



The influence of the Western Desert geomorphology on the deployment of Axis forces during the second battle of El Alamein (Egypt, August 31st –September 5th, 1942)

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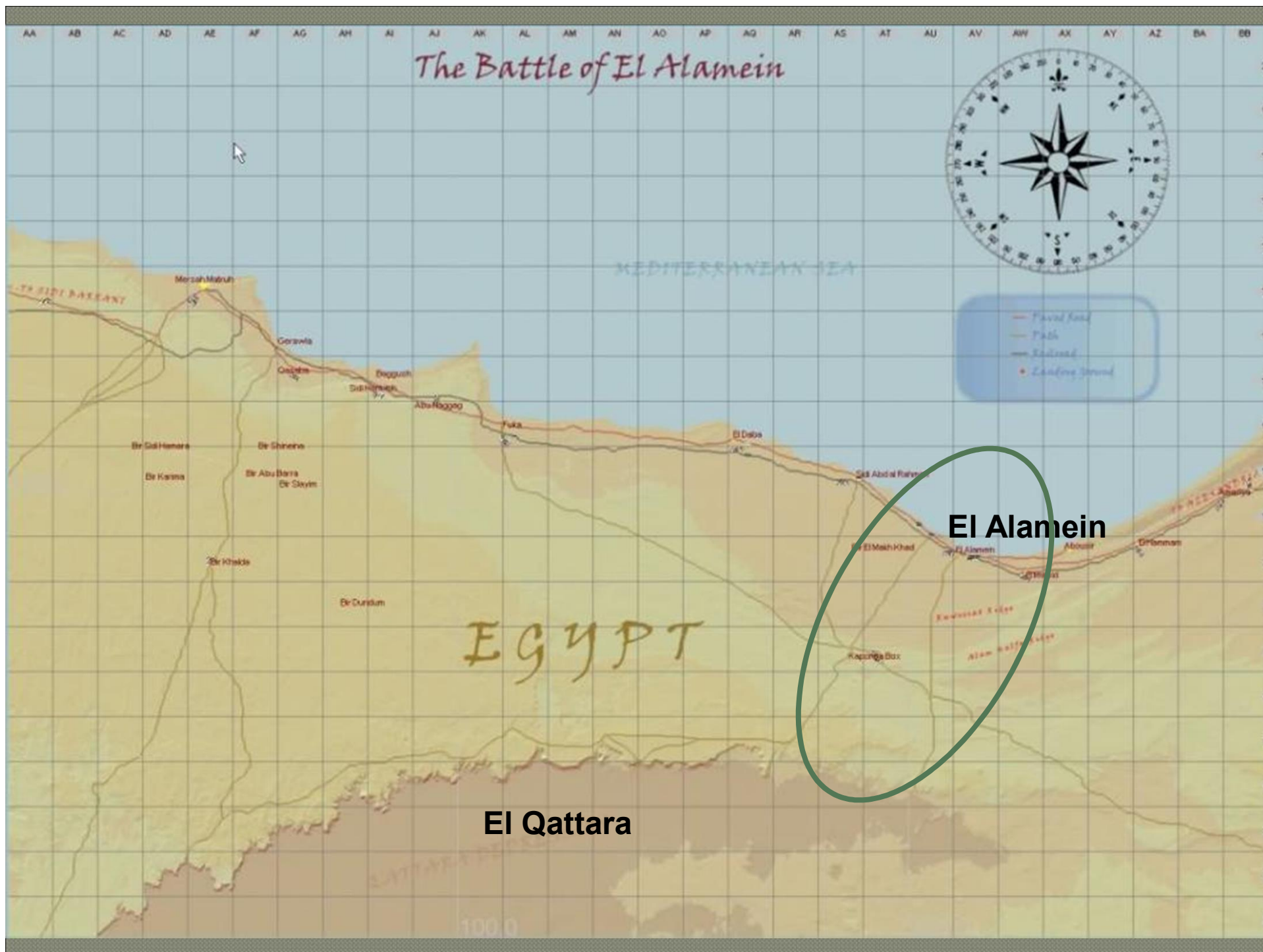
National Institute of
Oceanography and of Applied
Geophysics

Italian Society of
Military Geography
and Geology

The
El Alamein
Project

Società italiana di
Geologia
Ambientale

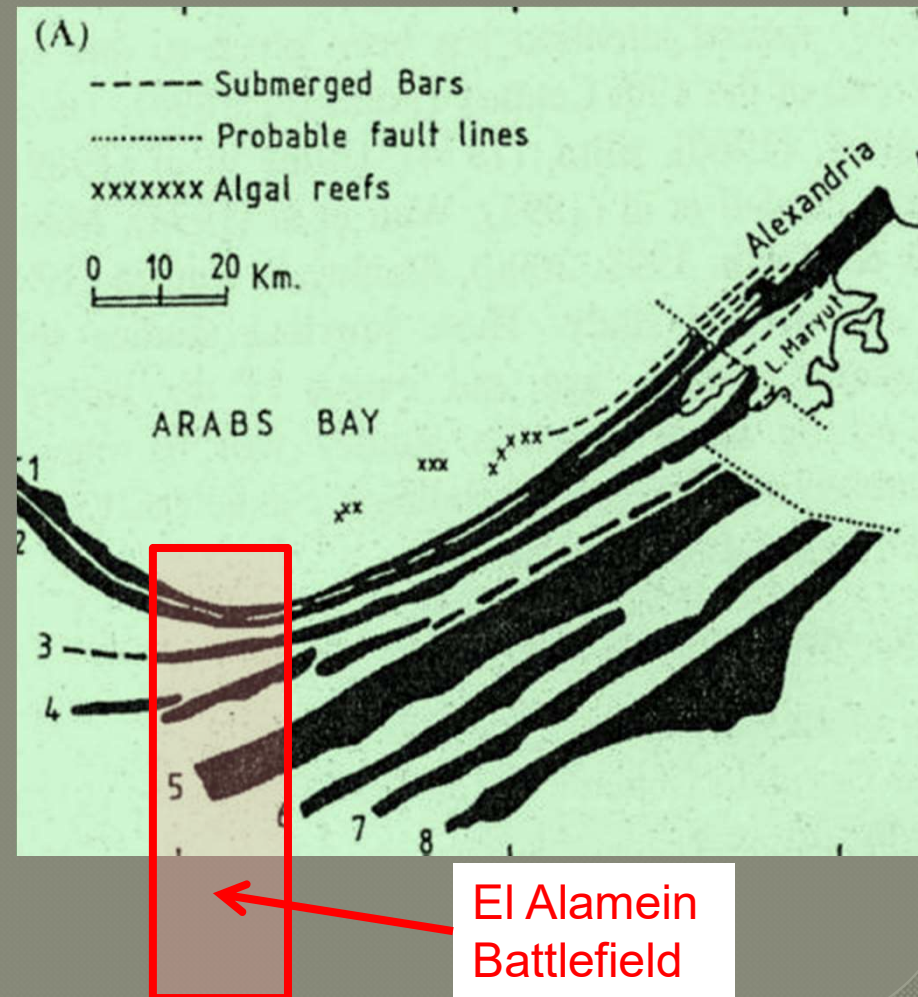
The Battle of El Alamein



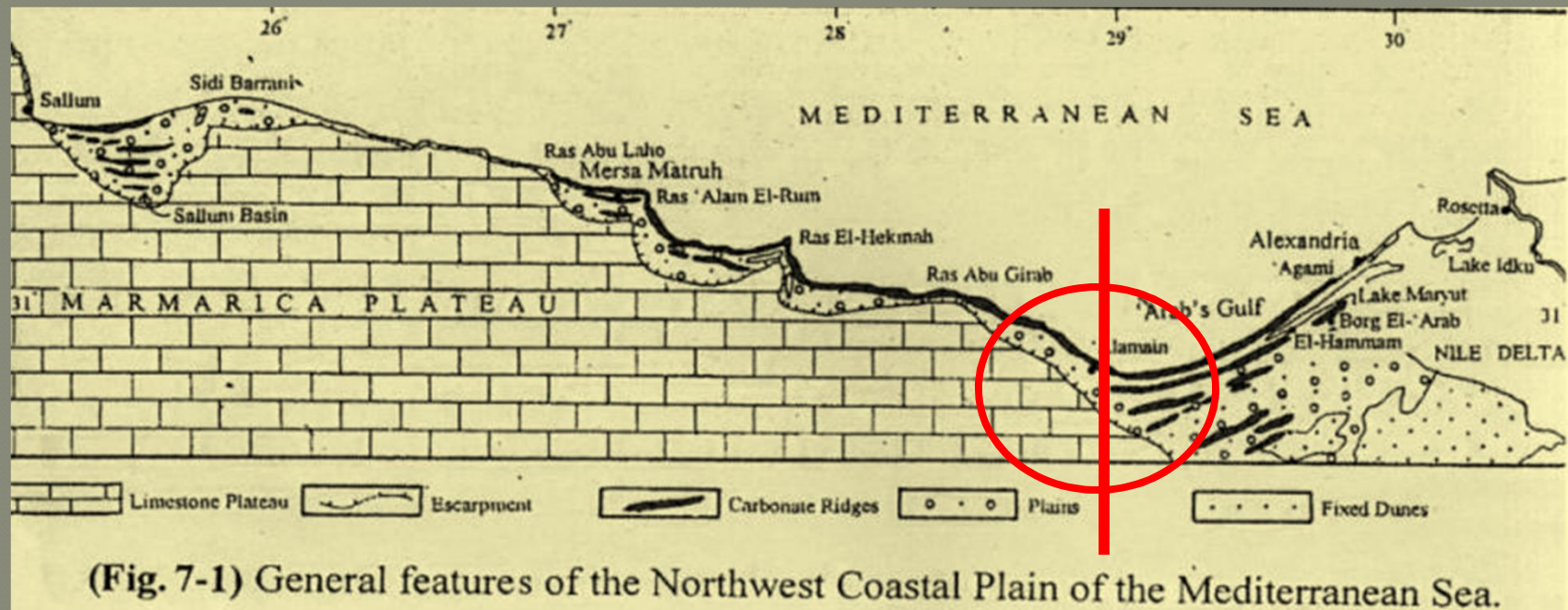
GEOLOGICAL SETTING

ALEXANDRIA AND THE WESTERN COAST

- Sebkhas are present along the coast
- Eight coastal ridges run in a south-westerly direction from South of Alexandria to South of El Alamein (elevation 10 to 100 m)
- Pleistocene off-shore bars + cemented dunes (superimposed)

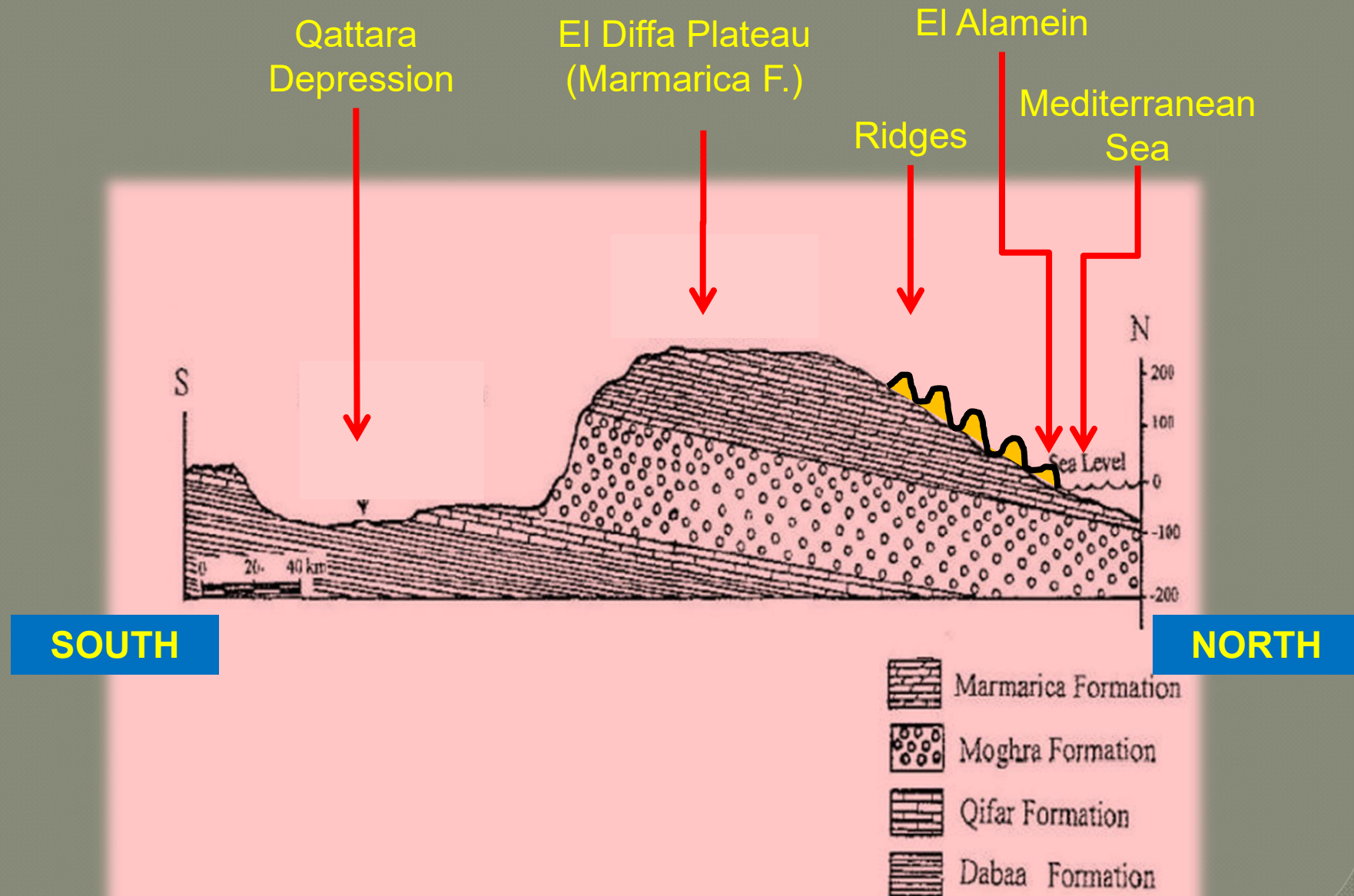


MARMARICA PLATEAU (EL-DIFFA)



- The Marmarica Plateau extends from the Libyan border to the Arabs' Gulf
- The Marmarica Formation is made by Miocene fossiliferous limestones, dolomites and shales
- 250 m high

GEOLOGY OF THE EL ALAMEIN BATTLEFIELD



THE SOUTHERN FLANK

- **Mesa Range (El Taqa Plateau) :**
7 terraces eroded by runoff waters

WADI-FAN system



500 m

➤ **Rainfall = 184 mm/yr at Alexandria**

EL QATTARA DEPRESSION

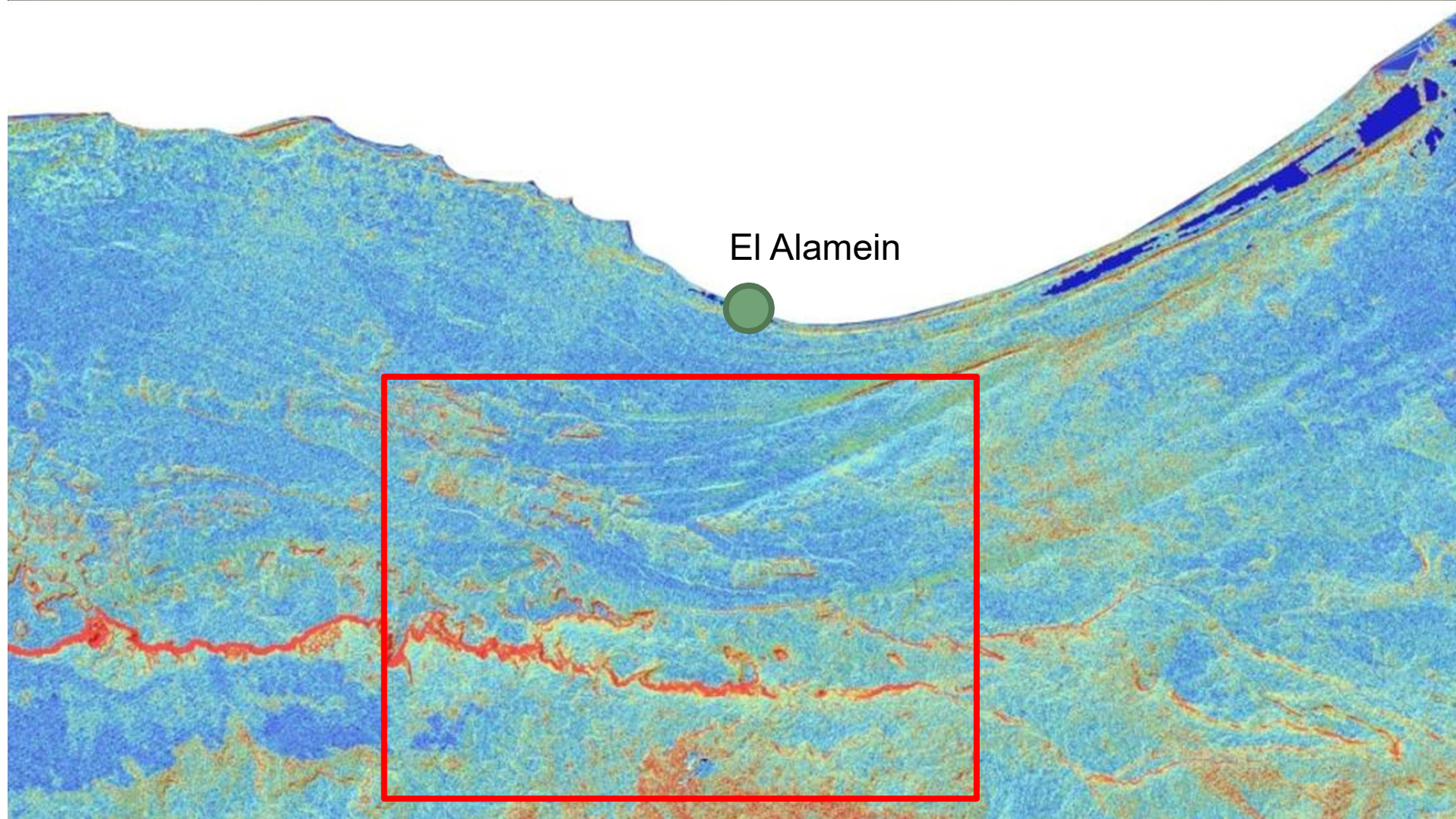


- It is the largest and deepest depression in Africa (-165 b.s.l.)
- 60 km far from the Mediterranean
- The northern rim is a high escarpment formed by questas fronts, while the southern margin gently slope to the Great Sand Sea

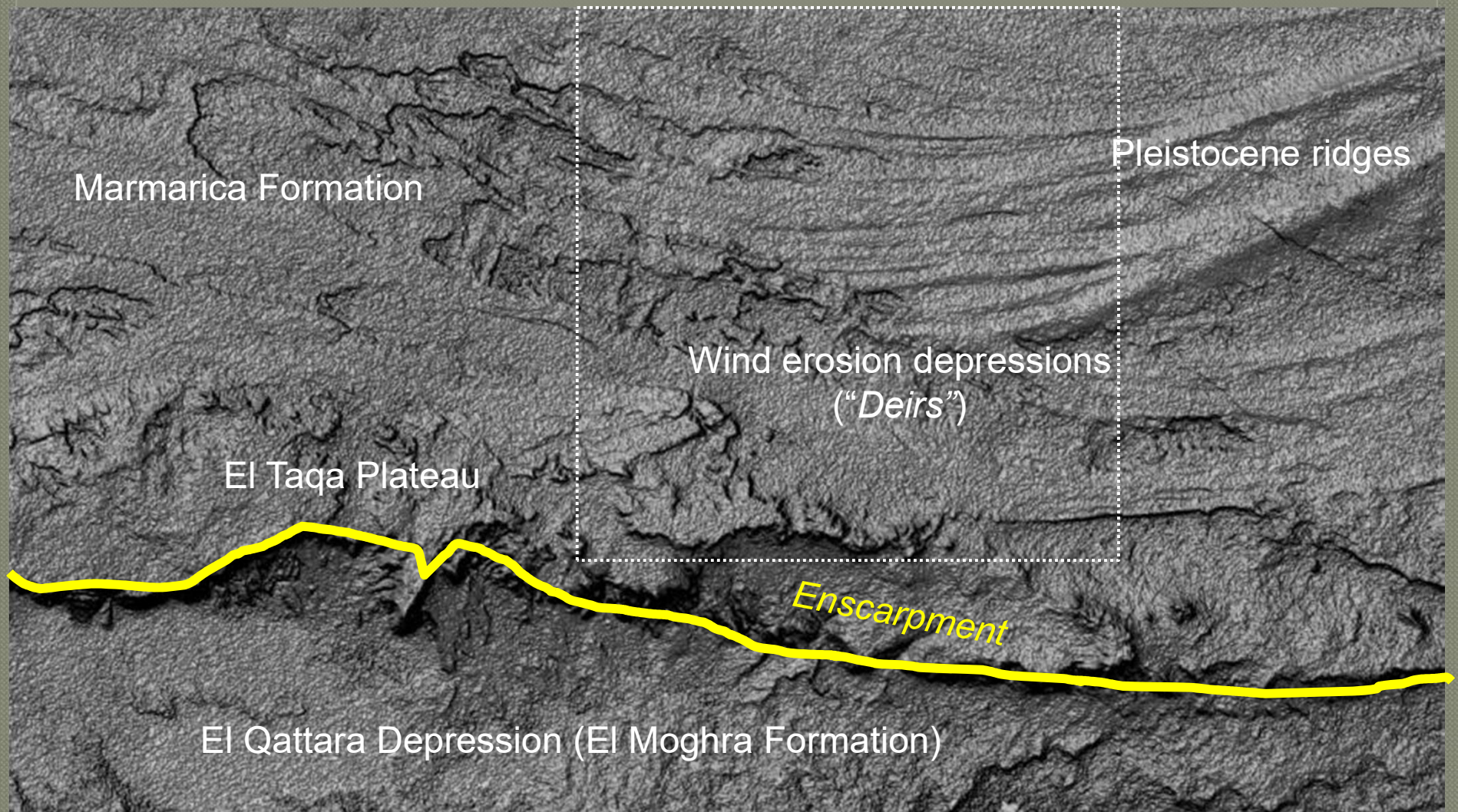
A wide-angle photograph of a desert floor, likely a sebkha, showing a vast, flat expanse of light-colored sand. Scattered across the surface are numerous dark, angular rocks and small, raised mounds of sand. The lighting is bright, casting soft shadows. The text "Wide sebkhas occupie the depression floor of El Qattara Depression" is overlaid in white in the lower right quadrant.

Wide sebkhas occupie
the depression floor of
El Qattara Depression

SRTM Slope Map (90 m pixel)



Aster DTM (15 m pixel) El Alamein Battlefield
(Southern part)

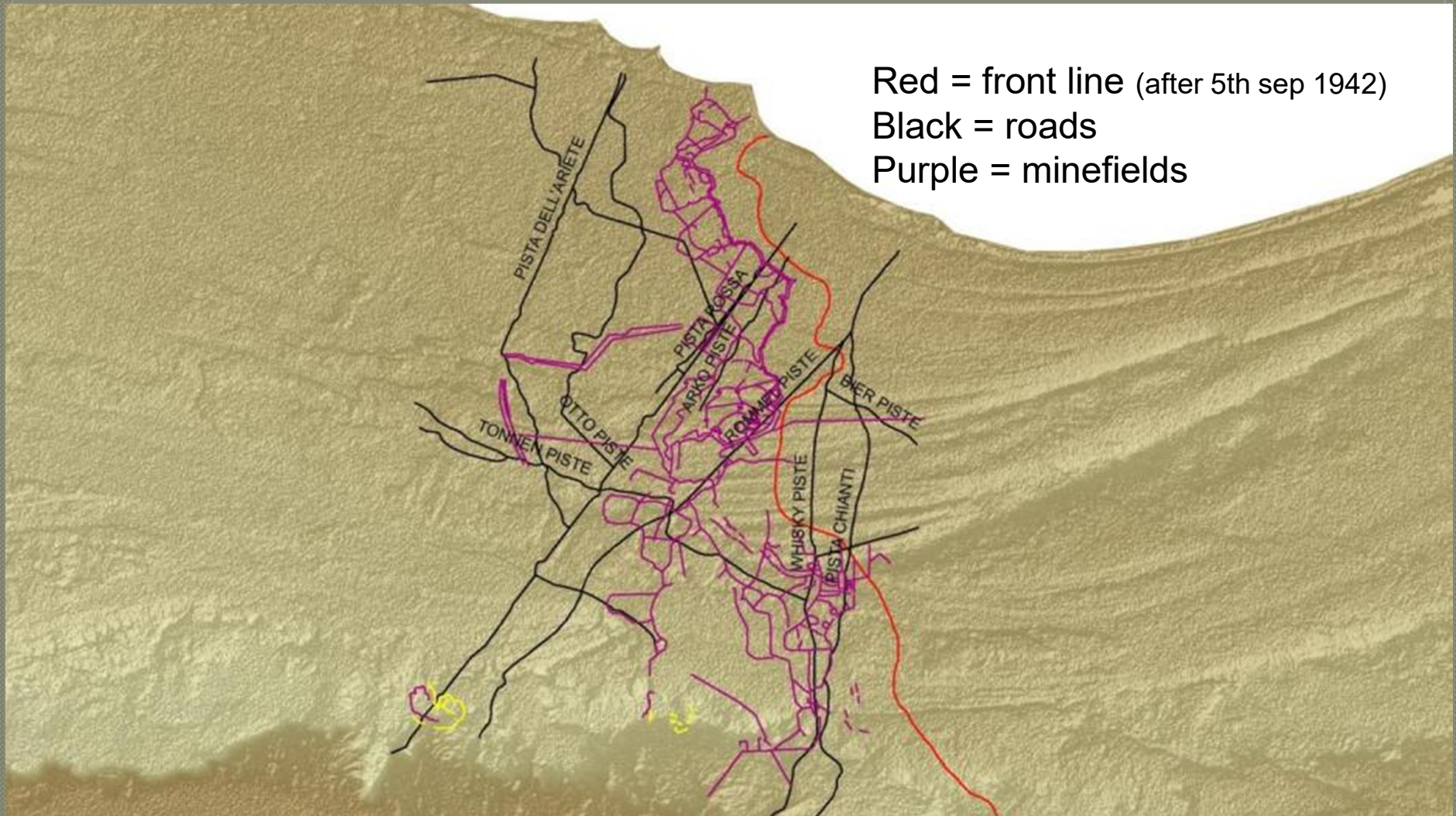


Roads and minefields

Red = front line (after 5th sep 1942)

Black = roads

Purple = minefields

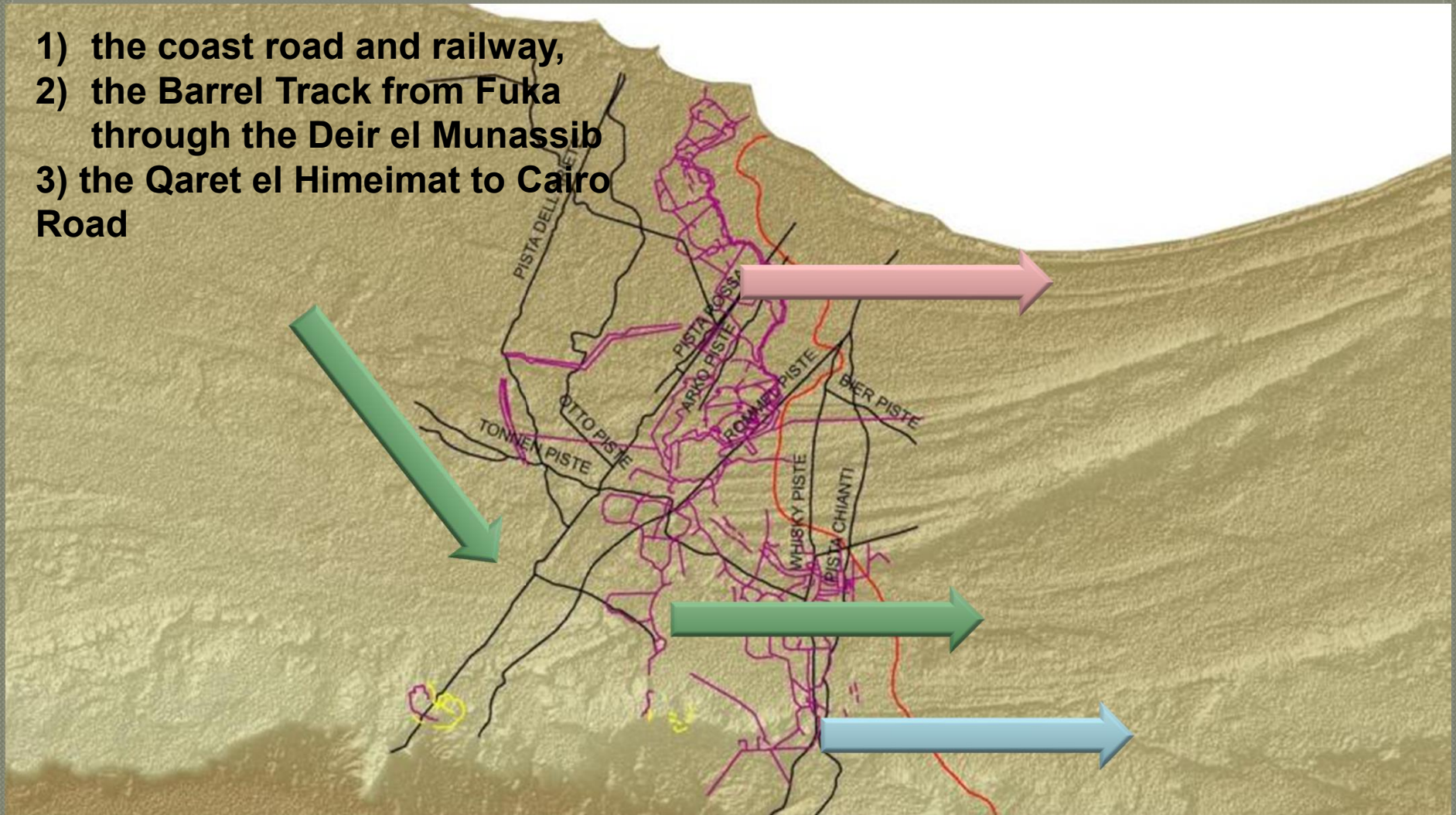


25 km

SRTM DTM (90 m pixel)

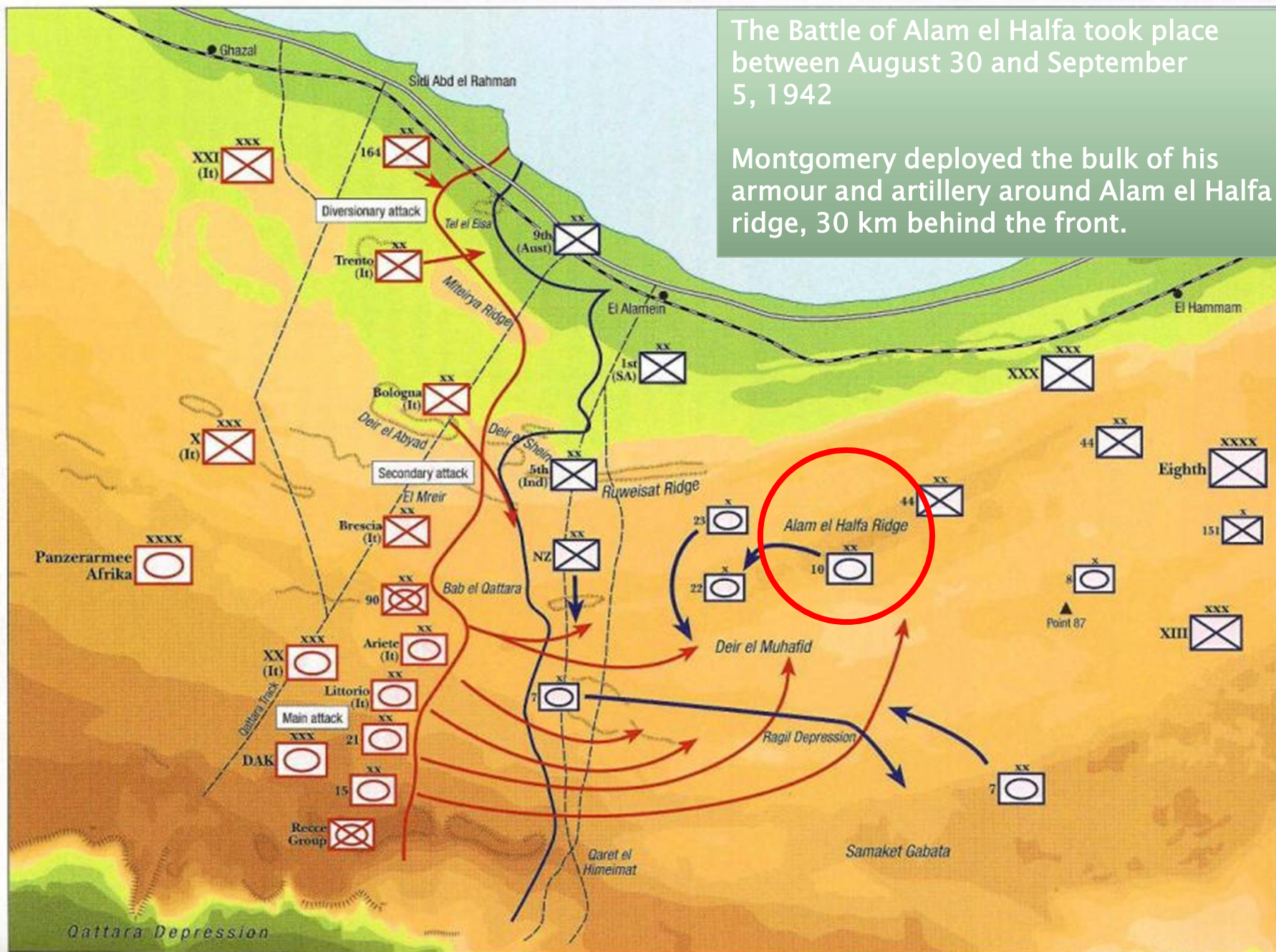
3 avenues of approach

- 1) the coast road and railway,
- 2) the Barrel Track from Fuka through the Deir el Munassib
- 3) the Qaret el Himeimat to Cairo Road



The Battle of Alam el Halfa took place between August 30 and September 5, 1942

Montgomery deployed the bulk of his armour and artillery around Alam el Halfa ridge, 30 km behind the front.

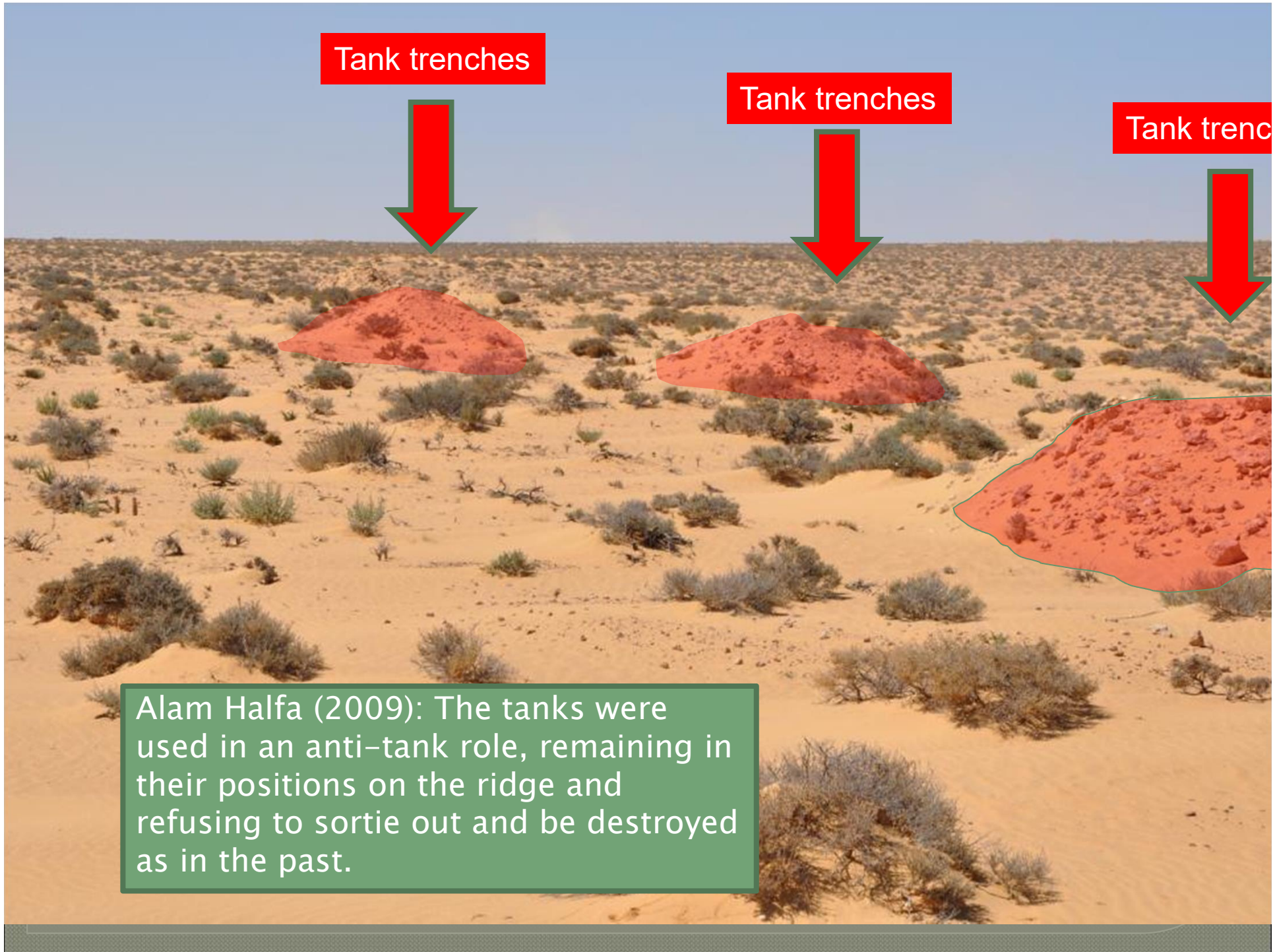


Tank trenches

Tank trenches

Tank trench

Alam Halfa (2009): The tanks were used in an anti-tank role, remaining in their positions on the ridge and refusing to sortie out and be destroyed as in the past.



With his supply situation precarious, and attacks on the ridge failing, Rommel ordered a withdrawal. Montgomery did not exploit his defensive victory, deciding instead to consolidate his forces.

The withdrawal



The reasons for a defeat

1. **Lack of fuel** due to sinking of Italian convoys from Malta and by RAF was the main factor
2. British **air superiority** played a decisive factor in winning the battle
3. **Minefields** were larger and deeper than it was supposed and the surprise was missed
4. Axis forces were pounded day and night by well deployed British **Artillery**



Desert surface

Reg (Serir)



Stony Hamada



Soft sand and small, rare dunes





RESERVATA 1001 100

SHEET 42 EGYPT — SCALE 1:100,000

EL HAMMAM

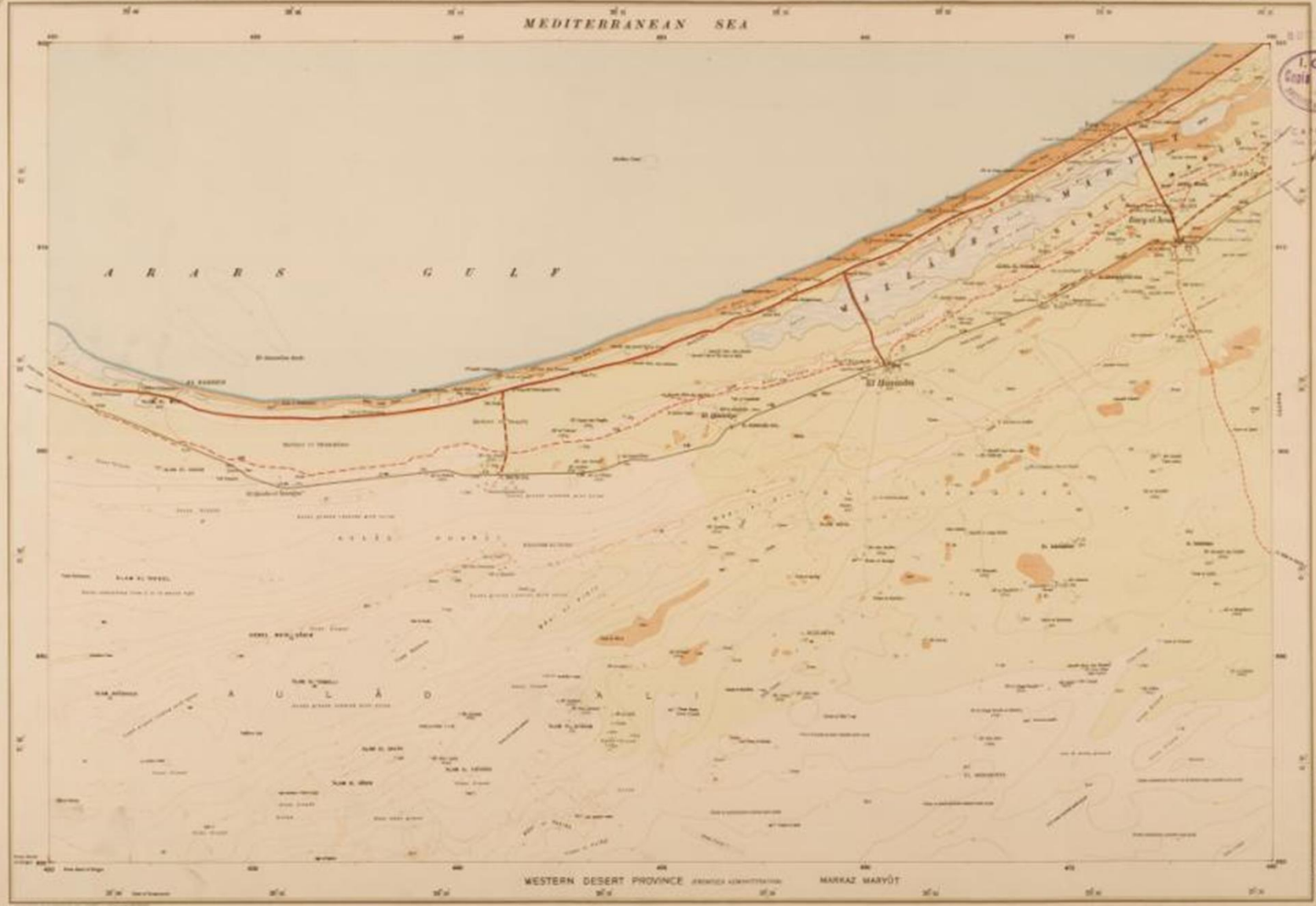
الحمام

مصر — مقياس 1:100,000

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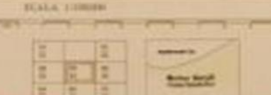
MEDITERRANEAN SEA

A R A B I A N G U L F



LEGENDA

1. Terrains	2. Routes	3. Lignes de contour	4. Lignes de niveau
5. Lignes de crête	6. Lignes de vallée	7. Lignes de pente	8. Lignes de direction
9. Lignes de drainage	10. Lignes de circulation	11. Lignes de communication	12. Lignes de transport
13. Lignes de service	14. Lignes de secours	15. Lignes de défense	16. Lignes de protection
17. Lignes de surveillance	18. Lignes de contrôle	19. Lignes de gestion	20. Lignes de planification



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Trafficability of desert surface



Italian patrols were sent to the Qattara Depression to check the possibility to maneuver for armored vehicles, but no mission was performed across the British lines.

LRDG infiltrated into Axis lines to draw “geological sketches”

No geological surveys are known nor from Italian neither from German geological military survey.

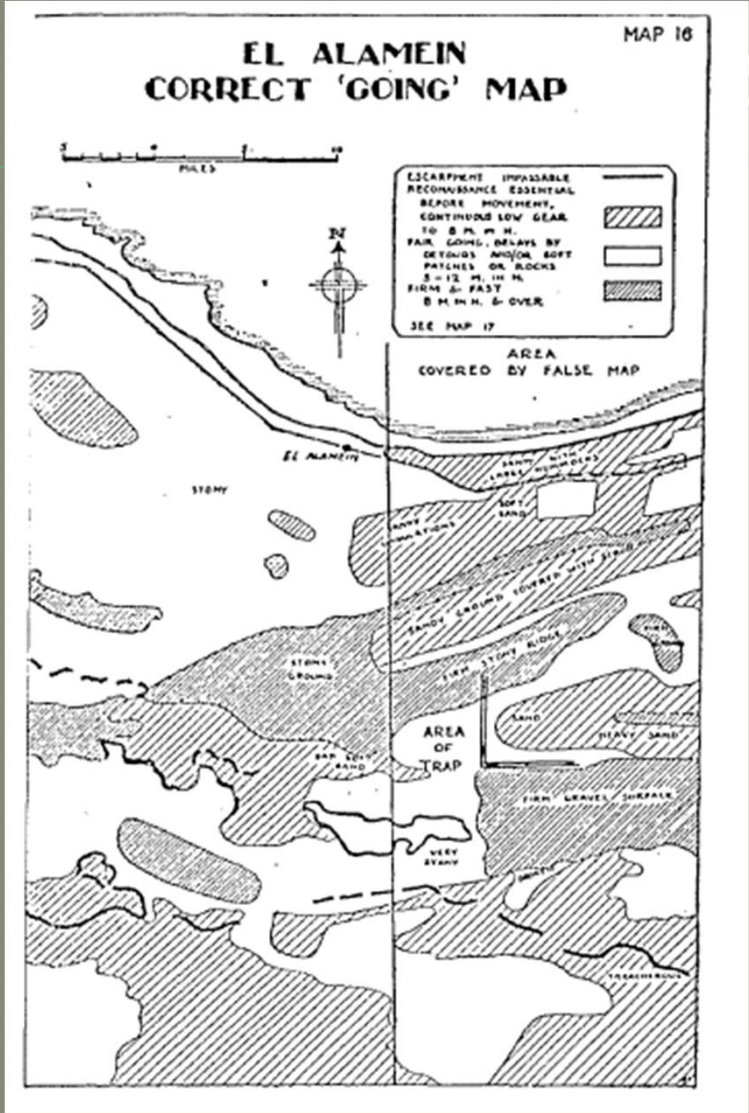


Nevertheless...new highlights

1. Rommel was unaware of British ULTRA intelligence, while Montgomery knew all the order of battle, the complete plan and the problems of lack of supply affecting Axis Forces
2. Rommel resigned and decided to leave Africa on 22nd (4 days before the battle foreseen on 26th), than in following days his changed his mind. His morale was not so high as it was in the previous battles.

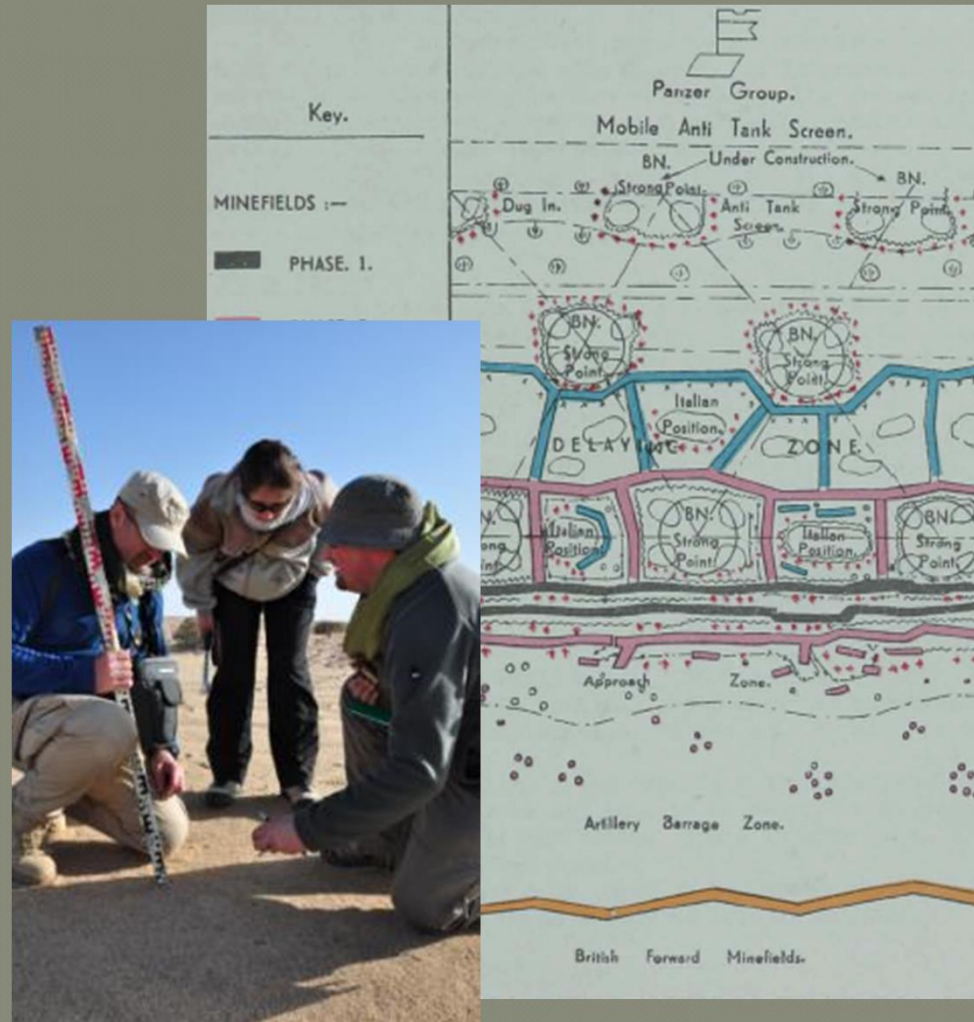


Hence, intelligence for the planning of the battle plan was poor: only an Italian aerial survey, missing the area of attack, no patrolling before the battle and the deception from a false British military and geological map



The ongoing research

1. Geological map of the site through Aster Analyses and field survey
2. Reconstruction of minefields and routes of attack by means of archive documents



A geological analysis of the battle

1. The El Alamein “funnel” was the only place where to stop axis advance (to keep it at all costs the withdrawal plans were burned by Montgomery)
2. El Qattara depression had no sebhas in the region of El Alamein, but El Moghra formation produces very fine sediments impassable for vehicles. The cuesta fronts form a steep escarpment with narrow passes.
3. The southern encompassment through the wind depressions was the only geomorphological suitable way, hence it was pretty predictable by the British (the plan was known in details on August 8, 1942)
4. Axis forces did not assume sufficient geological and geomorphological information before the battle
5. Sands and stony pavements augmented the consume of fuel for Axis Forces to a critical point (vehicles got stuck, had to drive with low gears and consumed much more of the fuel deserved to the attack).
6. The British made use of geology for deception, and took advantage of the dominant position over Alam Halfa Ridge (and others), letting Rommel to advance in open field on soft sandy surfaces not engaging a open battle with armoured divisions.
7. Ultra was the main reason for the defeat, but a wise use of terrain knowledge helped Montgomery in winning the battle.

THANK YOU

DANGER
MINES
KEEP TO
TRACK