile bowl, thin walls, everted rim. Very compact orange paste with some white grits and mica. One fragment has incised lines on the lip. [S343, 271, 252, 8, 96.]	
• **Type 12.** Convex profile bowl, as type 11, but coarser paste and thicker walls. Compact orange paste with white grits and mica. One fragment burnished and painted with a purple line under rim. [S335, 330, 133, 284, 91, 301.]	
• **Type 13.** Small decorated jar with vertical handle. Compact reddish paste with white grits and mica; surfaces smoothened. Decoration of bands of incised oblique lines and row of impress dots. [S276, 69, 6, 36 belong to one vessel.] [S245, 236, 274, 141, 251, 243, 121, 237, 289, 254, 324, 242, 257, 312.]	

• **Type 14.** Small convex profile bowl, everted rim, painted decoration on rim. Orange fine paste with no visible temper, ext. burnished. Bands of purple paint on inner rim and on body. [S316, 129, 128.]	
• **Type 15.** Large convex profile bowl with thickened and rounded rim. Compact orange paste with white grits and mica; one fragment reddish brown; surfaces burnished. For the purple paint see Munro-Hay: 311. [S15, 18, 14, 137, 16, 263, 266, 240, 62.]	
• **Type 16.** Deep globular bowl, thin walls. Light reddish brown compact paste with white small grits and mica; surfaces burnished. [US4, 2.]	
• **Type 17.** Necked jar with incised decoration. Compact grey paste with steatite temper; incised oblique lines. – See Munro-hay 1989: 307, fig. 16, 439, 440. [US4, 9.]	
• **Type 18.** Footed jar. Ovoid jar with everted rim; a fragment of a ring base should belong to this vessel. Medium compact grey paste with white, black grits, some mica and some steatite temper. Outer surface orange. [US4, 3.]	
• **Type 19.** Necked jar with incised decoration. High tronconical neck with everted rim, rounded bottom; vertical strap handle. Geometric incised and impress decoration on neck and shoulder. Two fragments compact orange paste with some white grits and mica (possibly some steatite temper), black rim, surfaces burnished, vertical knob on shoulder [US4, 5, 7.] One fragment fine grey paste with mica, grey slip on both surfaces; incised oblique lines and horizontal row of impress small crosses on neck. [US4, 6.]	
• **Type 20.** Globular bowl with painted decoration. Fine light beige paste with mica, light orange slip on exterior; surfaces burnished. Two incised lines and painted below the rim and incised lines forming triangular patterns, black paint filling the space between them. [US4, 4.]	
• **Type 21.** Shallow decorated large plate. Compact orange paste with white grits, grey core. Oblique incised lines on exterior, excised triangles on interior. [US4, 1.]	

• **Type 22.** Carenated deep bowl with horizontal handle. Compact grey paste with white grits and mica; surfaces smoothed. Incised triangles on upper wall – See Munro-hay 1989: 303, fig. 16, 427.	
• **Type 23.** Ovoid cooking jar with vertical handle. Compact black paste with steatite temper; surfaces burnished.	

One fragment of a ridged amphora has been shown to the members of the mission by a local inhabitant. It seems that it was collected while digging an Aksumite room on the northern slope of the site. A few shards of the same type have been collected by the team on the surface of the site. The presence of *amphores cotelees* is already known from the Aksumite layers in Matara (Anfray 1966: 16, fig. 9) and Adulis (Paribeni 1908, fig. 58). Anfray has pointed out that the presence of *amphores cotelees* is the proof of contacts with the Mediterranean (Anfray 1974: 745-765).

Figure 21: Fragment of amphores coteless (IG *2011).*

Besides, very few fragments of fine red polished ware seem to be imported *terra sigillata*, Italian or Eastern sigillata, though this identification is not sure. Anfray has also mentioned the presence of *terra sigillata* at Matara (Anfray 1974: 17).

Even fragments of what Anfray had called "braseros" at Matara could be identified in some fragments at Wakarida (Anfray 1966: 8, pl. XV).

VI. CONCLUSION

I. Gajda & F. Dugast

The second season of the French-Ethiopian project of archaeological and epigraphic investigations in Tigrai region has been successful. The different investigations performed on the site of Wakarida have permitted to estimate its archaeological potential.

- The **geophysical survey** proved to be really helpful in spite of particular, difficult conditions of the site: stony, hard soil, presence of geological formations. Several structures have been detected, more may be suspected.
- Three **soundings** have been undertaken, the choice of which was determined by the presence of visible structures (some of them unearthed by the inhabitants) and by the results of the geophysical survey.
- The **structures** unearthed in square D2 show a clear resemblance with Aksumite construction techniques. Are to be noticed in particular the walls built in unhewn stones separated in regular intervals by thin layer of large stone slabs which bring to mind the construction techniques used at the so called "Dongur Palace" near Aksum.
- The **pottery** collected on the surface reflects the intense occupation of the site in the Aksumite period. A preliminary typological study of the ceramics has been undertaken. A detailed study including drawings will be done during the next season.

– The **quick survey of the surroundings** of the site has shown its expansion to the eastern slope of the hill. Hence, the site proves to be larger than we have expected.

– The **local oral tradition**, several versions of which have been recorded by the team members, mentions settlers coming in ancient time from the Southern Arabia. Some vestiges of a dam, that should subsist near Wakarida, but which are not visible today, are attributed by the inhabitants to these early settlers.

All the methods of investigation employed during this season were complementary and facilitated the team to establish a strategy of investigations. All bring us to the same conclusion: the site was a small town or village during the Aksumite period.

Perspectives for the next season

As the main objective of our research is the contribution to the periodisation of the Ancient Ethiopian history, our investigation should be undertaken, in our opinion, both on the so-called "Pre-Aksumite" sites in the I[st] Millennium BC and the Aksumite sites in order to try to understand the transition from the "Pre-Aksumite" to the Aksumite civilisation.

Investigations of the Aksumite site of Wakarida

Our first aim during the next season is to start a regular excavation of the site of Wakarida. The sounding in the square D2 will be continued and extended to the West. New soundings will be opened in the area C2-D2 and C4 (and around) where both the geophysical investigation and the numerous pottery shards on the surface let us suppose the presence of important structures.

A systematic survey around the site will be undertaken, especially at Ra̓elä and Sawena, to endorse the legend.

The new collected pottery will be studied together with the one left in 2011 at Wukro, in order to fulfill the provisionnal typology.

Survey in the region of Feresmai

Together with the excavation on the Aksumite site of Wakarida, we would like to start a survey in the region of Feresmai where "Pre-Aksumite" sites were reported, namely Addi Be'akel (see I. Gajda & F. Dugast 2010: 15-16) in order to find a connection between "Pre-Aksumite" and Aksumite civilisations.

Iwona Gajda
Date: 20/05/2011

Fabienne Dugast
Date: 20/05/2011

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