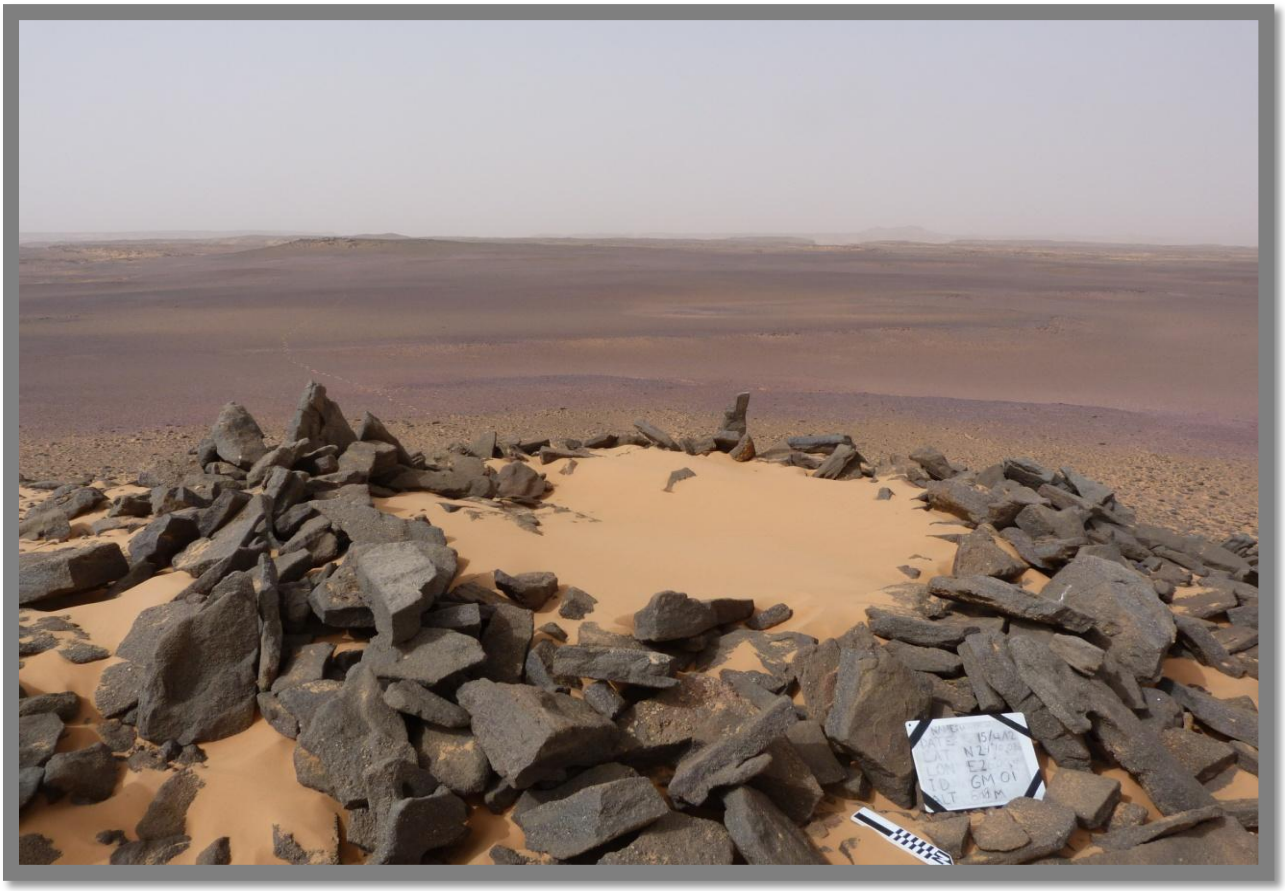
# THE EXPLORERS CLUB FLAG 60 REPORT

## Archaeological Exploration of the Libyan Desert, Egypt

April 2nd 2012 –April 25th, 2012



***Site QMM14 "Gara Marai Watchtower" Photo Credit: Sam Watson FRGS***

**Robert J. Atwater, FRGS, LF'05** and **Jason Paterniti, FRGS, MN'10**

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# Summary:

On 24 April 2012, the Libyan Desert Expedition completed the very first 3,700 kilometer circumnavigation of Egypt using 70 year old jeeps. Along this previously unexplored route, the team discovered an undocumented prehistoric settlement located approximately 90 kilometers north of the Gilf Al- Kibir[1]. Two undocumented sites possibly related to the Long Range Desert Group (LRDG) which operated in Egypt in the 1940's, were also identified.

***Figure 1:*** Robert J Atwater LF'05 and Jason Paterniti MN'10 in a wind storm with Flag 60 at site QMM14, Great Sand Sea Egypt

[1] Per regulations issued by Egypt's Supreme Council of Antiquities, only visual analysis of these archaeological sites was conducted.

April 25, 2012


**Figure 2:** 2012 Libyan Desert Expedition Route

# Introduction & Background

When I was a child, I had the opportunity to visit the Museum of Egyptian Antiquities in Cairo. I recall wandering the museum's great halls in awe of the seemingly endless rooms filled with the cultural remains of an ancient civilization. At that time, the history of these people seemed clearly written, both figuratively and literally in stone. Returning from this expedition to Egypt some thirty years later, I have come to realize that many of my assumptions regarding the history of ancient Egypt are being challenged by a small but dedicated group of deep desert explorers and scholars.

This is the story of my personal experiences travelling with one of these modern day explorers. As I write this, Mahmoud Marai and his colleagues are literally re-writing the history books regarding how the Ancient Egyptians explored, who they traded with, and perhaps most intriguingly, where the true roots of one of the greatest civilizations the world has ever known may lie.

This is also the story of technology and its impact on exploration. Since the time of the Pharaohs, technology has influenced how and where the human race has explored. From the recently discovered Abu Ballas water depot trail, a logistically complex system used by the ancient Egyptians to explore the deep desert, to the introduction of the combustion engine in the early 20th century, to our own use of high resolution remote sensing satellite imagery; new technologies continue to expand our exploration horizons.

My objective for this report is to share with a wider audience the material evidence being discovered out in the desert which challenges many of our established notions about ancient Egyptian civilization. I also hope to put what we discovered on this expedition into a broader context and to enthuse others to join in the quest to search for evidence which will help prove or deny the fascinating new theories currently being proposed.

# Habitation, Climate Change and Migration

The Western Desert of Egypt includes all the land in Egypt west of the Nile. This is two-thirds of the entire country, or more than 680,000 square kilometers. (Sampsell, 2003, p. 137). The name "Western Desert" comes from the perspective of those standing on the Nile looking west. It is alternatively known as the "Libyan Desert", a geo-political name given to the desert by the British seeking to declare it a separate land from the "French Sahara" (Scott, 2004, p. 617).

Today the Western Desert is uninhabitable save for a few depressions which provide for the handful of oasis which ring the "New Valley" (Sampsell, 2003, p. 137). Typically the Desert receives less than two mm/year of rain fall per annum, (Kröpelin, 2006, p. 803), but this was not always the case. A 2006 radio carbon analysis of paleo-lakes and playa levels between 16N and 24N indicate that a major shift in rainfall patterns occurred in the Western Desert around 8500BC. This shift in tropical monsoon summer rains resulted in a rapidly improving environment in what was previously a hyper-arid uninhabitable desert (Kröpelin, 2006, p. 803). This period, known as "Early Holocene Reoccupation Phase", saw the region develop into savanna which was rapidly populated by the northward migration of prehistoric hunter gathers from what is now Sudan and Chad (Barta, 2010, p. 31).

By the Mid Holocene Period (7000-5300 BC) evidence of developing pastoralism of both cattle and sheep herding can be found throughout the Western Desert (Kröpelin, 2006, p. 806) In the Late Holocene Period (5300-3500 BC) the monsoon belt apparently shifted back southwards, and the people of the Western Desert area began to migrate south and eastwards (Kröpelin, 2006, p. 804). Initially they may have concentrated around the Gilf Al-Kibir and Jebal 'Uweinat where water continued to collect for a time but eventually these people moved permanently into the upper Nile valley. (Barta, 2010, pp. 31-33). Traces of these civilizations are well preserved in the rock art and abandoned settlements structures. Amazingly these sites were unknown to the western world until 1923 (Brophy, 2011, p. 10).

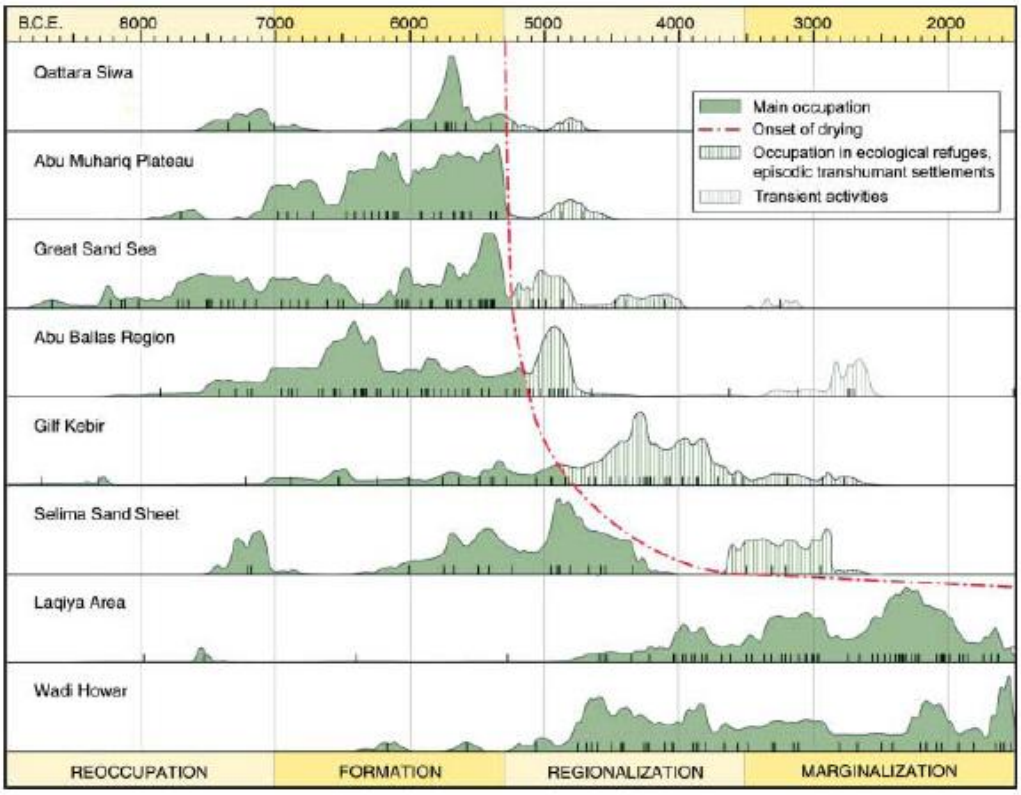



**Figure 3:** This excellent chart is reproduced in its entirety from Kuper and Kröpelin's 2006 paper: "Holocene Occupation in the Sahara". It graphically describes the major stages of Holocene occupation in the Eastern Sahara based on the cumulative curves of calibrated radiocarbon dates from 150 archaeological excavations (Kröpelin, 2006, p. 805).

**Pharaonic Civilization**

By the "Late Holocene Marginalization Period" (approximately 3,000BC) the Pharaohs of Egypt had gained firm control and unified the lands of the upper and lower Nile. At this point, the Western Desert had returned to an arid, mostly uninhabitable state considered by the inhabitants of the Nile to be the land of "*Evil and Death*" (Kröpelin, 2006, p. 806).

The remains of a village found in the 1940's, and dated to late Old Kingdom (2686-2181 BC) at Balat /Ayn Aseel on the eastern edge of Dakhla Oasis, represented Egyptologists best guess of the south western most limits of Pharaonic civilization and influence (Förster, 2007, p. 1).

Egyptologists assumed that the ancient Egyptians never ventured further west into the desiccated and lifeless desert due in part to the simple fact that the maximum independent distances which could be covered in the desert by donkey[2] is approximately 200 kilometers. [3]

For many decades, the absence of any findings or evidence of Pharaonic cultural material culture in the Western Desert supported the prevailing theory that the Pharaoh's never entered the "Land of the Dead" nor attempted to trade with cultures to the west.

However, in the last fifteen years, a group of explorers and scientists have been accumulating astonishing material evidence that the Ancient Egyptians not only entered the desert, but that the Pharaonic culture conducted trade with civilizations on the other side of the Western Desert. In 1999, Carlo Bergmann discovered 27 sites (water depots, markers (*alums),* and rest stations (*Muttahs))* which begin at Dakhla Oasis and terminate at the Gilf Al-Kibir. This chain of depots forms a long distance route in almost straight line along an orientation of 225 S SW which would have allowed travel well into the deep desert. Material evidence found at these sites extends the known limit of Pharaonic influence (First Intermediate Period: 2181-1991 BC) some 400 kilometers further south west than had previously been assumed. (Förster, 2007, p. 1).

In 2008, Mahmoud Marai and Mark Borda discovered a Pharaonic cartouche on a boulder on the south eastern slope of Jebal Uweinat some 570 kilometers south west of Dakhla. (Marai, 2012). The Cartouche which was translated by Egyptologist Aloisia de Trafford of the Institute of Archaeology, University College London, and Joe Clayton of Birkbeck College reads:

| **Left side:** | **Right side:** |
|---|---|
| *"Son of Re, Mentuhotep*<br>*King of Upper and Lower Egypt*<br>*Horus living Forever"* | *"Yam bringing incense*<br>*Tekhebet bringing [illegible]"* |

(Brophy, 2011, p. 65)

This inscription dated by Trafford and Clayton to the Middle Kingdom period (2134-1690 BC) provides the first physical evidence that the Ancient Egyptians did indeed cross deep into the Western Desert.

The purpose of our expedition was to build on the work of Bergmann, Borda and Marai in the search for evidence which can add to our understanding of who did the Ancient Egyptians trade with and what has happened to these civilizations?

[2] While not universally accepted, many believe the camel was not introduced to Egypt by the Persians until approximately 550BC

[3] It was also assumed that because the Desert had become a spiritual place of importance as a place of death, this created a further barrier inhibiting exploration (Robert Bauval and Thomas Brophy, 2011, p. 43).

# Expedition Objectives:

- To search for undiscovered ruins, pre-historic sites and other cultural material in a previously unexplored area of the Western Desert of Egypt.
- To gather information and make local contacts in support of a future expedition to search for possible traces of ancient settlements and trading routes through the Western Desert.
- To search for evidence of the purported remains of Cambyses Lost Army south east of Siwa Oasis.
- To field test 1940's era technology in order to gather information for future LRDG focused archeological expeditions.

# Expedition Members & Areas of Responsibility:

| Expedition Team | Nationality | Role |
|---|---|---|
| Toby Savage | English | Expedition Organizer |
| Mahmoud Marai | Egyptian | Expedition Leader & Desert Explorer |
| John Carroll | English | Co-Organizer and Historical Advisor |
| Sam Watson, FRGS | English | Co-Organizer and Historical Advisor |
| Rick Pewe | USA | Geologist & Mechanical Advisor |
| Karl-Gunnar Norén | Swedish | Historian |
| Robert J Atwater, FRGS, LF'05 | USA | Field Investigator |
| Jason Paterniti, FRGS, MN'10 | USA | Field Investigator |
| Dr. Albert Lin, FN | USA | Technical Advisor, Director , National Geographic Engineers for Exploration Program |
| Dr. Nathan Ricklin | USA | Field System Engineer, The Exploration Lab |
| Mohammed Sabry | Egyptian | Assistant |
| Tarek Abd El Fatah | Egyptian | Mechanic and Cook |
| Islam Samir | Egyptian | Iveco Driver |
| Mohammed Fawzy | Egyptian | Military Liaison |
| Sheriff Hassan | Egyptian | Police Liaison |
| Mohammed | Egyptian | Egyptian Security Forces |
| Ramadan | Egyptian | Egyptian Security Forces |
| Adel | Egyptian | Egyptian Security Forces |
| Youssef | Egyptian | Egyptian Security Forces |

**Figure 4:** The Libyan Desert Expedition team near the end of the Expedition

# Methods:

Technology has had a tremendous impact on extending man's ability to explore in the desert. The introduction of the sun compass, sand tracks, water condensers and the combustion engine literally opened up previously unknown areas of the desert to the early 20th century explorers Dr. J Ball, R.A. Bagnold and Kemal el-Din (Goudie, 2006).

Working in partnership with a team lead by Dr. Albert Yu-Min Lin, 2011 Lowell Thomas Medal recipient and Research Scientist/Emerging Explorer at the National Geographic Society, we sought to test the potential application of non-invasive technologies in the Western Desert in an effort to unshackle us from the physical constraints of water and petrol in our search for Pharaonic or prehistoric cultural material.

Using imagery donated to us by the satellite imagery company ViewFromAStar and Geo Eye, Albert Lin and his team "tiled" the GeoEye-1 50cm a pan-sharpened Bundled: Pan + 3-Bands, 1-File, True Color RGB imagery and then stored the reformatted data on a proprietary hosting platform. This process allowed us to view and geo reference the high resolution images in various mapping platforms including Google Earth from anywhere on earth. While this technology cannot replace physical exploration, it can greatly assist in the acquisition of new information about unexplored places in a more efficient and economic manner.

Our expedition also sought to field tested a 1943 Willy's and 1943 Ford GP Jeep similar to the equipment used in the 1940's by the Long Range Desert Group in order to advance our understanding of how such equipment performed in this environment. The primary source information collected will have direct application to an expedition seeking to identify LRDG related cultural material in what is now Libya and Sudan.

**Figure 5:** Expedition Organizer Toby Savage testing his "kite-cam" over a site in the Western desert

# Logistics:

We carried with us all subsistence requirements for 14 days in the desert including food, water and petrol. Back up and logistical support was provided by specially modified Land Cruisers and an Iveco 7 ton 4x4 Truck which carried all of our fuel and provisions. Jeep fuel consumption was provisionally calculated at 20 liters per 100 kilometer. Adequate fuel for both Jeeps to complete 1,600 kilometers was carried in tank in the Iveco and transferred to jerry cans as required.

Access to the land south and west of the Oasis circuit that runs in arc from Cairo through Bahariya, Farafra, Dakhla and Kharga is restricted. This area is designated as a "border zone" and to explore here one must obtain a permit and "escort" which are provided by various ministries via an approved travel agent. (Scott, 2004). As of 2010, travelling south of N 29 requires all expeditions be accompanied by armed soldiers from the Egyptian Army.

**Figure 6:** Jeep and Iveco truck: 70 years of desert vehicle technology on one expedition

# Expedition Route:

The starting point of our expedition was determined by the extreme fuel and water loads the vehicles would be carrying in the early days. We travelled in a clockwise fashion from the last sealed roads at the Dakhla Oasis depression over relatively smooth and flat terrain rather than attempting to cross the Great Sand Sea fully laden.

From Dakhla Oasis we headed into the desert to Bir Sahara (N 22 52 E 28 36) where we intended to explore in and around the Gilf Al-Kebir. From there we entered the Great Sand Sea from the south at its center latitude of East 26 10 roughly 600 kilometers south of Siwa oasis.

**Figure 7:** Robert Atwater LF'05, Mahmoud Marai Expedition Leader and Jason Paterniti MN'10
1,500kms from Cairo near the Gilf Kibir

# Findings & Results

In order to test our remote sensing technology, we identified one known site and one previously unexplored area north of the Gilf Al-Kibir. These sites were identified by our expedition leader and desert explorer Mahmoud Mara. Within these two separate locations 34 targets were identified.

In the Great Sand Sea we identified a 5 x 5 square kilometer area centered around a natural formation called Pillar Rock or *Sakhret al-Amud*.

Left: **Figure 8**: High resolution image of *Sakhret al-Amud*. We selected this site specifically because it is well known and reasonably easy to reach. In addition to this three meter high limestone formation shown by the high resolution satellite imagery to have many 4x4 tracks converging on it, there were several other targets scattered amongst the dunes which did not appear to have recent tracks leading to them. Our primary purpose here was to conduct a search of this area in order to calibrate what we were seeing in the imagery with what was actually out in the field. Of the 19 targets in this search area we were able to ground truth seven.

Of these seven sites, we were able to locate and classify five targets. What we found in this area was the mundane detritus of modern desert life: oil barrels & tires. However even these results were valuable to us as we quickly began to differentiate a tire from a barrel on the sat imagery. The image to the right in **Figure 9** is a tire. We began to interpret the pixilated colors allowing us to distinguish man-made objects from the natural colors found in the desert sedimentary and igneous rocks. From what we have learned from this experiment, we are confident we can apply this technology on a future expedition where we will search for water jar depots and remains of square shaped rest houses similar to those found by Carlo Bergmann in 1999 along the Abu Ballas Trail between Dakhla, and Jebal 'Uweinat.


## Prehistoric Sites

### I. Gara Marai Site Qmm14

This previously unexplored plateau is located 330 kilometers west of the oasis town of Dakhla, and almost 300 kilometers east of the nearest inhabitation - Kufra in Libya to the west. We named this plateau "Gara Mahmoud Marai".

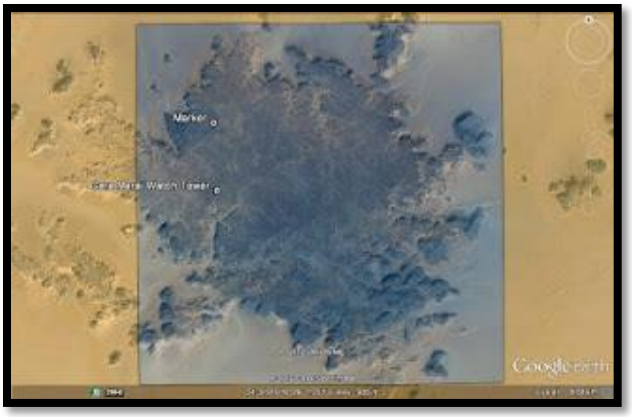

**Figure 10:** Map of QMM location

As we broke camp on the morning of April 15th, a sand storm came up. It seemed as if we sailed across the sand in a fog heading towards the plateau. Driving through this ethereal void, Mahmoud Marai related to us that in the 1920's, the great desert explorer Hassan Bey first discovered Jebal 'Uweinat in similar conditions.

**Figure 11:** Crossing the Great Sand Sea

Using the GEOEYE sat imagery we identified a number of areas on this plateau whose geography resembled places where prehistoric settlements and rock art have been discovered in and around the Gilf and Jebal 'Uweinat. This rock art has been tentatively dated to the sixth-fourth millennia B.C. and possibly to the period between 4300-BC-3300 BC which was the time of the most intensive habitation in the area of the Gilf Kibir. (Barta, 2010, p. 25)

**Figure 12:** Using sat imagery to locate QMM




Specifically we looked for deep wadis where prehistoric people would have sourced water for their livestock using the mouth of the wadi to pen in their animals as well as provide a secure location. As we entered the wadi it became clear that it was too shallow to hold water but we decided to explore up on top of the plateau a number of targets identified by sat imagery.

**Figure 13:** High resolution satellite Imagery of Gara Marai. Image courtesy of GEOEYE


**Figure 14:** GEOEYE high resolution imagery showing location of QMM14

Following our GPS to a point one kilometer north of the Wadi entrance, we located our first target which we designated QMM14 or the "Watchtower" at an altitude of 891m.

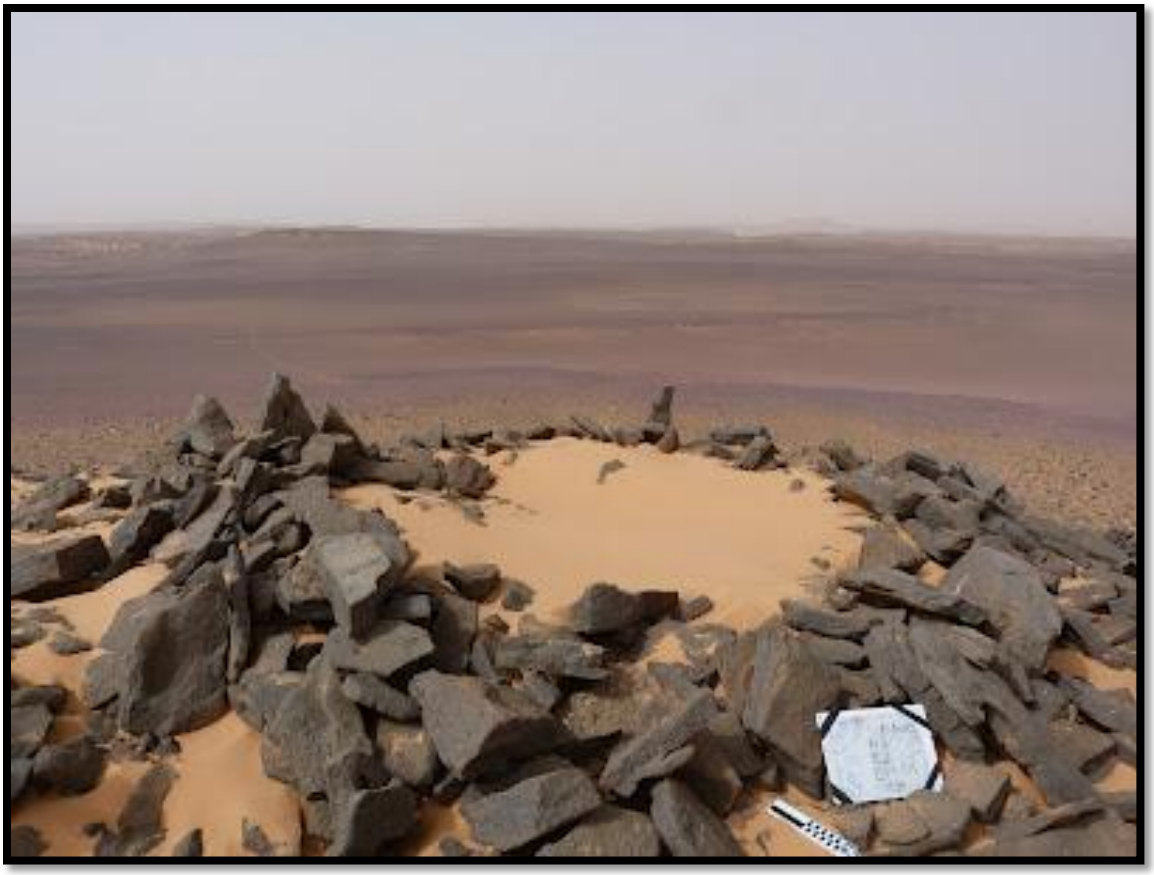


**Figure 15:** Gara Marai Watchtower. Photo Credit Sam Watson, FRGS

**Figure 16**: Bob Atwater EC LF '05 stands at the base of the "Watchtower"

The rocks used to build this structure were identified as rough sandstone conglomerate by our geologist. The oval structure's dimensions are: 2.8 meters x 3.3 meters in diameter:

**Figure 17**: LDE Expedition team Jason Paterniti MN'10 and Mahmoud Marai examining site QMM14

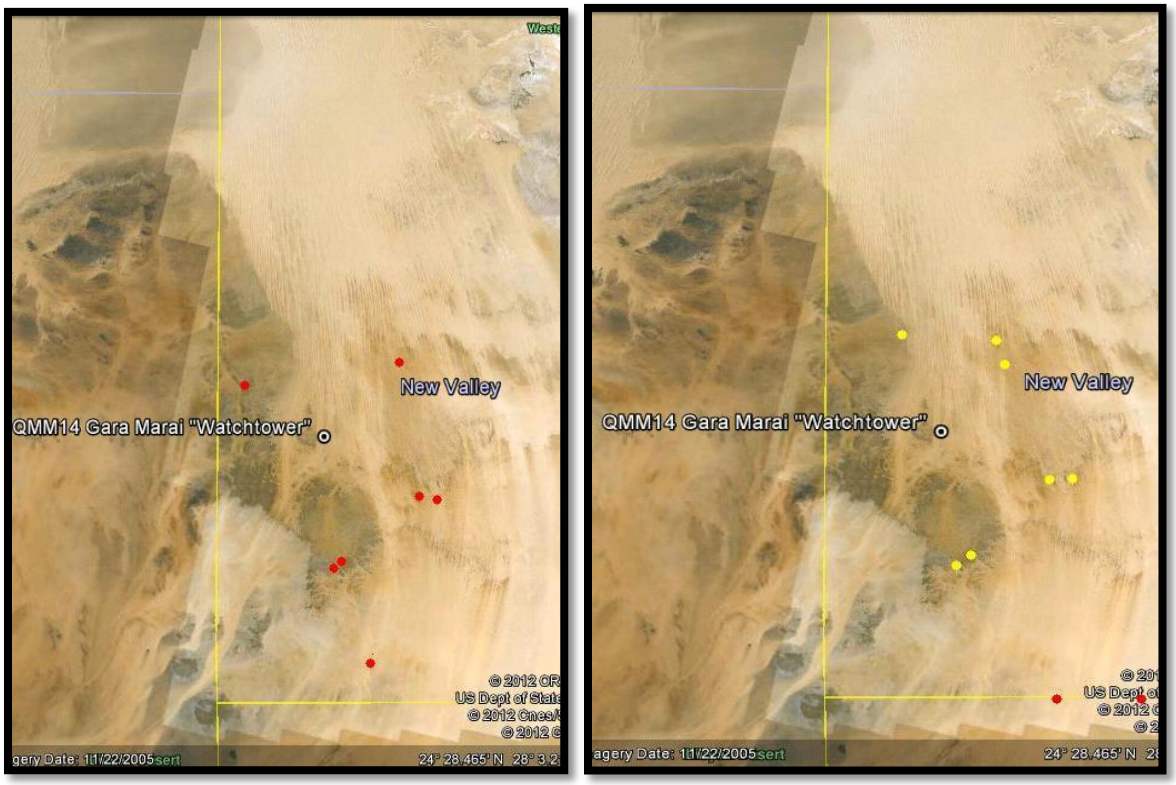
Photo Credit Rick Pewe

## II. Settlement Structure

755 meters north of QMM14 another site was identified QMM2C using the satellite imagery:


**Figure 18:** QMM settlement structure

Here we found the remains of what appear to be a round structure similar to structures found throughout the Gilf and Jebal 'Uweinat. Little is known about the people who lived in these areas although based on climate change analysis: "Around 3500 BC represents a definite turning point in the occupation history of the Egyptian Western Desert, when permanent occupations definitely ceased and only limited transhumant populations managed to survive for another few centuries" (Barta, 2010, p. 33).




**8,500 BC to 5,300BC** **5,300 to 3,500BC**

**Figure 19:** The above images plotted on Google Earth draw from the data compiled and presented by Kuper and Kröpelin. Red dots indicate major occupation areas during the relevant time period; yellow dots represent isolated settlements in ecological refuges and episodic transhumance (Kröpelin, 2006). Note site QMM is overlaid over both time series graphics falling right in the middle of previously documented archaeological sites which were permanently inhabited up to 5,300 BC and there after only sporadically used.

At 890+ meters this plateau could have been an isolated settlement, what Kröpelin calls "ecological favored refuges" similar to the Gilf Al-Kebir Plateau where during the "marginalization Phase" (3500-150BC) transient human occupation retreated to highland areas which continued to receive rain and benefit from water collecting in wadis or temporary lakes. (Kröpelin, 2006, p. 803)

### III. Directional Marker

One kilometer due north of QMM14, Marai identified a marker located on a hill at an elevation of 896 meters. Marai says this marker shows clear signs of being placed and carefully buttressed. From this prominent hill site QMM14 lies on an orientation of almost due South (179 degrees) towards the Gilf Al-Kibir. Was this deliberate?

**Figure 20:** M Marai examining a stone marker atop Hill QMM15 (Photo Credit Rick Pewe)

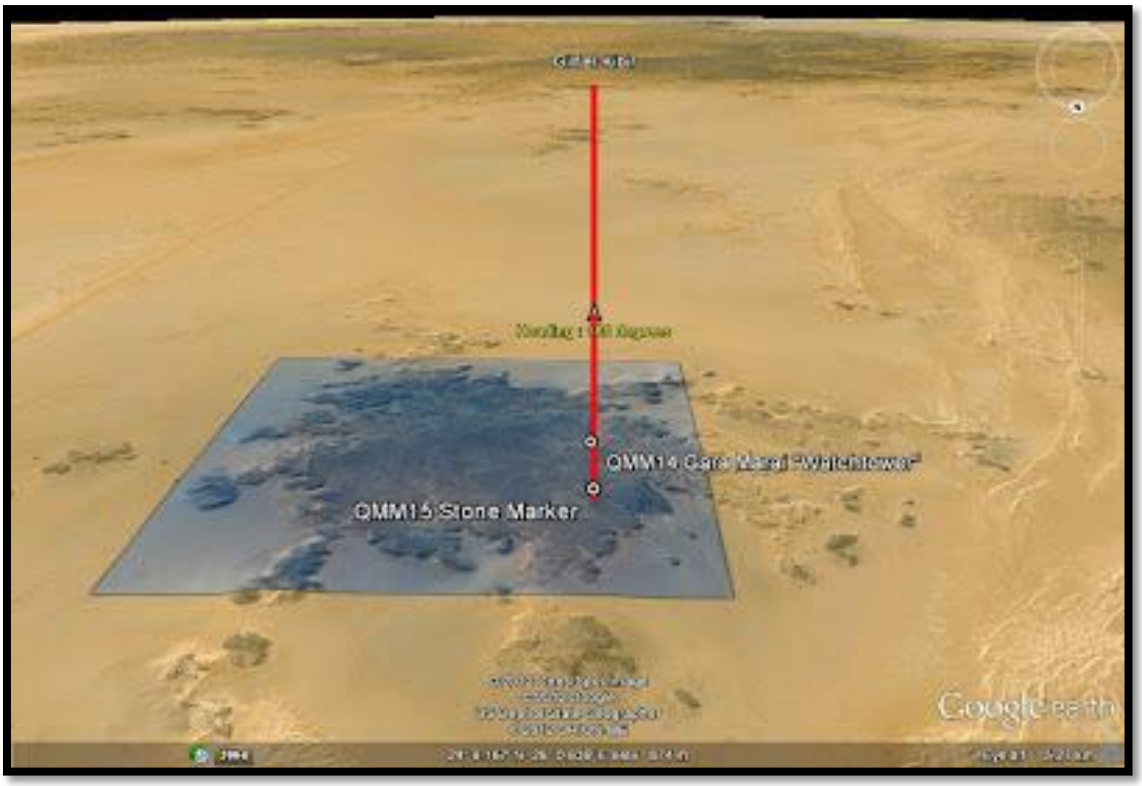



**Figure 21:** Orientation of Qmm14 and Qmm15 towards the Gilf (Image Courtesy Google & GEOEYE)

**Implications of the find:**

Based on our current knowledge, if these sites are in fact the remains of a prehistoric settlement it would be one of the northern most discoveries of its kind in the Gilf area to date (Marai, 2012).

## Long Range Desert Group Artifacts and Sites

The extreme climate changes evidenced in the Western Desert caused lengthy episodes during which human activity appears to have been absent. Ironically this same extreme environment also serves to preserve evidence of human occupation in a vivid stratigraphy unlike anywhere else on earth. For example, alongside prehistoric artifacts and sites we also discovered the remains of World War Two era cultural material.

**History of the LRDG**

The Long Range Desert Group (LRDG) was created in 1940 to conduct reconnaissance and commando type raids or "piracy on the high desert" against the Italian and Germany armies operating in the Western Desert during World War II. The LRDG's actual tactical accomplishments were limited. However, the strategic role they played in forcing the enemy to re-deploy front line troops to reinforce what it had previously been considered a naturally protected flank along the south and eastern desert had a tremendous impact on the war. The deep desert operations conducted by the LRDG helped alleviate the precarious position of the dangerously under resourced and outnumbered British Army attempting to protect its interests in Northern Africa.

**Figure 22:** LRDG Fuel Depot

While this is not the forum to discuss military history, it should be noted that the LRDG was important to our expedition because this unit owes its existence to the pre war experiences and accomplishments of a group of deep desert explorers. Founding members of the LRDG including Ralph A Bagnold and Patrick Clayton spent the 1930's exploring the western desert as well as developing technologies such sun compasses, water condensers and sand ladders to extend the range of where they could travel in the quest to "fill in" the still largely blank spaces on the map of Egypt, Libya and the Sudan.

## I. LRDG Fuel Depot


Approximately 70 kilometers into the desert, Mahmoud Marai shows us a LRDG fuel dump depot site he found in 2009. At this prominent rock outcropping we find various artifacts including many of the maligned four gallon petrol containers known as “flimsies” stamped “Shell Oil”.

In the hyper arid environment the desert preserves the historic as well as the prosaic evidence of everyday life. At this LRDG site we find an evaporated milk can labeled: “Nestle 7/7/42” and to the left in **Figure 23**: a tin of corned “Bully” Beef from Argentina used by the British army.

## II. “LRDG Truck #1”

17 kilometers west of the fuel depot we come to the remains of a LRDG patrol truck found by the explorer Carlo Bergmann in the winter of 2007 while on one of his camel expeditions.

**Figure 24:** Sand tire from LRDG site II

Strewn around this site are four sand tires for a 30 CWT truck, various bits of camp life (bottle, tin cans etc) as well as an “in-line” 6 cylinder overhead valve head which is stamped: 838773 Gm J-17-16 and the block reads: XR3758456.

**Figure 25:** Engine Block from LRDG Site II

Our team believes this may have been a 30 CWT 1939 Egyptian or 1942 Canadian build. In this environment tracks tend to remain visible for years or even decades and we did not see any evidence of recent activity at this site.

**Figure 26**: LRDG Site II

**Figure 27:** Detail of engine block from LRDG site II

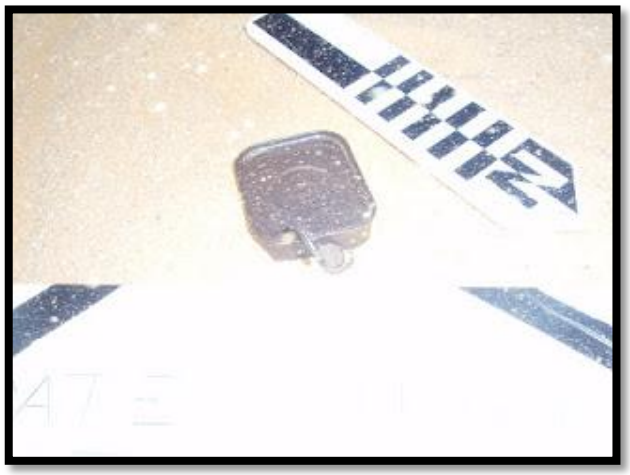


**Figure 28:** Sardine can from where the LRDG may have eaten while trying to fix and or salvage their vehicle.

Three kilometers south we came to the hill where in 1983 Major-General David Lloyd Owen ex-Y Patrol Commander and his team recovered ”Waikaha" (Mori word meaning strong water) a Chevrolet WA 133-inch wheel base 4 x2 30 cwt truck and raised a cairn with a plaque to honor the men of the LRDG .

**Figure 29** Left image: WWII era Chevrolet LRDG truck. Image courtesy of Piers Lloyd Owen Copy right LRDG association Right Image: LRDG Cairn

## III. LRDG Trail & Artifacts

On 11 April 2012, we followed a set of tracks that we assumed was relatively recent traffic heading towards the Gilf area. Upon examination, however, the width of the tire tread and the condition of the reg**,** led us to conclude that these tracks may be WWII era.

Further on we spotted a "flimsy" and almost drove past it as these artifacts are not uncommon in the desert. As we came along side it we also found a broken shovel stamped "1941 N.S.W."

**Figure 30:** Old Tracks

Supporting our theory that we had found a new set of tracks and site was the existence of the shovel *in situ*, which would be too tempting an object for any "collector" to leave by the side of a track especially since it bears the inscription "1941 N.S.W" ( New South Wales)?

**Figure 31:** LRDG shovel photo credit: Karl-Gunnar Norén

## IV. "LRDG Patrol Vehicle"

Following the set of tracks we found the day before, we discover an abandoned truck. John Carroll, Karl Gunner Norén and Sam Watson our LRDG experts agree this truck was probably a patrol vehicle.

Its engine block is stamped Ford Motor Company 1942 stamped on and based on other evidence it appears to be a Canadian built right hand drive patrol truck. VIN : 718789, 029016474.

**Figure 32:** LRDG Site IV Patrol Vehicle

**Implications of the find:**

Based on our follow up research with local guides, as well as the small community of Western Desert and LRDG experts suggests that this may not be a completely new discovery. The desert explorer Andras Zboray says he visited an upside-down 30cwt Ford in 2007. To our knowledge this is the first dissemination of information about this vehicle which brings the total known number of Sudan Defense Force and or LRDG trucks in Egypt Libya to eight.

**Figure 33:** Examining the Patrol vehicle

Zboray tells us that the route we found may have been one of the many alternatives used by the Kufra Convoys, if coming from Bir Missaha it bypasses the dunes in their entirety. From our present knowledge, it appears that all the wrecks in the Salima sand sheet / Gilf area

are Sudan Defense Force vehicles, the only one which is confirmed LRDG is the truck near Ain Dalla. (Zobary, 2012)

**Figure 34:** Red lead primer, green base coat and blue/cream camouflage colors are evident in the wheel well. This find is diagnostic and will give historians a better idea of the patterns used as most historical evidence from this time period is in black & white photos.

**Figure 35:** Scratched into the paint on the back gate of the truck is "Farafra Abu Mungar" All of our Arabic speakers agree this script is interesting as it is written in an old style not commonly used any more.

**Figure 36:** Expedition team with Flag 60 at LRDG Site IV

# Main Conclusions, Questions and next steps:

The Libyan Desert Expedition was partially successful in its objectives:

- The team successfully completed the very first 3,700 kilometer circumnavigation of the Egyptian Desert using 70 year old jeeps along the way gathering data related to the performance characteristics of this equipment which can be applied in the search for cultural remains associated with the 1941 "T" Patrol LRDG expedition.

- Two previously undocumented sites possibly related to the British Long Range Desert Group (LRDG) were identified.

- While no new rock art or Pharaonic material was discovered, a prehistoric watchtower, a round settlement structure and directional markers were discovered using satellite imagery on a plateau approximately 90 kilometers north of Aqaba Pass in the Gilf Al-Kibir. From what we have learned from this experiment and our findings at the Gara Marai site, we are more confident we can apply this technology on a future expedition where we will search for evidence ancient trade routes across the Western Desert linking Pharonic Egypt to civilizations in what are now Chad and the Sudan.

- In preparations for a future expedition, we had hoped that we would be able to spend time south east for Siwa oasis familiarizing ourselves with the terrain where previous explorers have searched for the Lost Army of Cambyses. Due to late arrival of the jeeps to Alexandria Port, and facing a three day sand storm known as the *Khamsin ,* reduced visibility to almost nil, this effort had to be abandoned. [4]

In conclusion, this expedition has demonstrated that the technology can in fact be useful in analyzing large areas to identify prehistoric and other sites located in the Western Desert as small as two meters in diameter. A follow up expedition which will seek to extend the work of Carlo Bergmann, Mahmoud Marai and others who believe that ancient trade routes exist which will link Pre-Pharonic Egypt to cultures in what is now Chad and Sudan is planned for November 2014.

[4] It is not difficult to believe that an army of fifty thousand could have gotten lost if they had suffered through a week of this type of storm. Reading about the *Khamasin* in a book from the comfort of your home is one thing, feeling its energy sapping, debilitating, disorientating affects day after day brought us one step closer to understanding Almasy's and Rolf's descriptions of how harsh and hostile this environment can be for the unprepared.

**Questions:**

**QMM Archaeological Sites:**

Are the sites discovered related to the same prehistoric peoples who populated the Gilf Kibir who are responsible for the rock art found at the cave of Swimmers and the Foggini-Mestikawi Cave discovered in 2002?

Who were these people? Where did they come from and are the predecessors of Ancient Egyptians?

**CHS Protection issues:**

What is the correct procedure to follow to protect cultural heritage sites and material from destruction and theft from treasure or souvenir hunters? In discussing this topic with desert explorer Kuno Gross, Gross believes that it is better not to search and announce discoveries. He suggests" I add small plate made of aluminum, where it was mentioned in Arabic and English language that this site is a monument of the history and that it shall remain on that location undisturbed. At some places at least it worked".

This is a difficult topic but I believe that in order to protect these sites it is the people of Egypt who stand the most to gain from recognizing the significant value both cultural and economic value that these sites and artifacts contain who must become the stewards of their cultural heritage. In stark contrast to the horror stories we had heard about the tourist and military police being inept, corrupt or bureaucratic, our expedition was lucky to have a group of Egyptian officials who took both our protection as well as the protection of their cultural heritage seriously.

## Lessons Learned:

**Expedition preparation:**

Due to the late arrival of the container ship carrying the jeeps we began our expedition three days behind schedule. Compounding our problems, the team was starting to show the effects of sleep deprivation, having gotten only 3 hours sleep in the last 48 hours. Due to the hard end date of our military travel permits in the border zone region we would have to make the tough call of which objectives to abandon. More concerning though was the fact that out of necessity the jeeps were driven hard straight out of the cargo container almost 1,200 kilometers over a 24 hour period whereas we had planned to spend a day checking them over after their two month sea voyage. This was not how we had planned the expedition to start by any means. What lessons can be learned?

It is my belief that this situation was not the result of lack of planning. The expedition organizers accurately identified all material risks and issues and mitigated them as well as could be expected. Specifically they had taken into account potential delays resulting from Egyptian customs bureaucracy

and based on discussions with the freight forwarder had built in a 10 day buffer. They did not however take into account the possibility that the container ship engaged to transport the jeeps would have mechanical problems and that the replacement vessel would be late in discharging its cargo because it made an unscheduled stops in Malta along its route to Alexandria. We cannot fault poor planning for failing to anticipate this series of extremely unlikely chain of events. Had we attempted to mitigate anything and everything that could possible go wrong we would have never left home.

The question that arises though is what can we learn about expedition risk management: specifically the decision making process? In this case, the entire trip depended on the jeeps reaching Egypt within a very tight window. The estimates factored in for getting the jeeps through the port system were reasonable (in fact conservative), but we were still delayed because of the occurrence of an unexpected low joint-probability event. In the future, if I am involved with a project that will fail if a critical piece of equipment is not available on site by a certain date I will use what I have learned here to make sure that I allow for a buffer in each link in the logistical chain.

## Expedition Team Management

While our team of eight principals was comprised of well seasoned explorers, we also came from four different cultures. Few of us had worked together before beyond a brief two day training meeting in England and as such we did not have the benefit of knowing each other's strengths and weakness. After 48 hours of almost constant driving, engines were overheating and tempers were short. Most importantly in my view, in an attempt to maintain good relations amongst a group of equals, we had not established a clear chain of command or delegation of duties and roles, a situation sure to lead to trouble if not addressed.

After breakfast, the team met to discuss the situation. Happily our years of collective experience prevailed and we agreed to organize ourselves into sub groups each with specific tasks and roles. As a wise man once said "one must learn to be both a good Leader and a good Follower". Rick Pewe assumed the role of operational control for which he was uniquely qualified. With equal dexterity he sorted out fuel lines, adjusted timings on the jeeps, as well as efficiently but diplomatically got each member of the team to accept a specific role and responsibility. Of all the accomplishments of this expedition, watching this group confront the physical and mental challenges that threatened us early on but which resulted in forging a cohesive and effective team is the achievement of which I am most proud. I would be happy to head back out into the desert with each and every member of our team.

Note: In our team debriefing communications after the expedition, there were decidedly mixed opinions about this topic with some arguing that a clear of chain of command should be established prior to the expedition whilst others felt it would have been wrong to attempt to set this up this any earlier without knowledge of our individual strengths. What we did all agree with was that deciding how and when to establish an effective delegation of roles and responsibilities for an expedition depends on the parties involved. I suspect the correct system for a given expedition is a function of the cultural norms and preferences of the people involved. Perhaps the lesson learned here is that there is no "right" answer

but expeditions are well advised to factor in and attempt to understand the individual and cultural management preferences of the team members in order to maximize the chances of a successful expedition.

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# Appendix

### Expedition Sites:

| No. | GRID | TARGET | LAT | LON | Description | Tracks? | Altitude meters | Column1 |
|---|---|---|---|---|---|---|---|---|
| 1 | PR | PR1 | 27° 7.673'N | 26° 28.813'E | Pillar Rock | x | | |
| 2 | PR | PR2 | 27° 8.482'N | 26° 27.877'E | white shape | | | |
| 3 | PR | PR3 | 27° 8.446'N | 26° 29.322'E | wind swept black shape | | | |
| 4 | PR | PR4 | 27° 8.085'N | 26° 28.056'E | small black shape | | | |
| 5 | PR | PR5 | 27° 7.991'N | 26° 29.273'E | med black object | | | |
| 6 | PR | PR6 | 27° 7.776'N | 26° 28.309'E | med black object | | | |
| 7 | PR | PR7 | 27° 7.845'N | 26° 28.583'E | large black object | | | |
| 8 | PR | PR8 | 27° 7.858'N | 26° 28.712'E | large black object | x | | |
| 9 | PR | PR9 | 27° 7.642'N | 26° 28.487'E | large black object | | | barrel |
| 10 | PR | PR10 | 27° 7.491'N | 26° 28.305'E | med black object | | | barrel |
| 11 | PR | PR11 | 27° 7.321'N | 26° 28.750'E | white cross | x | | |
| 12 | PR | PR12 | 27° 6.709'N | 26° 29.453'E | 2 objects | | | rock can 5 boards wide |
| 13 | PR | PR13 | 27° 6.369'N | 26° 29.783'E | small black shape | | | |
| 14 | PR | PR14 | 27° 6.310'N | 26° 29.116'E | small black shape | x | | |
| 15 | PR | PR15 | 27° 6.216'N | 26° 28.735'E | med black object | | | tire |
| 16 | PR | PR16 | 27° 6.014'N | 26° 29.444'E | 2 black objects | | | 2 barrel |
| 17 | PR | PR17 | 27° 7.426'N | 26° 28.068'E | white line | x | | |
| 18 | PR | PR18 | 27° 7.914'N | 26° 27.591'E | large object | | | missing |
| 19 | PR | PR19 | 27° 7.896'N | 26° 29.571'E | small black shape | | | |
| 21 | QMM | QMM1C | 24° 10.222'N | 26° 0.562'E | 2 circles 5m diam | | 893 | natural formations |
| 22 | QMM | QMM2C | 24° 10.430'N | 26° 0.579'E | 1 circle 2 m diam | | 894 | prehistoric structure |
| 23 | QMM | QMM3 | 24° 10.249'N | 26° 0.304'E | rocks or linear shapes | | 887 | |
| 24 | QMM | QMM4 | 24° 10.497'N | 26° 0.365'E | unknown | | 890 | |
| 25 | QMM | QMM5 | 24° 10.743'N | 26° 0.678'E | rock? | | 889 | |
| 26 | QMM | QMM6c | 24° 10.738'N | 26° 0.824'E | circles? | | 884 | |
| 27 | QMM | QMM7c | 24° 11.015'N | 26° 0.688'E | circles? | | 883 | |
| 28 | QMM | QMM8 | 24° 9.903'N | 26° 0.428'E | rocks? | | 890 | natural formations |
| 29 | QMM | QMM9 | 24° 9.452'N | 26° 0.396'E | linear shape on hill side | | 852 | path |
| 30 | QMM | QMM10w | 24° 10.312'N | 26° 0.195'E | wadi | | | |
| 31 | QMM | QMM11w | 24° 9.779'N | 26° 0.054'E | wadi | | | |
| 32 | QMM | QMM12w | 24° 9.759'N | 26° 0.571'E | wadi | | | natural formations |
| 33 | QMM | QMM13w | 24° 8.892'N | 26° 1.468'E | wadi | | | |
| 20 | QMM | QMM14 | 24° 10.034'N | 26° 0.472'E | circle | | 891 | watchtower |
| 34 | QMM | QMM15 | 24° 10.540'N | 26° 0.454'E | hill | | 896 | directional marker |

**Expedition Inventory List**

| Provisions List |
|---|
| 2000 liters of Diesel |
| 1000 liters of Gasoline |
| 1000 liters of Water ( gray) |
| 40 boxes X 20 btls/650mm – 25 box X 12 btls/1500 mm Mineral water |
| 60 Bottles of Soft drink |
| 10 boxes X 36 eggs = 360 Eggs |
| 60 Cans of tuna |
| 60 Can of Corn beef |
| 50 Cans of beans |
| 30 Kg of minced meat |
| 35 Kg of Chicken |
| 30 Kg of White cheese |
| 30 kg of Cheese |
| 15 Kg of Cold cuts |
| 6 jars of Honey |
| 6 jars of Jam |
| 400 packs of tea |
| 400 packs of Nescafe |
| 20 Kg of Sugar |
| 20 liters of Milk |
| 20 pack of Rice |
| 20 pack Macaroni |
| 30 Jars of Tomato Sauce |
| 10 boxes of paper napkins |
| 200 roles of toilet papers |
| 550 plastic plates |
| 550 plastic fork |
| 550 plastic spoon |
| 550 plastic knife |
| Salt – pepper |
| 350 pcs of Arab Bread |
| 40 packs of toast |
| 10 bottles of Oil |

*Provided by Siag Travel*

## Fuel consumption

Estimated Ford 3.5 km/L[5] (approximately 12 miles per U.S. gallon) Willy's 4.3Km/L over sand running 15 PSI in the tires.

| Start | End | DATE | KMS | Cummulat | Terrai | OA | MA | MT | octane |
|---|---|---|---|---|---|---|---|---|---|
| Cairo | Bahareya | 8-Apr-12 | 775 | 775 | tarmac | 55.4 | 64.6 | 12:00 | 90 |
| Bahareya | Dakhla | 9-Apr-12 | 471 | 1,246 | tarmac | n/a | n/a | n/a | 90 |
| Bahareya | Dakhla | 10-Apr-12 | 103 | 1,349 | tarmac | 25.8 | 26.3 | 3:46 | 80 |
| Dakhla | NC1 | 10-Apr-12 | 66 | 1,414 | tarmac | 65.6 | 65.6 | 1:00 | 80 |
| NC1 | NC2 | 11-Apr-12 | 268 | 1,682 | reg | 27.6 | 59.6 | 4:30 | 90 |
| NC2 | NC3 | 12-Apr-12 | 206 | 1,888 | reg/sand | 24.6 | n/a | n/a | 90 |
| NC3 | l3 | 13-Apr-12 | 30 | 1,919 | reg/sand | 22.7 | n/a | n/a | 90 |
| l3 | nc4 | 13-Apr-12 | 152 | 2,071 | reg/sand | 16.7 | 37.2 | 4:11 | 90 |
| NC4 | NC5 | 14-Apr-12 | 172 | 2,243 | sand | 19.6 | 36.2 | 4:28 | 90 |
| NC5 | NC6 | 15-Apr-12 | 170 | 2,413 | sand | 36.2 | 48.4 | 3:23 | 90 |
| NC6 | NC7 | 16-Apr-12 | 272 | 2,685 | sand | 27 | 47.6 | 5:42 | 90 |
| NC7 | NC8 | 17-Apr-12 | 187 | 2,872 | sand | 24 | 44.6 | 4:11 | 90 |
| NC8 | Siwa | 18-Apr-12 | 133 | 3,005 | sand | 13.1 | 32.8 | 4:03 | 90 |
| Siwa | Alexandria | 20-Apr-12 | 538 | 3,543 | tarmac | 52.3 | 67.3 | 8:00 | 90 |
| Alexandria | Cairo | 21-Apr-12 | 226 | 3,769 | tarmac | 49.6 | 61.4 | 3:40 | 90 |
| | | | **3769.05** | | | | | | |

[5] (british imperial liters)

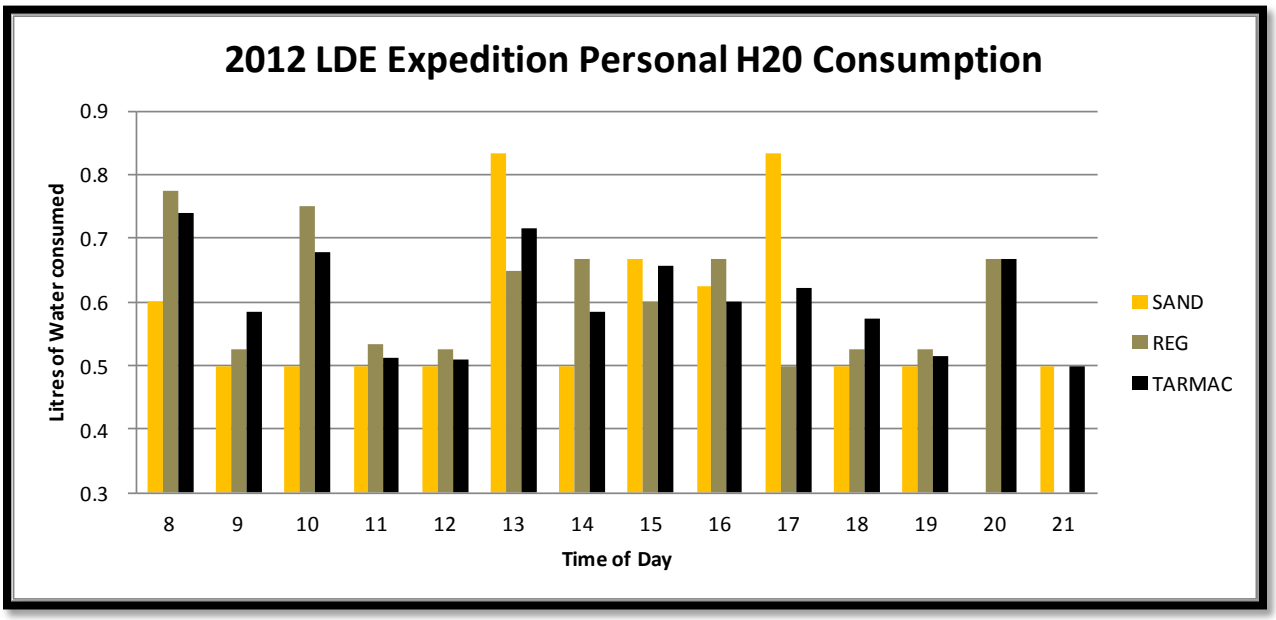
## Water consumption

"The body is far more particular about water than food and the acceptable margins between what it needs and what it gets are very much narrower; if there is any shortfall at all, performance will be affected quickly , and before long, terminally" (Sheppard, 2008)

"A widely accepted basic daily water requirement for a person in a temperate climate is 2.5 liters per day-sedentary, no work. This rises to a generalized 5.0 liters per day "in the tropics"/ Experience over a number of hot climate –expeditions show water can rise many times this figure:

- Night/day temps 5/35 degrees C: 5-10 liters per head per day
- Night/day temps 25/45 degrees C: 8-15 liters per head per day (Sheppard, 2008)"

For our expedition we calculated we needed at least 825 liters of water plus reserves rounded up to 1,000 (actual water carried was 975 liters). Due to the fact we would be travelling in open top jeeps and thus exposed to the dehydrating affects of conduction of a cool fluid (air) passing over a warm surface (our skin), I thought it might be useful to also calculate my actual consumption rate for the trip in an open top jeep operating in a mean temperature range of 21-31 Celsius.




I have travelled extensively in the desert by motorcycle and have felt the effects of dehydration from winds so was well aware of the impact it can have on the body. We used water almost exclusively for drinking with less than 1% of our portable water being used for necessities like brushing teeth and minimal washing which broadly correlates to Sheppard's estimates.

April 25, 2012

| DAY | Mean Temp C (Dakhla) | Dakhla Mean wind speed (Km/h) | Mean Temp C (Siwa) | Siwa Mean wind speed (Km/h) | Condition | TIME 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | H20 Consumption (litres) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-Apr-12 | 29.1 | 2.4 | 30.4 | 8.5 | tarmac | 1.5 | | 1 | | | 1 | | 1 | | | | | | | **4.5** |
| 8-Apr-12 | 30.3 | 3.9 | 26.5 | 9.1 | tarmac | 0.5 | | 1 | 0.5 | 0.5 | 0.5 | 0.5 | | 0.5 | | | | | | **4** |
| 9-Apr-12 | 29.9 | 9.3 | 23.3 | 11.5 | tarmac | 0.25 | | 0.5 | | | 0.5 | | 0.5 | 0.5 | 0.5 | 0.5 | | | | **3.25** |
| 10-Apr-12 | 26.1 | 10.2 | 19.8 | 12.4 | tarmac | 1.5 | | 0.6 | | 0.5 | | 0.5 | 0.5 | 0.6 | 0.6 | | | | | **4.8** |
| 11-Apr-12 | 21 | 7.8 | 18.4 | 8.9 | sand | 1.5 | 0.5 | | 0.5 | 0.5 | 0.5 | 1 | | 1 | 0.5 | 0.5 | 0.5 | | | **7** |
| 12-Apr-12 | 21.3 | 5.2 | 21.9 | 13 | sand | 0.5 | 0.5 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 | | **6.7** |
| 13-Apr-12 | 22.9 | 4.6 | 26.1 | 12.4 | sand | 0.6 | 0.6 | | 0.6 | 0.6 | 1.1 | | 0.6 | | 0.5 | 0.5 | 0.5 | 1 | | **6.6** |
| 14-Apr-12 | 26.4 | 5.2 | 27.9 | 18.9 | sand | 0.5 | 0.5 | 0.5 | | 0.5 | 0.5 | 0.5 | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | | **5.5** |
| 15-Apr-12 | 25.9 | 10.2 | 22.2 | 11.3 | sand | 0.5 | | 0.5 | | 0.5 | 1 | | 0.5 | 0.5 | 0.5 | | | | | **4** |
| 16-Apr-12 | 25.7 | 7.6 | 22 | 10.9 | sand | 0.5 | 0.5 | | 0.5 | 0.5 | 0.5 | | 0.5 | 1 | 1 | | | | | **5** |
| 17-Apr-12 | 27.5 | 3.9 | 26.8 | 21.3 | Sand Storm | 1 | | 0.5 | 0.5 | 0.5 | 1 | | | 0.5 | 1 | 0.5 | | | | **5.5** |
| 18-Apr-12 | 25.5 | 16.9 | 21.3 | 24.1 | Sand Storm | 0.5 | | 0.5 | 0.5 | 0.5 | | 0.5 | | 0.5 | | | | | | **3** |
| 19-Apr-12 | 22.6 | 8.7 | 19.9 | 8.1 | Sand Storm | 0.5 | 0.5 | | | 0.5 | | | 1 | | | | 0.5 | | 0.5 | **3.5** |
| 20-Apr-12 | 22.5 | 5.6 | 21.7 | 5.4 | tarmac | 0.5 | | | 0.5 | | 1 | | | 0.5 | | 0.5 | 0.5 | | 0.5 | **4** |
| 21-Apr-12 | 24.5 | 6.5 | 26.1 | 8.9 | tarmac | | 1 | | | | 0.5 | | | | | 1 | 0.5 | | | **3** |

***Weather data:*** *http://www.tutiempo.net/en/Climate/SIWA/04-2012/624170.htm*