

AOrOc (UMR 8546)

Archéologie d'Orient et d'Occident
(CNRS / PSL [EPHE, ENS])

AOrOc is a research unit merging nine teams from several institutions (CNRS, PSL [EPHE, ENS] specialized in archaeology, history, philology and digital humanities, in the Antiquity round the Mediterranean.

<http://www.archeo.ens.fr/>

François LECLERE is an archaeologist / egyptologist directing the *Mission française des fouilles de Tanis* (EPHE) in Egypt

Luc LAPIERRE is a specialist of satellite imagery and GIS; he joined AOrOc after having done all his career in CNES, Toulouse; he is also a member of the SFPT



aoroc
CNRS PSL



MISSION FRANÇAISE
DES FOUILLES DE TANIS

الْبَحْثَةُ الْفَرَنْسِيَّةُ لِلْحَفَائِرِ بِضَاةِ الْجَبْرِ

USE CASE

TANIS / AVARIS-PIRAMESE. Geo-archaeology and Palaeo-Landscape of Important Egyptian Nile Delta Ancient Cities, with the Help of PLEIADES NEO very High-Resolution Satellite Imagery

General sketch- map of the Nile Delta with ancient cities and position of ancient Nile branches and ancient sea-shores.

Extract showing the considered region and archaeological sites.



(© Fr. Leclère [MFFT];
background: MODIS RRT,
NASA/GSFC [J. Desclotres],
2003.

Application: Geo-Archeology
Products: PNEO

Location: North-Eastern Nile Delta, Egypt

AIRBUS



Challenge

TANIS is an important archaeological site of the N.E. Delta:

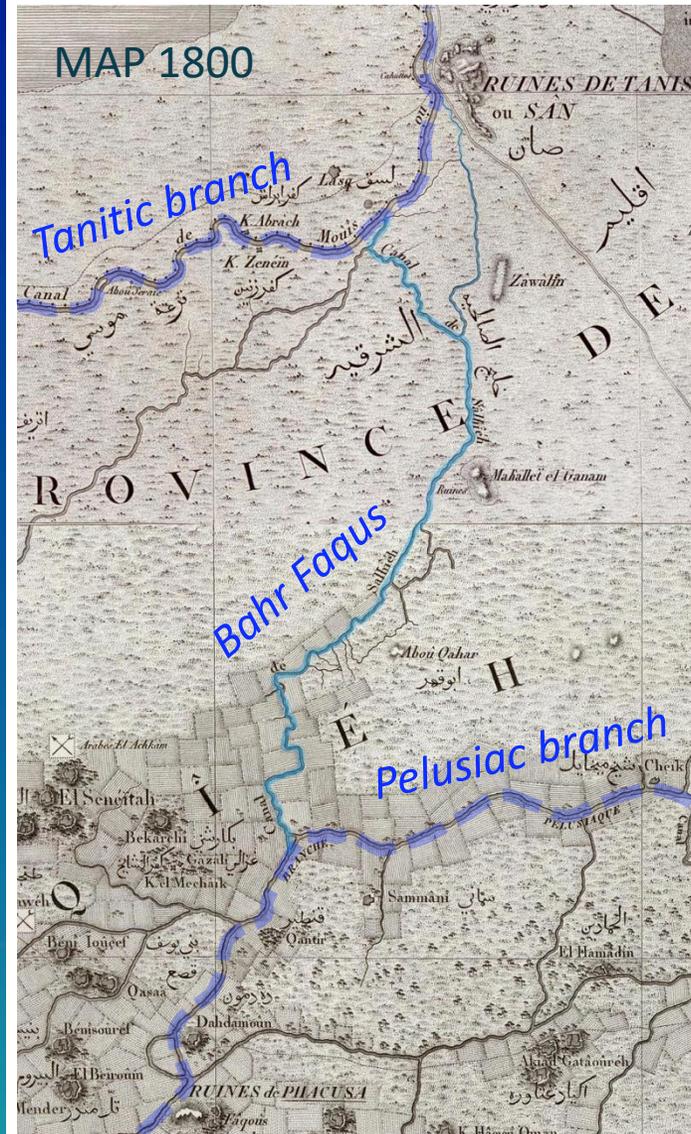
— Ruins of an **ancient royal capital city and inland harbour**, founded at the end of the 2nd mill. BC along the ancient **Tanitic Nile branch**.

— **Temples built** with massive stone remains from the monuments of **AVARIS & PIRAMESSE**, two other important royal cities and harbours of previous periods, **20 kms away**, along the neighbouring **Nile branch (Pelusiatic)**, whose partial silting had caused their abandonment.

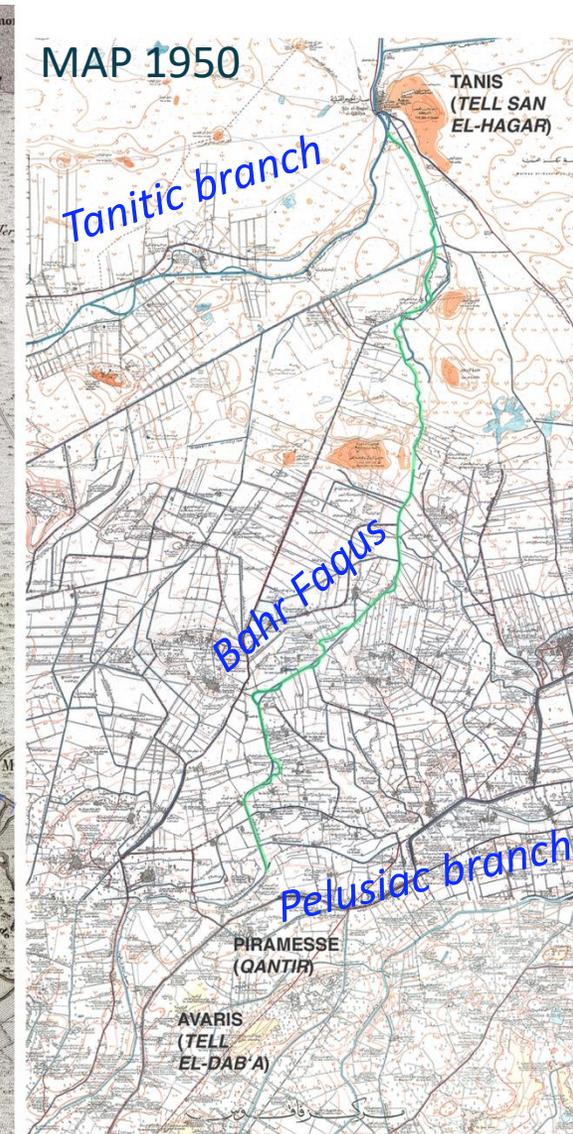
— **Ancient rivers and canals** are now mostly silted up but traces can sometimes be **detected in modern hydrography** and micro-variations of the **ground surface topography**.

— Today's **Bahr Faqus drain** might be the last avatar of an **ancient waterway** used for moving the heavy stone elements from Piramesse to Tanis.

— **Highly precise 3D information on the surface topography in the considered area** is needed to check this hypothesis.



Extract of map of the region between Tanis and Piramesse made in 1800 (© P. Jacotin, in *Description de l'Égypte (...)*, Atlas géogr., 2^{de} éd. 1826, pl. 30+35)



Same area on the 1:25000 maps of the Survey of Egypt in 1950 (N° 89-92/690).

Bahr Salhie / Bahr Faqus drain underlined in blue and green



Solution & Results

Pléiades Neo imagery:

— Acquisition of **tri-stereo images** on 29/11/2022; considered area: 4,4 km E-W x 24 km N-S = 106 km²; cloud cover: 0 %; combined incidence angle: ~21°; B/H ratio: 0.59.

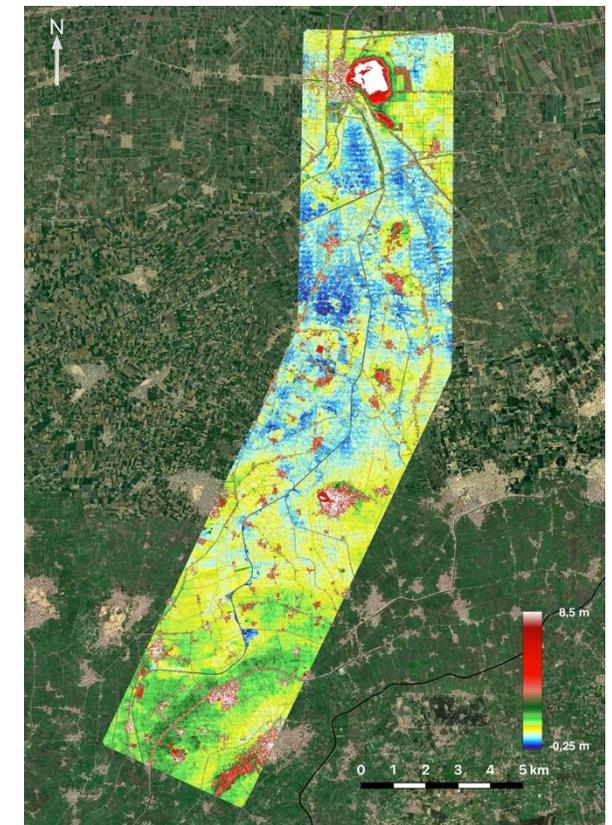
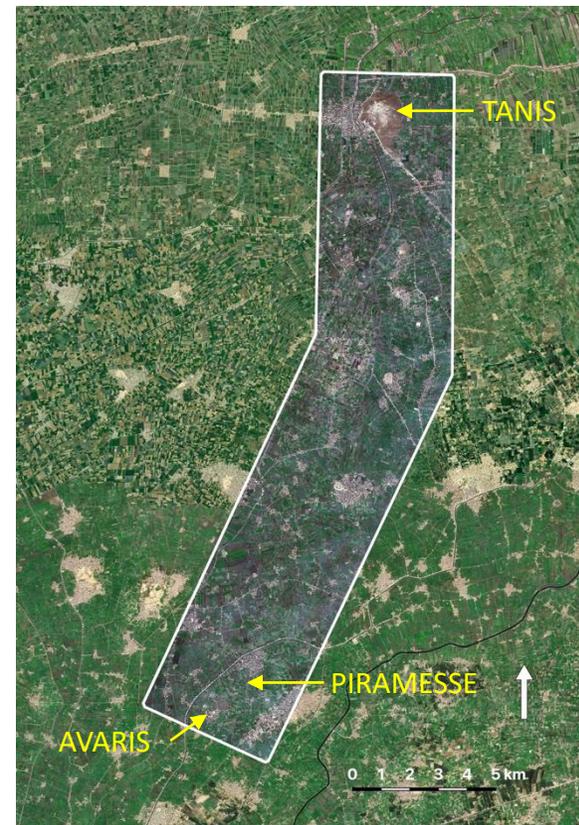
— Delivery format : primary panchromatic + multispectral bundle (RGB & NED bands); DIMAP-Geo TIFF; 16 bit; reflectance.

— Ortho-images and DSM produced with **CARS** (CNES Algorithms for Surface Reconstruction [D. Youssefi], CNES) + **OTB** (Orfeo ToolBox; for pan-sharpening and ortho-rectification [L. Lapierre, AOrOC/SFPT) + **Qgis**

Pléiades Neo Imagery helped to:

— **produce high-quality false-colour DSM and true-colour ortho-photography showing (among many data):**

- Ancient hydrographic features at regional scale (levees of the Pelusiac branch; no contradiction to possible ancient waterway towards Tanis).
- Detailed archaeological features at the scale of the site of Tanis (levelled ancient domestic constructions)





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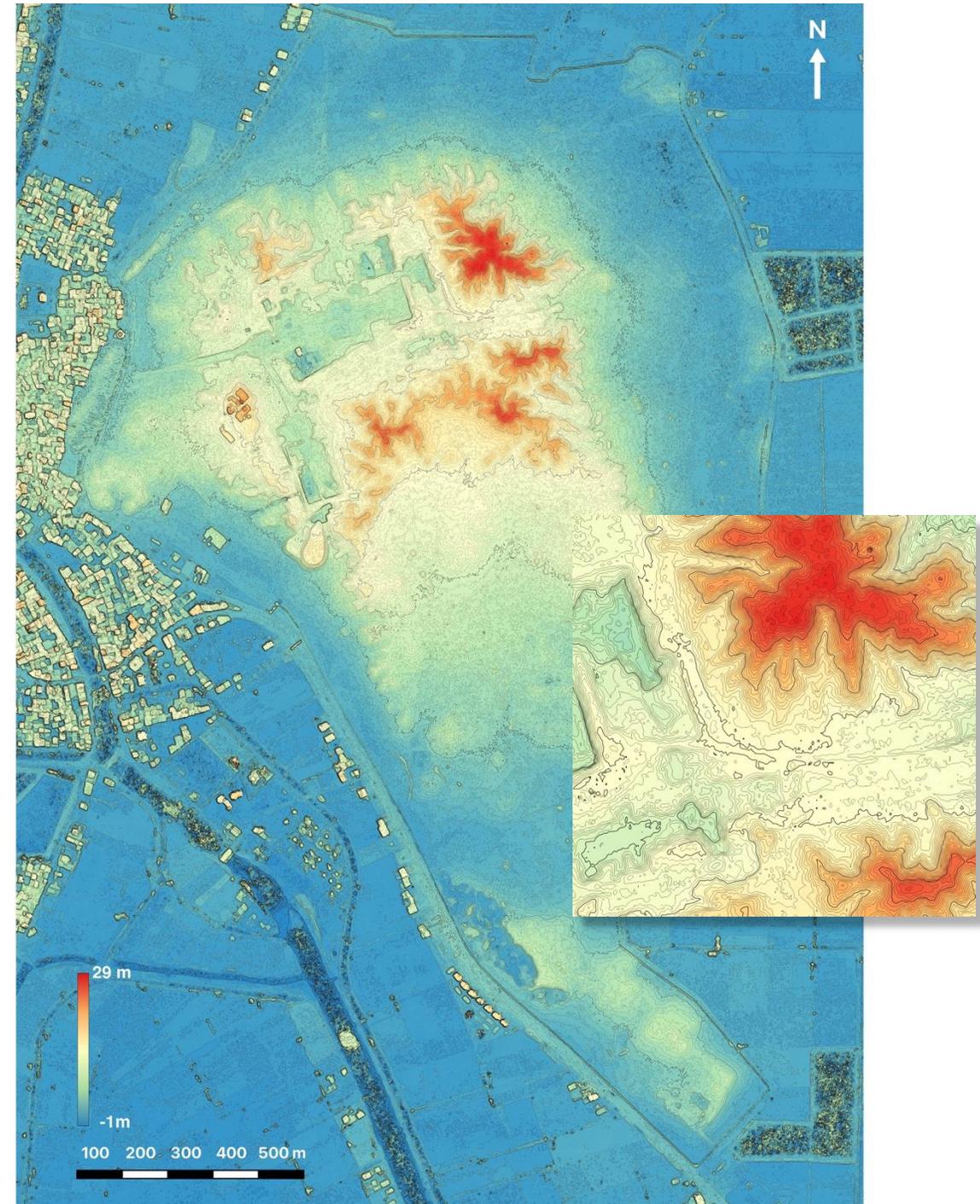
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— **produce a false-colour DSM + high-precision contour map of the site of Tanis** (iso. 0,25m)





Benefits

+ **Extra capabilities:** detection of small features not visible on RGB images (DSM) or underlying features (NDWI2).

- **Pléiades Neo satellite imagery proved to be a convenient alternative** to Airborne LIDAR (now difficult to implement in Egypt) for **producing high-resolution (0,3m/p.) ortho-images and DSMs.**
- **Great number of high-precision data useful for regional geo-archaeological & local archaeological interpretation.**
- **Sharing the results with other archaeological missions involved in the area (Austrian and German teams working in Avaris and Piramesse) would offer great perspectives of further fruitful research and interpretation**

Organisations Involved:



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CNRS PSL



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المهمة الفرنسية للحفائر بمنطقة المنيا

Extra capabilities on PNEO imagery : detection of small features not visible on RGB images



DSM



NDWI2

