# New Geoheritage Sites: Outdoor Geological Museums as a tool for the Sustainable Development

## Short Title : Geotourism

**Keywords**: Geoheritage; Geoparks; Geotourism; Geodiversity; Geohazards; Sustainable development

**Funding and Duration**: 1,000,000 pound / 12 Months

**Total cost:** 1,000,000 pound

**Research Theme:** Archaeology and Cultural Heritage

**Proposal Summary: English and Arabic**

Egypt has tremendous outdoor geologic museums that have yet to be explored; these geoheritage sites are various, coastal, geothermal, volcanoes, springs, oases, meteorite impacts, black and white deserts, unique rocks, and geomorphological landscapes. This project aims at detecting new sites and evaluate them as potential geotourism areas using cutting-edge technology. The impact of this project is to use these sites as tool for sustainable development, and record these locations as geoheritage sites to introduce them as a geogeotourism sites that are on the international tourism agenda, for both scientific and tourism communities. The participating team has experiences covering different geologic disciplines, and archaeology supported with publishing the results through international first class journals. The preliminary study comprises fieldwork investigations for new proposed sites along the Western Desert including Oases such as Siwa, El-Baharyia, El-Farafra, Dakhla and Kharga for locating spring and lacustrine deposits as a possible Geosites proxy for climatic changes during the Green Sahara times (Middle to Late Kingdom pluvial times. Other areas along the Eastern Desert including the different ancient mining sites and for distinguished rock features of different types including Hamamat Group of rocks at Wadi Hamamat with their characteristic petroglyphs and historic graffiti. In addition to sites proposed on the itinerary of the basic visit while tourists visiting coastal areas such as the Meteorite Lake and coral reef terraces record the Paleoclimate and paleosea level at Ras Wizr, Ras Samadi, and Wadi El-Gemal in Halayeb and Shalateen. The research plan will be implemented using remote-sensing data, field data, petrographical and geochemical analyses including few isotope geochemistry and heritage site management methodologies.

تزخر مصر بتنوع البيئات الجيولوجية ويشكل الكثير منها متاحف جيولوجية هائلة والتي لم يتم استكشافها بعد؛ وتتنوع مواقع التراث الجيولوجي بين ساحلية، وبراكين، وينابيع، وواحات، وصدمات نيزكية، وصحاري سوداء وبيضاء، وصخور فريدة، ومناظر طبيعية جيومورفولوجية. يهدف هذا المشروع الي استكشاف أماكن جديدة وتقييمها كمناطق جذب سياحي وتراث جيولوجي باستخدام أحدث التقنيات. يتمثل تأثير هذا المشروع في استخدام هذه المواقع كأداة للتنمية المستدامة، وتقديم هذه المواقع كمواقع للسياحة الجيولوجية لكل من المجتمعات العلمية والسياحية. يتمتع الفريق المشارك بخبرات تغطي مختلف التخصصات الجيولوجية والآثار مع توثيق لهذه الدراسات من خلال إصدار أبحاث متميزة في النتائج الأولية المستندة إلى دراسات العمل الميداني تشير لوجود العديد من الأماكن المرشحة كي .دوريات علمية موثقة تكون مواقع فريدة للسياحة الجيولوجية. كما يمكن للسائح العادي زيارتها على هامش زيارتة للمناطق الساحلية في مرسي

علم علي ساحل البحر الأحمر والساحل الشمالي الغربي كما في واحة سيوة وفي الوقت نفسه، تشمل المواقع الجيولوجية أماكن لأول وفي القوت نفسه تشمل هذه الدراسة مواقع ستسجل للمرة الأولى كمواقع تراث جيولوجي يمكن وضعها على الأجندة السياحية مثل مواقع صخور الحمامات وأماكن تعدين الدهب وبحيرة النيزك وغيرها. سيتم تنفيذ خطة البحث باستخدام بيانات الاستشعار عن بعد، والبيانات الميدانية ، وتحليلات الكيمياء ، جيوكيمياء النظائر.

**Introduction/Background**

Wadi Hammamat in the Eastern Desert has been the place for the route of early human migration with well-preserved rock art, the site for first geologic map[1] and gold mining sites with a well-preserved graffiti conducted by the ancient Egyptians (Fig. 1), and the trade route from Thebes to the Red Sea and vice versa. Consequently, the quarrying areas of excavating ornamental stones attracted the attention of the Roman army who created a Roman Castrum right next to the most important mine of porphyry rock[2] in Gabal Dokhan to the west of Hurghada. The Red Sea is a natural laboratory for continental rifting process[3], and exciting geoheritage sites. For example, the Zabargad Island which is a fragment from the lithosphere beneath the Red Sea[4] (Fig. 2a),has an ongoing live process for the formation stalactite and stalagmites in the entrance of Ain El Ghazal (Fig. 2b). Furthermore, the Meteorite Lake (Fig. 2c) is an exciting site along the Red Sea coast.

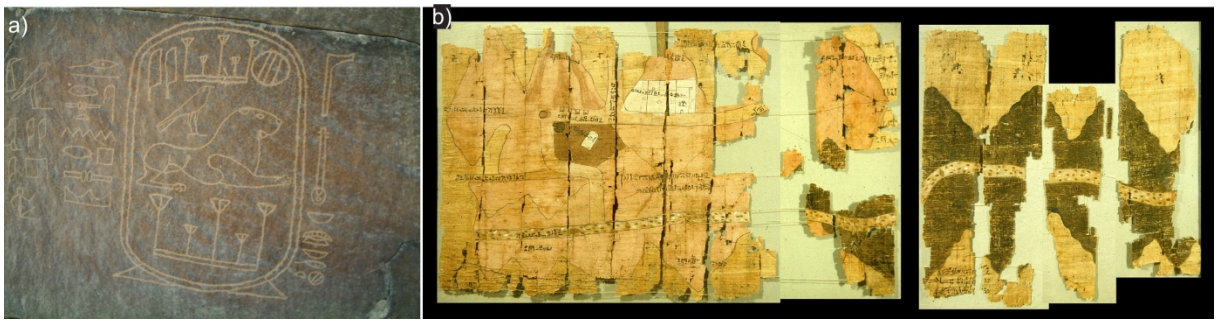


**Fig. 1: a)** Ancient Egyptian petroglyphs (graffiti) in Wadi Hammamat; b) Turin papyrus map (the oldest mining map, 1200 BC) conducted at El-Sid gold mine, Italy.

Most of the geosites in Egypt are characterized by their relation to important historical, archaeological, religious and spiritual contexts, which contributes to maximizing its ability to attract tourists with different backgrounds. Examples for some well-known geosites include, Mount Moses in Sinai, Moses' springs, Hamam Pharaun, and Hamam Musa in Tur Sina.

Moreover, some well-documented geoparks are unique in the framework of the geologic history, such as Wadi El Hitan, which is the first geological site registered as on the UNESCO World Heritage List, Wadi Sannur Cave, and El Hassana Dome and many other areas.

Geotourism is an important sub-sector of tourism in many countries, i.e., Oman, USA, Norway, UK, Brazil, Chile, Greece, Italy, Malaysia, Korea, and Australia. Geotourism is an important tool to improve the usage of the natural resources, encourage sustainable development, and increase the national income through heritage management plans to these sites. There are many geoheritage sites that are not documented for public and scientific communities. Egypt's geoheritage needs a new documentation and site registration as well as an innovative branding plan to encourage tourists to lead the unbeaten path and explore new layers of Egyptian heritage.

Fig.2: a) Zabargad Island, uplifted sub-Red Sea lithosphere; b) Live process for the formation of stalactites at Ain El Ghazal; c) The Meteorite hole.

This research will use cutting-edge high technology to compile an inventory of the geoheritage sites in Egypt through remote sensing, field investigations, geochemical analyses, age-dating, and isotope geochemistry if needed. The research will also create a risk assessment plan and map for the geoheritage inventory sites. After this, a detailed branding plan and possible tourist itineraries can be created through the different local stakeholders.

**Objectives**

Objective 1: Documentation

The first objective is to explore new geoheritage sites, document these sites, and deliver the results to both scientific and media outlets. This will be created through a georeferenced inventory list with accurate metadata. The results of this objective will be published in Q1 academic journals as well as poplar media outlets. The potential of discovery of geoheritage sites in the Eastern and Western Deserts of Egypt is very high (Fig. 3), and this research project will help locate areas that need to be documented.

Objective 2: Risk Assessment

The second objective of the project is to create a risk assessment plan and map for the sites documented on the inventory. The risk assessment methodology will follow that which has been standardized by UNESCO for sites of heritage value.

Objective 3: Branding Plan

This third and final phase of the project will include a heritage branding plan for Egypt's geoheritage that is put forward with the local stakeholders. This plan aims to create itineraries for vising with the local stakeholders as well as social media engagement plan with Egypt's geoheritage.

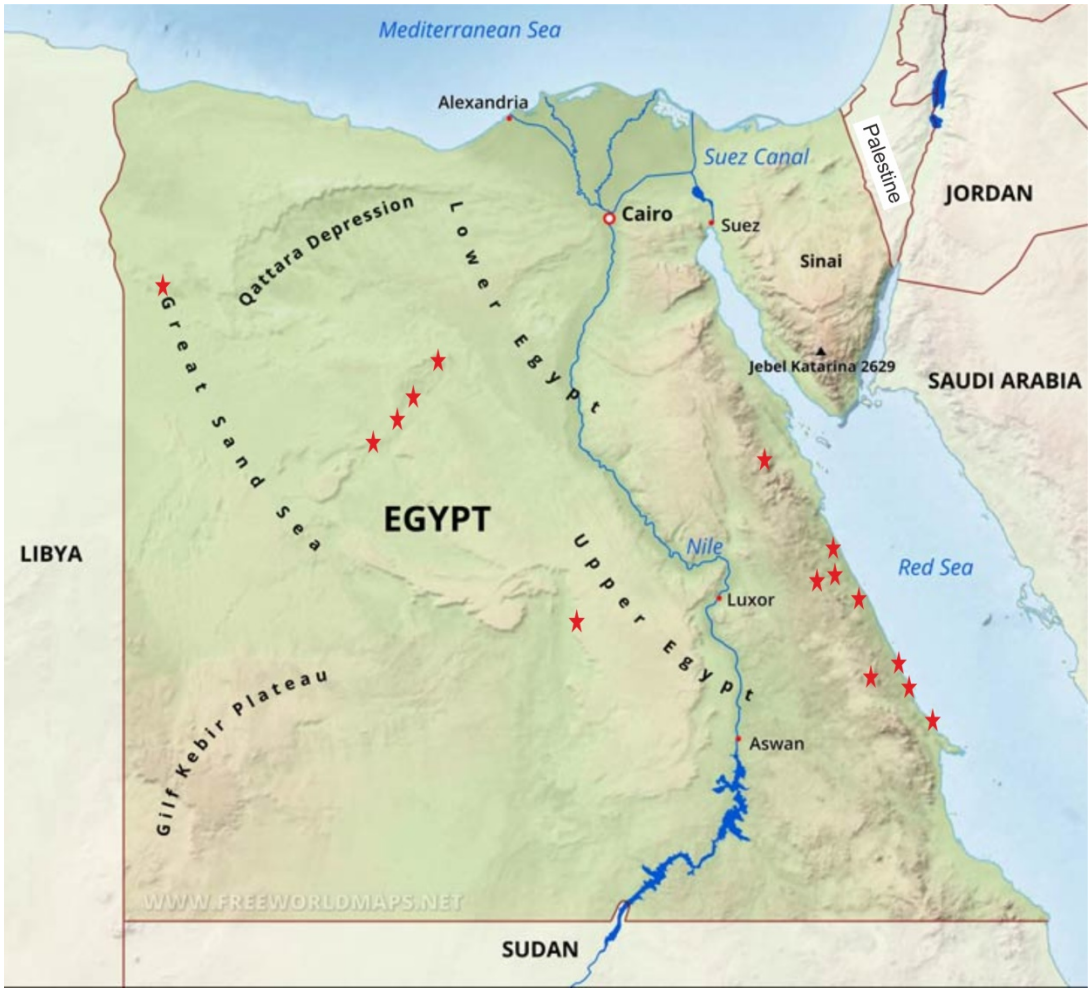


**Fig. 3:** The proposed geoheritage localities in the Eastern and Western Deserts (red stars)

**Project Description and Methodology**

1. Remote-sensing data will be used to establish base layers for the topography, structural elements, regional geology, and accessibility of the proposed sites. Meanwhile, the processing of remote-sensing data is significant in measuring changes over past decades due to human impact and intervention. Furthermore, fieldwork studies will be conducted to collect samples, photograph features, and record geologic measurements, carry out the risk assessment, and construct detailed geologic maps.

**2.** Laboratory studies will be integrated with previous studies; including petrographical, mineralogical and geochemical investigations for major and trace elements. To understand the geo-provenances, geochronological studies will be carried out for very limited samples as far as necessary. The geochronology may include radiocarbon, uranium series and other available techniques.

3. Field Location description will include georeferenced geological and historical data and detailed description such as: the selected location for the present study including different sites at Oases along the Western Desert such as Siwa oasis (ex. natural spring and lake, salt fields and salt mineralization), Lacustrine deposits at Bahariya and white and black deserts, lacustrine lakes at Dakhla, tufa and travertines at Dakhla and Kharga oases.

At the Eastern Desert and Red Sea coast we will focus on coastal coral reef terraces recoding Quaternary sea level, some feature related to intertidal sites, Meteoritic Lake and locations at Wadi El Gemal, Ras Wizr and Ras Samadi.

**Anticipated Results and Evaluation Criteria**

The main expected result of this research is documenting new geoheritage sites and potential analysis for site management and heritage branding. Furthermore, results will be delivered to key media outlets, newspapers, and websites.

**Expected Project Outcomes and Impact to AASTMT**

I. An inventory of the geoheritage sites as an outcome of the surveyed areas with their associated risk assessment georeferenced data and risk map.

III. Wherever the sites are located within communities, there would also be a stakeholder's analysis of developmental opportunities through heritage site management and destination branding.

IV. Media campaign to foster social engagement with geoheritage in Egypt that uses social media as well as other visibility material

IV. Academic articles in high impact factor journals to document the project, activities and results.

**Resources**

1. Equipment and lab facilities: there is currently microscope lab available for petrographic studies of thin sections under polarizing research microscope, and stereomicroscope to identify fossils.
2. Resources that are planned to be obtained in order to carry out the proposed research project:
    - Brunton Axis Pocket Transit 0-360 (2 pcs.)
    - Estwing pick end hammer.
    - Estwing chisel end hammer.
    - Cold chisel with hand guard.
    - 2.5 lb. & 1 lb. geological hammers.
    - Pencil chisel and Tile scribe
    - GigaPan
    - Professional drone camera
    - Professional digital camera
    - Professional 360 degree camera
    - Portable laser scanner
    - Drilled core sampler
    - Laser grain size counting

3. Software:

Many different types of available software and codes will be used during different stages:

1. For geologic mapping, ArcGIS, QGIS, Global mapper, Google earth, and surfer will be used.
2. For editing CorelDRAW, Adobe Illustrator, and Inkscape software's are available.
3. For statistical analyses Python-programming language will be used.
4. GCDkit, and Python-libraries for geochemical analyses.
5. Isoplot, and other software will be used for geochronology and isotope studies.
6. Steronet, FABRIC7, GeoOreint, Noddy, Poly3D, and SG2PS free software will be used for stress/strain analysis.

**Proposed teams**

- **AASTMT Team**

**1. Dr. Monica Hanna; Acting Dean, College of Archaeology and Cultural Heritage.**

Dr. Monica Hanna is an international figure in the world of Archaeology. She did her undergraduate studies in Egyptology and Archaeological Chemistry at the American University in Cairo (AUC), 2004. Hanna then pursued an MA TEFL 2006 at AUC as well. She later joined the University of Pisa, Italy to complete her doctorate in archaeology entitled 'Problems of Preservation of Mural Paintings in the Theban Necropolis: A Pilot Study on the Theban Tomb 14 using 3D Scanning Techniques .'
From July 2011 until November 2012, Monica was a post-doctoral fellow in the Topoi Cluster of Excellence in the Department of Egyptology and North African Studies in Humboldt University .
Currently, Hanna is the acting Dean of the College of Archaeology and Cultural Heritage, Arab Academy for Science and Technology and Maritime Transport (AASTMT) in Aswan, Egypt where she has founded a program specialized in Archaeology and Cultural heritage with eight departments for the BA level.
Her research focuses on space, knowledge and identity of archaeological sites, with particular interest on different meanings and reflections of heritage on identity of space and communities. She has worked on a project in al-Qurna, Luxor on the different narratives of the multiple worlds of the Theban Necropolis and its meanings to the various stakeholders. Post the year 2011, Hanna has been working with the media and a group of volunteers to bring awareness to the plight of various archaeological sites in Egypt, including and especially Dahshur, Abu Sir el-Maleq and Ancient Heliopolis. She courageously spoke and defended the heritage of Egypt and its protection .
Hanna has been granted numerous awards including the SAFE beacon award for 2014 for her efforts in the salvage of antiquities under conflict and was named by UNESCO the Monuments Woman of 2014. She has also received 'Distinguished AUC Alumna' two times, once in Cairo 2014 and the other in New York 2015. Her current research focuses on decolonizing archaeology, repatriation and

restitution amongst methods for accessibility for the wider public to archaeology and heritage with particular interest in digital humanities.
In 2020, she was awarded a research grant as part of Action for Restitution in Africa in collaboration with University of Oxford.
In 2021, she has started a Master's of Jurisprudence in University of DePaul for Cultural Property International Law.

**2. Dr. Ibrahem Badr; Associate Professor of Conservation, College of Archaeology and Cultural Heritage**

Dr. Ibrahem Badr has worked on conservation and restoration projects in the Egyptian museum and other archaeological sites. He has a great experience in archaeometry, documentation and publications.

**3. Four other researchers to be confirmed.**

- **Damietta University team**

**1. Prof. Hesham Elasmar Prof. of Quaternary Geology (Co-Investigator)**

More than 35 years of experiences in Quaternary and coastal geology. He was INQUA member and published more than 60 papers in highly ranked earth science journals. He got several scholarships including IFAQ-UNESCO and Royal Society of London. He worked as a head of Geology Department at Makrere University, in Ughanda, as a Technical cooperation expertise in African Fund, Ministry of Foreign Affairs, As a cultural attaché in the Egyptian Embassy at Athens , Greece and Director of the Egyptian cultural center in Athens, then Advisor to the Minister of Higher Education, and finally advisor to the Vice Rector for Technology transfer as King Saud University.

**2. Dr. Ehab Assal Ass. Prof. in Sedimentology (Project Coordinator)**

He is a sedimentologist with expertise in shallow marine sedimentology. His research interests focuses on the sedimentology and diagenesis of carbonate systems, though more recently on siliciclastics as well. He has graduated with a PhD through Joint Supervision Program (Durham University, United Kingdom/Mansoura University, Egypt) in 2009, after which he worked as a lecturer in sedimentology at Mansoura University based on Damietta (2009-2012) and at Damietta University (2012-present). He earned a six months postdoc. Fellowship at Department of Earth, Ocean and Ecological Sciences, University of Liverpool (2016-2017) working on carbonate concretions from Paleocene and Eocene. He has extensive experience in the integration of stable isotopes, geochemical, CL, XRD, SEM from outcrop and subsurface

data to determine the depositional environments and evaluate paleoenvironmental and paleoclimatic implications. He worked on depositional systems from Egypt, Libya, Saudi Arabia and Oman. He studied the environmental impacts of human activities on the northwestern coastal area in Egypt in collaboration with Prof. Hesham El-Asmar. This study proposed an inventory for a new protected geosite, whilst aiming to promote regional sustainable development including various environmental conservation activities. He has published several papers in international peer-reviewed journals, so he will be involved in data interpretation and writing the scientific articles.

### 3. Dr. Haytham Sehsah Lecturer of Rocks/Tectonics

Haytham is an experienced researcher with an interest in igneous, metamorphic, tectonics, geochemistry, and geochronology. He obtained his PhD through joint mission between (Adelaide, Australia and Damietta, Egypt), and he has a keen interest in paleoclimate and paleogeography. His experience in these disciplines is important for the project at different stages. Specifically, he performed desk studies before, so he will be involved in preparing the base maps for the proposed geosites. Moreover, he will be engaged in the fieldwork to participate in detailed field mapping, and collecting the relevant data and samples. He has an experience in analyzing petrographic, geochemical data using software and programming languages (i.e., Python). He has publications in international peer-reviewed journals, so he will be involved in data interpretation and writing the scientific articles.

### 4. Dr. Ahmed Elbahrawy Lecturer of Structure Geology

Ahmed is a lecturer of structural geology at Damietta University. His researcher interest focuses on structural geology, tectonics, geomorphology, mapping, and field geology. He got his PhD from Damietta University, Egypt in 2019. He has a keen interest in paleostress analysis and virtual 3D geoscience. He has a great experience in field geology and mapping gained through years of work, which will be important for achieving the aims of the project at different stages. He has an experience in remote sensing application and stress and strain data analysis. Moreover, he will be involved in the preparation of the final map of the proposed geosites. Also he will have a role in data interpretation and writing the scientific articles.

**Research Team Information Table**

| Name of Res. Team Member in English | Name of Res. Team Member in Arabic | University / Institute In English | Position / Title | % of time spent on project | No. of months | Incentive per month (LE) | Number of other projects and their IDs | Total % of time spent on other projects | Contact No |
|---|---|---|---|---|---|---|---|---|---|
| Monica Hanna | مونيكا حنا | AASTMT(PI) | Dr. | 20% | 12 | | | | |
| Ibrahem Badr | إبراهيم بدر | | Dr. | 20% | 12 | | | | |
| Researcher (s) | باحثين من الأكاديمية | | TA | 20% | 12 | | | | |
| Hesham M. Elasmar | هشام مصطفي الاسمر | Damietta Uni/ Geology Department | Prof. | 20% | 12 | | | | |
| Ehab M. Assal | ايهاب مصطفي عسل | | Ass. Prof. | 20% | 12 | | | | |
| Haytham Sehsah | هيثم صحصاح | | Lecturer/ Dr | 20% | 12 | | | | |
| Ahmed Elbahrawy | احمد البحراوي | | Lecturer/ Dr | 20% | 12 | | | | |

**Project Management**

This research will be conducted as teamwork of two proposed teams (AASTMT team and Damietta Uni. team) sharing responsibilities, collaborating to achieve the goals at the specific time. Periodic online meetings will be held to follow-up on the progress of the project, discuss the results and write progress report each three months, and solve the problems. Tasks/activities will be conducted as follows:

1. Desk studies (AASTMT / Damietta)
2. Fieldwork (AASTMT / Damietta)
3. Lab. Studies (AASTMT / Damietta)
4. Data analyses and interpretation (AASTMT / Damietta)
5. Writing articles (AASTMT / Damietta)

6. Delivering results to media (AASTMT / Damietta)

**Breakdown of Costs Other Grant(s)**

The cost breakdown provided in the table below. The travel component of this project is really important and so it has be shifted with the equipment.

| Eligible costs | Break downs | AASTMT support (L.E.) |
|---|---|---|
| **(A)Staff Cost** (15%) | Dr. Monica Hanna | 0,000 |
| | Dr. Ibrahem Badr | 20,000 |
| | Damietta and AASTMT Researchers | 130,000 |
| | **Total** | **150,000** |
| **(B) Travel** (35 %) | Travel | 350,000 |
| | **Total Equipment** | **350,000** |
| **(C) Equipment** (2%) | Consumables | 5,000 |
| | Equipment | 15,000 |
| | **Total travel** | **20,000** |
| **(E) Other Direct Costs** (33 %) | Fieldwork (15 %) | 150,000 |
| | Samples preparation and thin sectioning (3 %) | 30,000 |
| | Geochemical analyses (5 %) | 50,000 |
| | Geochronological analyses (5 %) | 50,000 |
| | Isotope analyses (5 %) | 50,000 |
| | **Total other direct costs** | **330,000** |
| **(F) Incentive** (15%) | Monthly incentive (1.25 %) | 12,500 |
| | **Total incentive per year** | **150,000** |
| **(G) Total Costs** | | **1,000,000.00** |

**Plans for Disseminating Research Results / Sustainability of the action**

The collected research data will be published internationally to advance research in AASTMT, and to increase both national and international collaboration with different research authorities. Discovering new geosites will be used to improve the usage of our natural resources, encourage sustainable development, and increase the national income. The research results will be delivered to media outlets, newspapers, and websites. The LPI is expected to provide updates on the progress of following the plan in each progress report each three months. In the case that data cannot be shared from a particular project due to any confidentiality concerns, proper justification will be provided.

**Key Publications and references**

1 Harrell, J. A. & Brown, V. M. The World's oldest surviving geological map: the 1150 BC Turin Papyrus from Egypt. *The Journal of Geology* **100**, 3-18 (1992).

2 Makovicky, E., Frei, R., Karup-Møller, S. & Bailey, J. C. Imperial porphyry from Gebel Abu Dokhan, the Red Sea Mountains, Egypt.: Part I. Mineralogy, petrology and occurence. *Neues Jahrbuch für Mineralogie-Abhandlungen/Journal of Mineralogy and Geochemistry* **193**, 1-27 (2016).

3 El Khrepy, S. *et al.* Transition from continental rifting to oceanic spreading in the northern Red Sea area. *Scientific Reports* **11**, 1-7 (2021).

4 Bonatti, E., Hamlyn, P. & Ottonello, G. Upper mantle beneath a young oceanic rift: peridotites from the island of Zabargad (Red Sea). *Geology* **9**, 474-479 (1981).

5. Reynard, Emmanuel, and José Brilha, eds. *Geoheritage: assessment, protection, and management*. Elsevier, 2017.

6. Brocx, Margaret, and Vic Semeniuk. "Geoheritage and geoconservation-history, definition, scope and scale." *Journal of the Royal Society of Western Australia* 90, no. 2 (2007): 53-87.

**Declaration of original submission and Other Grant(s) (Max. one page)**

LPIs declare that their proposal did not and will not be submitted in whole or part for funding; twice within the same cycle, or to other funding programs within AASTMT, or other funding agencies.

**Acknowledgment Form:** ***Please copy this section, sign and scan it as a part of your proposal***

By signing below, I acknowledge that I have read, understand and accept to comply with all the terms of the foregoing application, mentioned in AASTMT general conditions and guidelines for submitting a research proposal, including, but not limited to:

- The total number of the application pages should not exceed **30 pages** excluding a cover page, as well as all sections of the proposal (as mentioned in AASTMT General Conditions and Guidelines for Submitting Research Proposal).
- At any time, a contracted AASTMT project team member should only be participating in a maximum of one project.
- Allowable budget maximum limit should be strictly adhered to in the project proposal. In all cases, requested budget has to be justified in detail.
- AASTMT guidelines, IPR rules, code of ethics, etc. (www.aast.edu), should be read carefully and adhered to. These are integral parts of the contract.
- All proposals – in addition to PI and other data - must be uploaded to the AASTMT website by the designated deadline. Uploaded PI data should conform to the corresponding data in the application form.

**Applications will not be considered eligible and will be discarded in the following cases**:

- Proposals submitted by e-mail or sent as hard copies or uploaded to the AASTMT website after the deadline.
- Proposals not conforming to the designated format.
- Proposals whose uploaded PI data does not conform to PI data in the proposal file.
- Proposals in which the allowable budget maximum limit has been exceeded.
- Proposals in which maximum allowable contracted AASTMT project participation limit has been exceeded.
- Proposal letter does not include a scanned copy of the signed and stamped PI institution endorsement letter in case of team member work outside AASTMT.
- Proposal does not include a scanned copy of the signed acknowledgment form.

Date & Signature: Monica Hanna March 15th, 2021

**DETAILED PLAN ON PROJECT'S ACTIVITIES (*GANTT CHART*):**

| Activity Name | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10 | M11 | M12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Main 1: Main Task 1 | Fieldwork | | | | | | | | | | | |
| Sub 1.1: Sub Task 1.1 | Analysing remote-sensing data | | | | | | | | | | | |
| Sub 1.2: Sub Task 1.1 | Fieldwork | | | | | | | | | | | |
| Sub 1.3: Sub Task 1.1 | Preparing rock samples | | | | | | | | | | | |
| Main 2: Main Task 2 | | | | Laboratory analyses | | | | | | | | |
| Sub 2.1: Sub Task 2.1 | | | | Thin sections | | | | | | | | |
| Sub 2.2: Sub Task 2.2 | | | | Mapping and | | | | | | | | |
| Sub 2.3: Sub Task 2.3 | | | | Geochemical analyses | | | | | | | | |
| Main 3: Main Task 3 | | | | | | | Data interpretation | | | | | |
| Sub 3.1: Sub Task 3.1 | | | | | | | Maps and fieldwork | | | | | |
| Sub 3.2: Sub Task 3.2 | | | | | | | Petrography/ Geochemical data | | | | | |
| Sub 3.3: Sub Task 3.3 | | | | | | | Submitting Articles | | | | | |
| Main 4: Main Task 4 | | | | | | | | | | Results | | |
| Sub 4.1: Sub Task 4.1 | | | | | | | | | | Articles | | |
| Sub 4.2: Sub Task 4.2 | | | | | | | | | | Media | | |
| Sub 4.3: Sub Task 4.3 | | | | | | | | | | Social Engagement | | |