CURRENT ASSESSMENT OF THE GEOTHERMAL POTENTIAL IN MOZAMBIQUE

LUÍS MAGAIA, FRANCISCO VIEIRA & BOAVENTURA CUAMBA

WP 9.1 GEOSCIENCE

EDUARDO MONDLANE UNIVERSITY

MAPUTO - MOZAMBIQUE

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LEAP-RE

Long-Term Joint EU-AU Research
and Innovation Partnership on Renewable Energy

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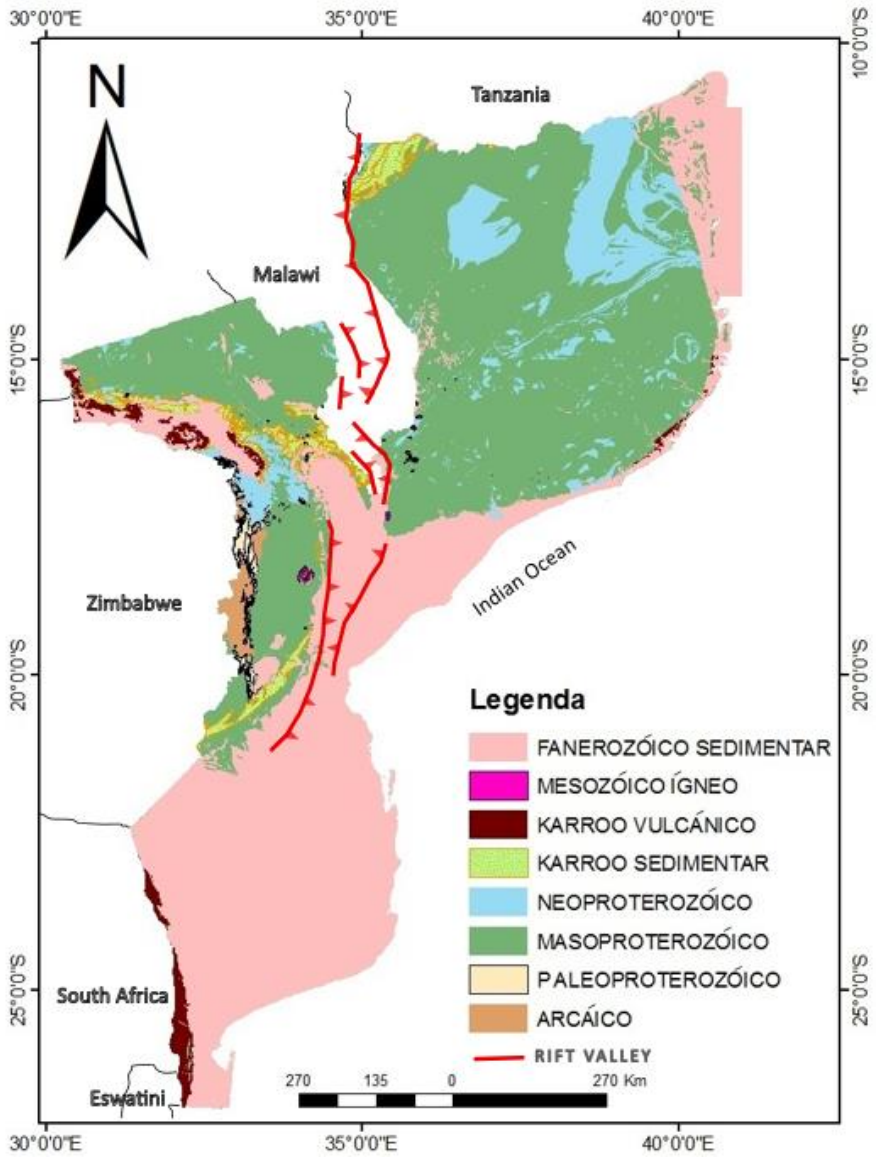
Introduction

Two main tectonic events have affected significantly the geology of Mozambique, namely the Karoo and the East African Rift System (EARS).

The surface geology in Mozambique is divided into two assemblages: the crystalline and metamorphic terrains.

These assemblages are mostly of Precambrian age, which cover the northern and western part of the country, while the Late Mesozoic and Cenozoic sediments cover the eastern and southern part of the country, forming a wedge thickening to the east and south plunging into the Mozambique Channel filling up the Mozambique Basin.

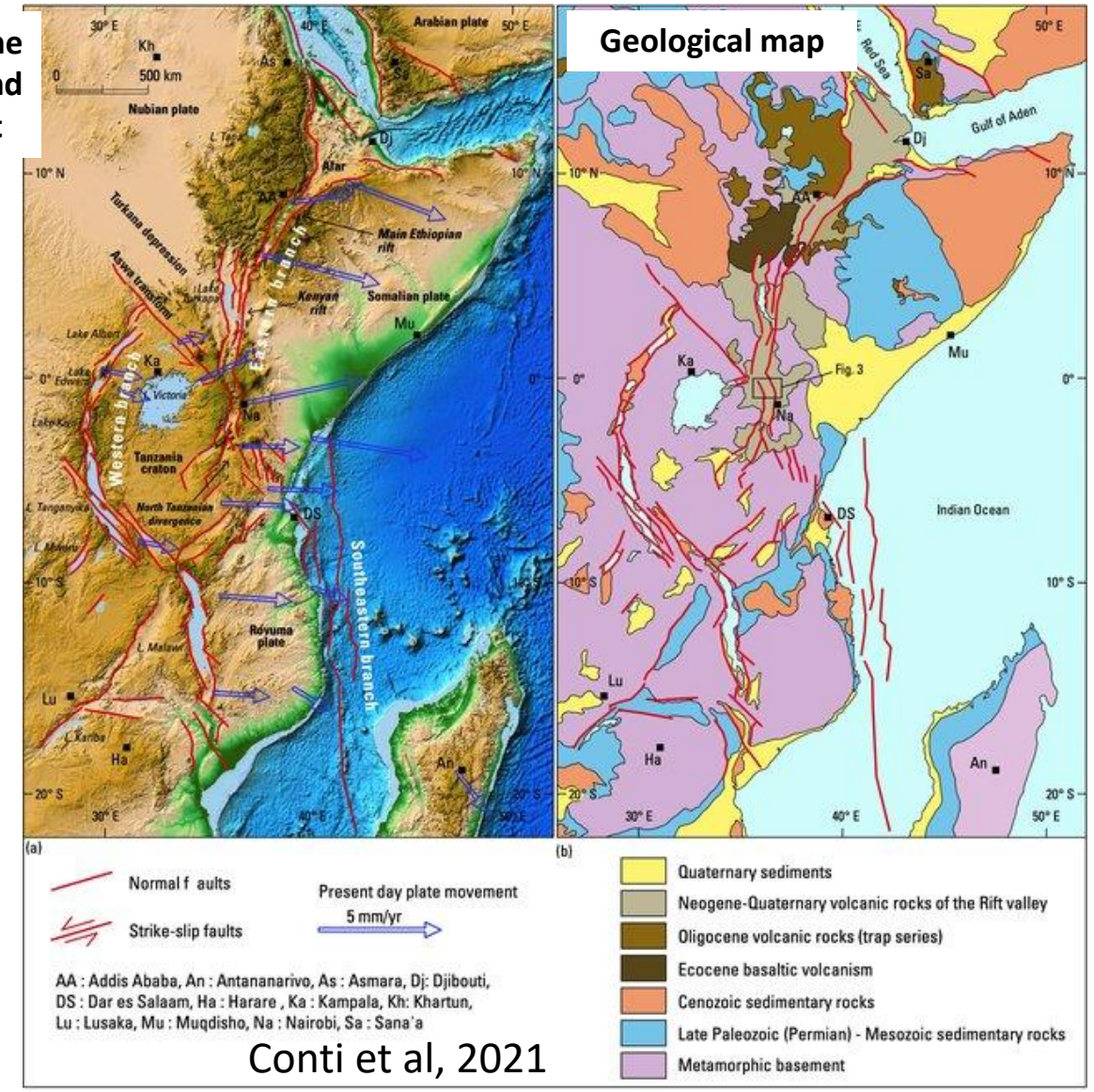


Introduction

Main tectonic features of the East African Rift System and Present day plate movement

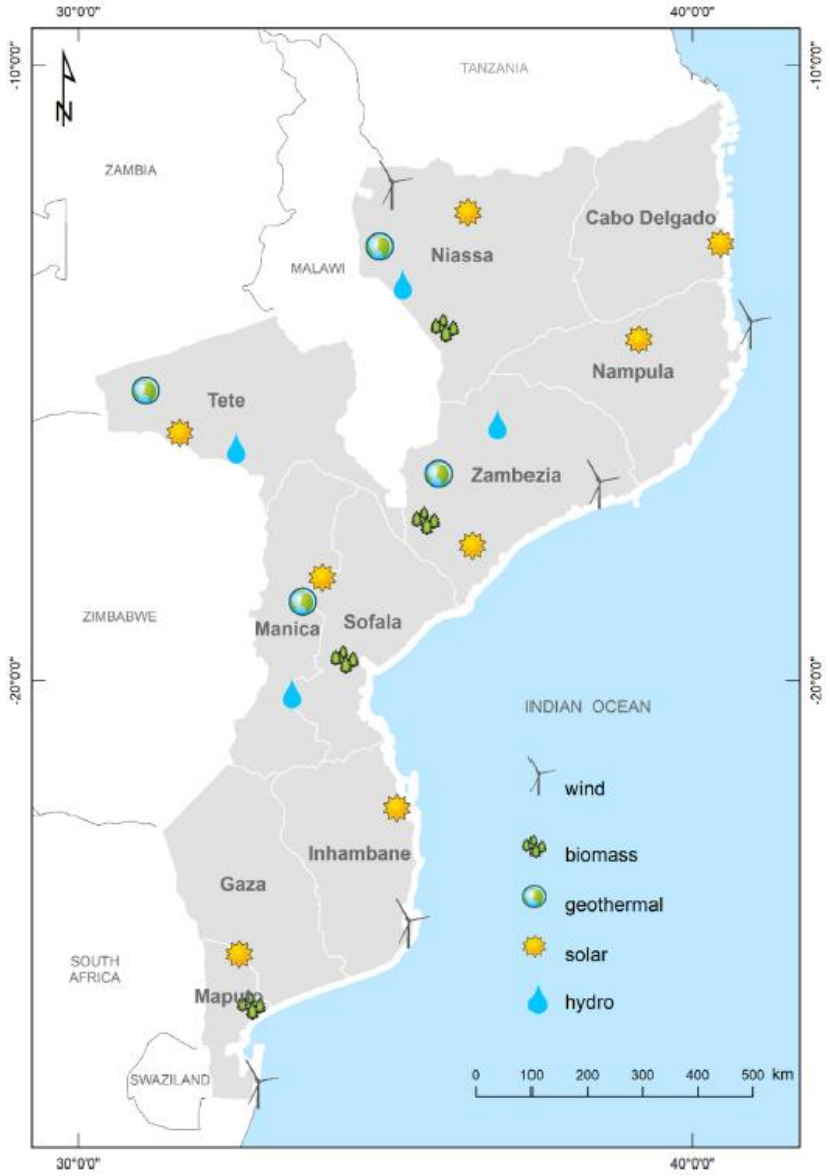
The East African Rift System in Mozambique cuts through the crystalline terrain, and either it terminates against the Cenozoic sedimentary cover or it is buried beneath it (Martinelli et al., 1995).

The rift valley is primarily responsible for a significant seismic activity in the territory.



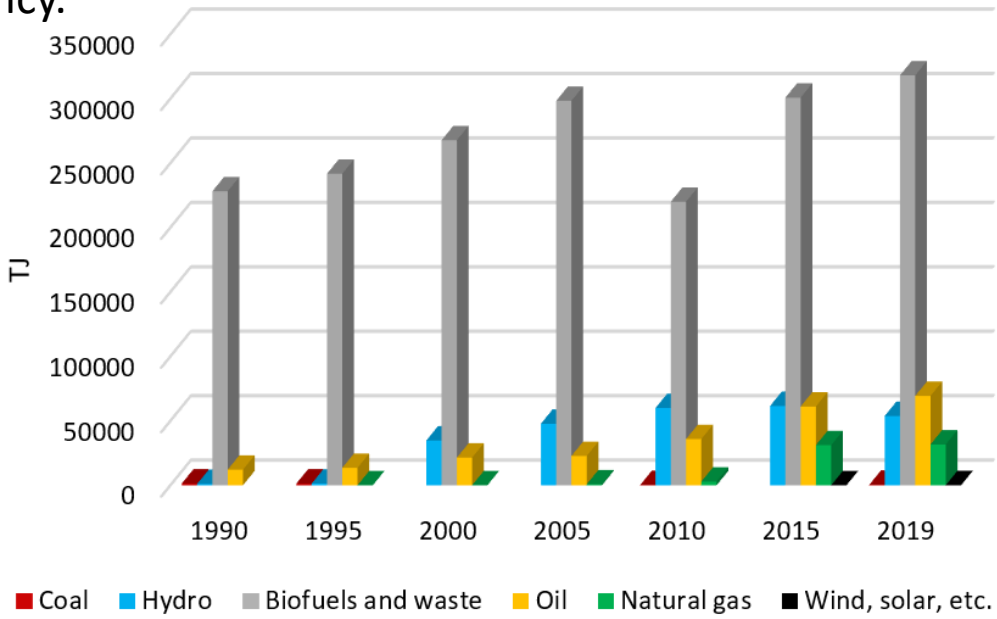
Conti et al, 2021

Introduction



Distribution of potential renewable resources in Moz

The development of geothermal energy in Mozambique could represent an important advantage for the country in addressing the sustainable development goal number 7 – "affordable and clean energy". However, currently its contribution in the country as a source of energy is nil and consequently not accounted for in the energy matrix by the International Energy Agency.

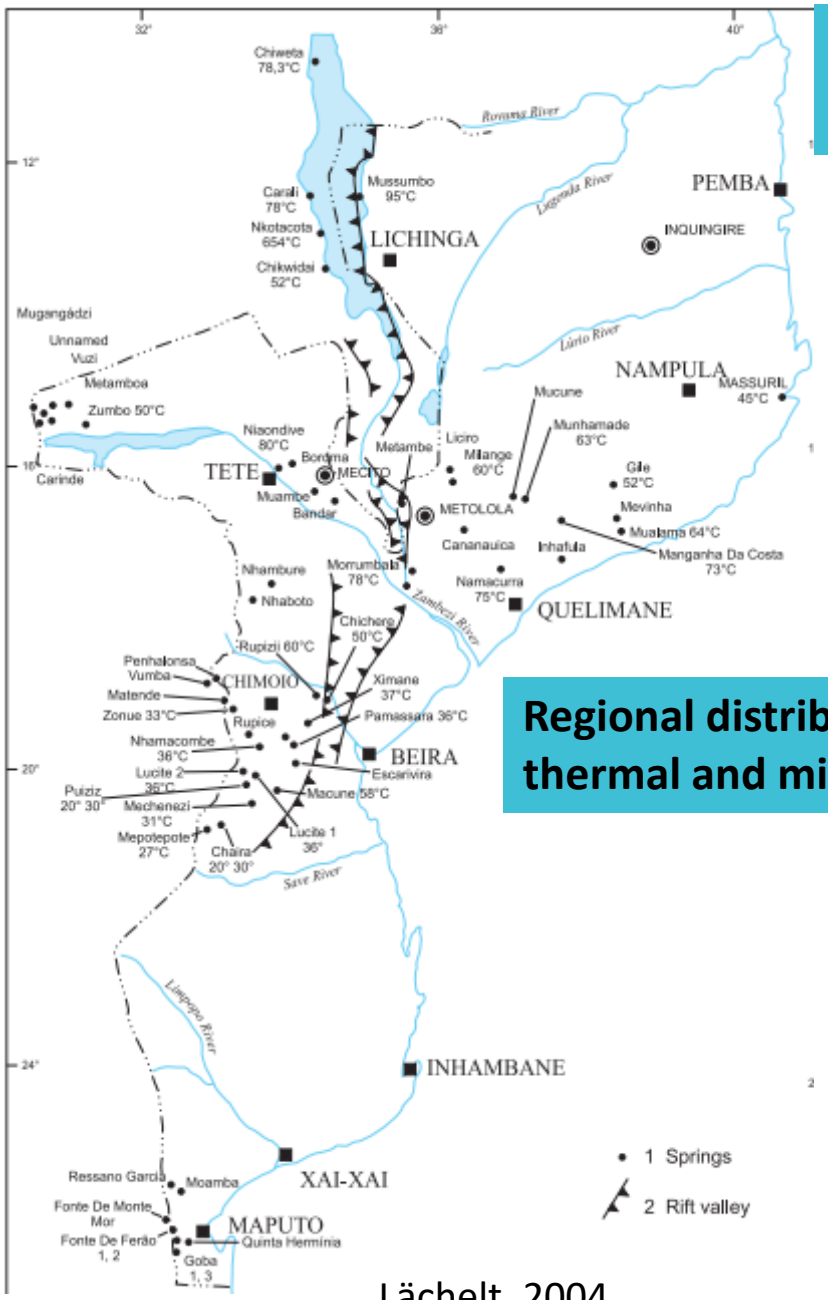


Total energy supply (TES) by source, Mozambique 1990-2019
(Source: International Energy Agency)

Previous studies

- Thermal springs with temperatures > 50 °C occur predominantly on active rift borders.

- Springs situated on rifting reactivated structures of the basement are characterized by water temperatures between 20 – 50 °C.



Regional distribution of thermal and mineral springs

Lächelt, 2004.

Previous studies

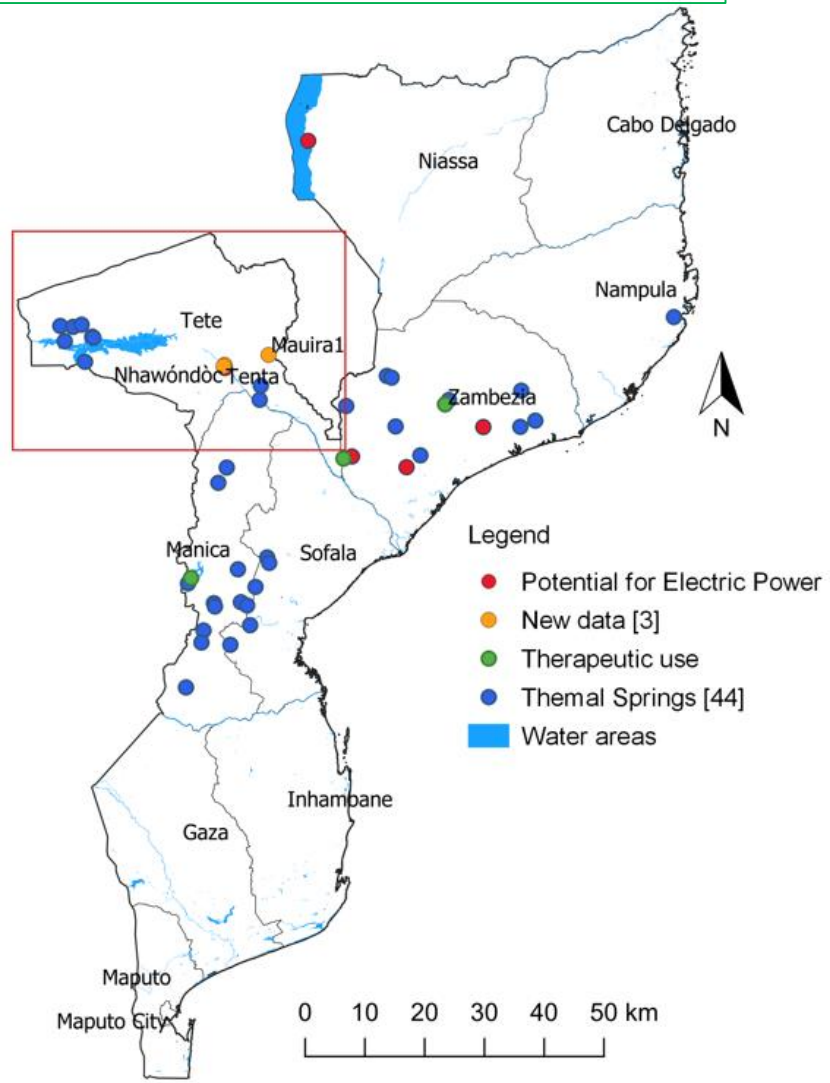
New data findings by Procesi et al, 2022, in the crystalline basement of Tete province, indicate low salinity fluids and an absence of corrosive components.

Accordingly, the geothermal system may be conveniently exploited for direct and indirect uses: **agriculture**, **pasteurization**, **beet sugar extraction**, **distilled liquor**, and/or **power generation by binary cycle or conventional flash plants.**

New data points by Procesi et al. 2022

Site	Long	Lat	Elevation	T (°C)	TDS	pH
Nhawondoc	33.46192	-16.00174	158	66	1512	7.9
Tenta	33.44448	-16.02411	121	51	1460	8.0
Mauira1	34.15315	-15.84933	339	42	951	7.8

Distribution of known thermal springs



Current studies under LEAP-RE Project

Mawira 1 Thermal Spring - Lat 15°50‘51,42''S Long 34°08‘50,01''E

Moatize District - Tete Province

The site lies in the Matinde Formation which comprises a thick succession of alternating, fine-grained to gritty and very coarse-grained sandstones.

Findings:

- Dark polluted water
- Temperature < 50 °C
- Hand washing clothes
- Bathing

Current studies under LEAP-RE Project

Mawira 2 Thermal Spring - Lat 15º50‘57,46''S Long 34º09‘11,25''E

Moatize District - Tete Province

Located about 650 m from Mawira 1 Thermal Spring.

Same geology as Mawira 1 site.

Findings:

- mud and shallow marsh
- Temperature < 50 °C
- Cattle watering

Current studies under LEAP-RE Project

Tenta Thermal Spring - Lat 16º01'26,23''S Long 33º26'40,23''E

Marara District - Tete Province

Geology - Tete Suite

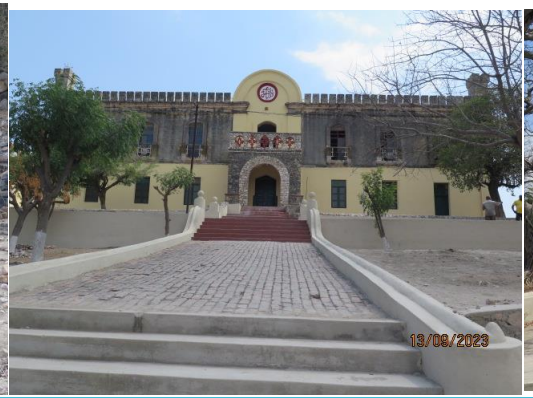
Composed predominantly of gabbro, leucogabbro and norite, with subordinate anorthosite and minor but widespread ultramafic rock types.

Physicochemical parameters measured in situ

#	Parameter	Unit	C I (95 %)	
			Nhaondue (14/09)	**Tenta (13/09)**
1	**pH**		9,04 ± 0,00	**8,91 ± 0,00**
2	**Oxidation Reduction Potential**	mV	-90,53 ± 0,38	**-90,33 ± 0,29**
3	**Dissolved Oxygen (saturation)**	%	36,00 ± 0,25	**64,97 ± 0,38**
4	**Dissolved Oxygen (concentration)**	ppm	2,98 ± 0,02	**5,34 ± 0,02**
5	**Electrical Conductivity**	µS/cm	4845,33 ± 1,43	**4786,33 ± 1,43**
6	**Electrical Conductivity**	µS/cm^{A}	4770,00 ± 0,00	**4751,00 ± 2,48**
7	**Resistivity**	MΩ.cm	0,0002 ± 0,00	**0,0002 ± 0,00**
8	**TDS**	ppm	2423,00 ± 0,00	**2393,00 ± 0,00**
9	**Salinity**	PSU	2,59 ± 0,00	**2,56 ± 0,00**
10	**Temperature**	ºC	> 55	**55**

Current studies under LEAP-RE Project

Findings: The Tenta thermal spring has a potential for ecotourism due to its proximity to Zambezi river and "Missão de Boroma" – an historical church funded in 1885 by Jesuit missionaries - and easily accessible from Tete City (about 25 Km).



Current studies under LEAP-RE Project

Nhaondue Thermal Spring - Lat 16º00'06,30''S Long 33º27'43,10''E

Moatize District - Tete Province

Located about 3 km from Tenta Thermal Spring

Geology - Tete Suite

Physicochemical parameters measured in situ

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			Nhaondue (14/09)	Tenta (13/09)
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10	**Temperature**	ºC	**> 55**	55

Current studies under LEAP-RE Project

Nhaondue Thermal Spring - Lat 16°00'06,30''S , Long 33°27'43,10''E

Findings:

- Temp. > 55°C
- Artisanal gold mining 100 m along the stream
- Degradation of the landscape in the area
- Silting of the stream
- Possible water pollution

Concluding Remarks

- The current studies in Mozambique indicates potential for geothermal energy in areas located in the proximity with the EARS.
- However, further detailed geochemical, geophysical and socio-economic studies are required in those areas for better characterization and assessment of the geothermal potential.
- Accordingly, the expected results could lead to the conclusion that some springs may be used for power generation while others could be used for leisure and/or therapeutic treatment.
- In addition, it is urgent that measures be undertaken to protect the sites of occurrence of thermal springs against artisanal mining activities which for very little gain are causing site and landscape destruction as well as causing pollution in the area.

Thank you!

Email: **luis.a.magaia@uem.ac.mz**

WhatsApp: **+258 84 637 8328**