

Využití GIS při archeologickém výzkumu v Súdánu

Jan Pacina, Fakulta životního prostředí, UJEP
Ústí n. Labem

Jan.Pacina@ujep.cz



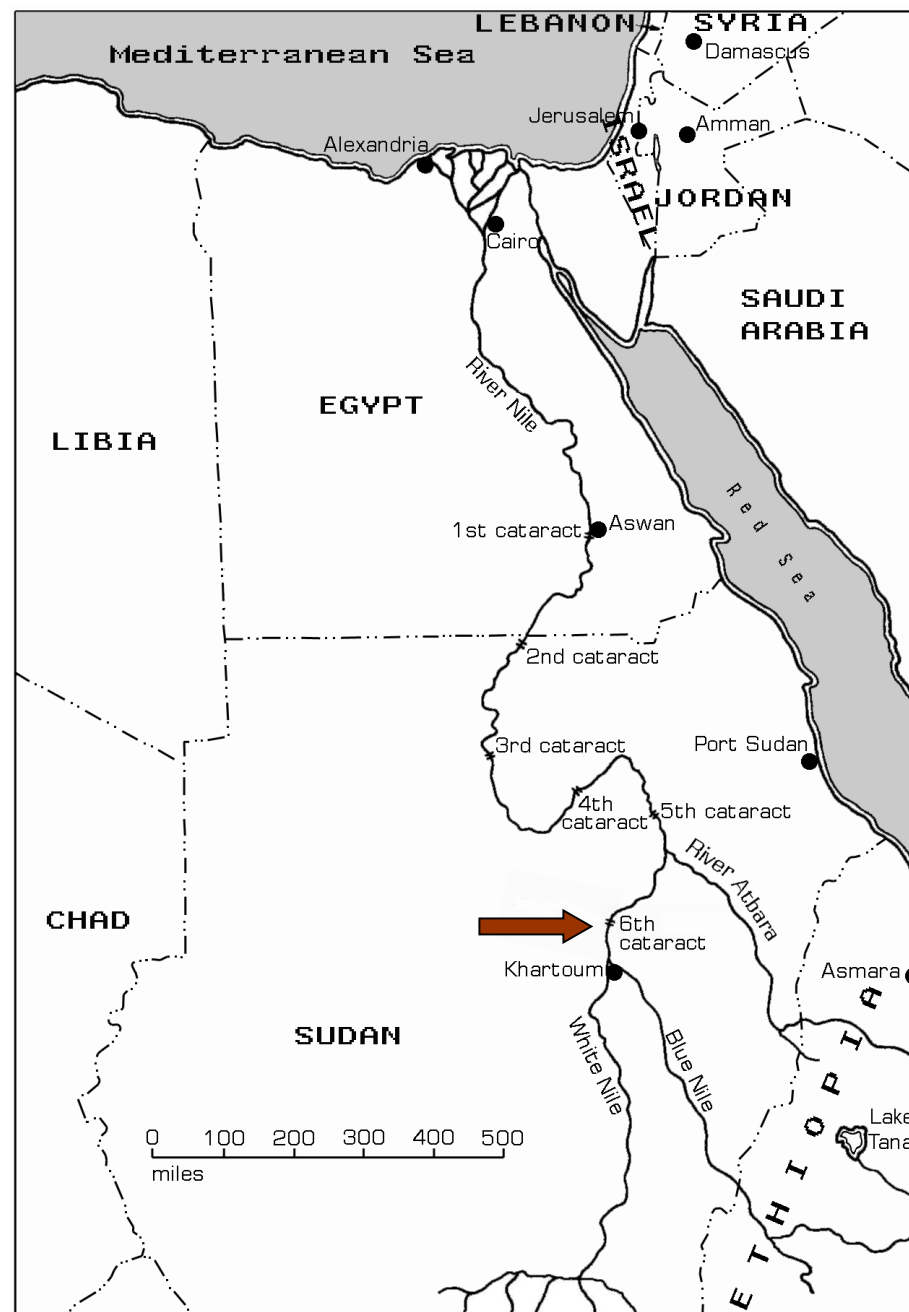
Projekt Sabaloka

■ 2009-2011

krajinný archeologický průzkum pohoří na obou březích Nilu. Nalezeno více jak 100 archeologických lokalit.

■ 2011-2015

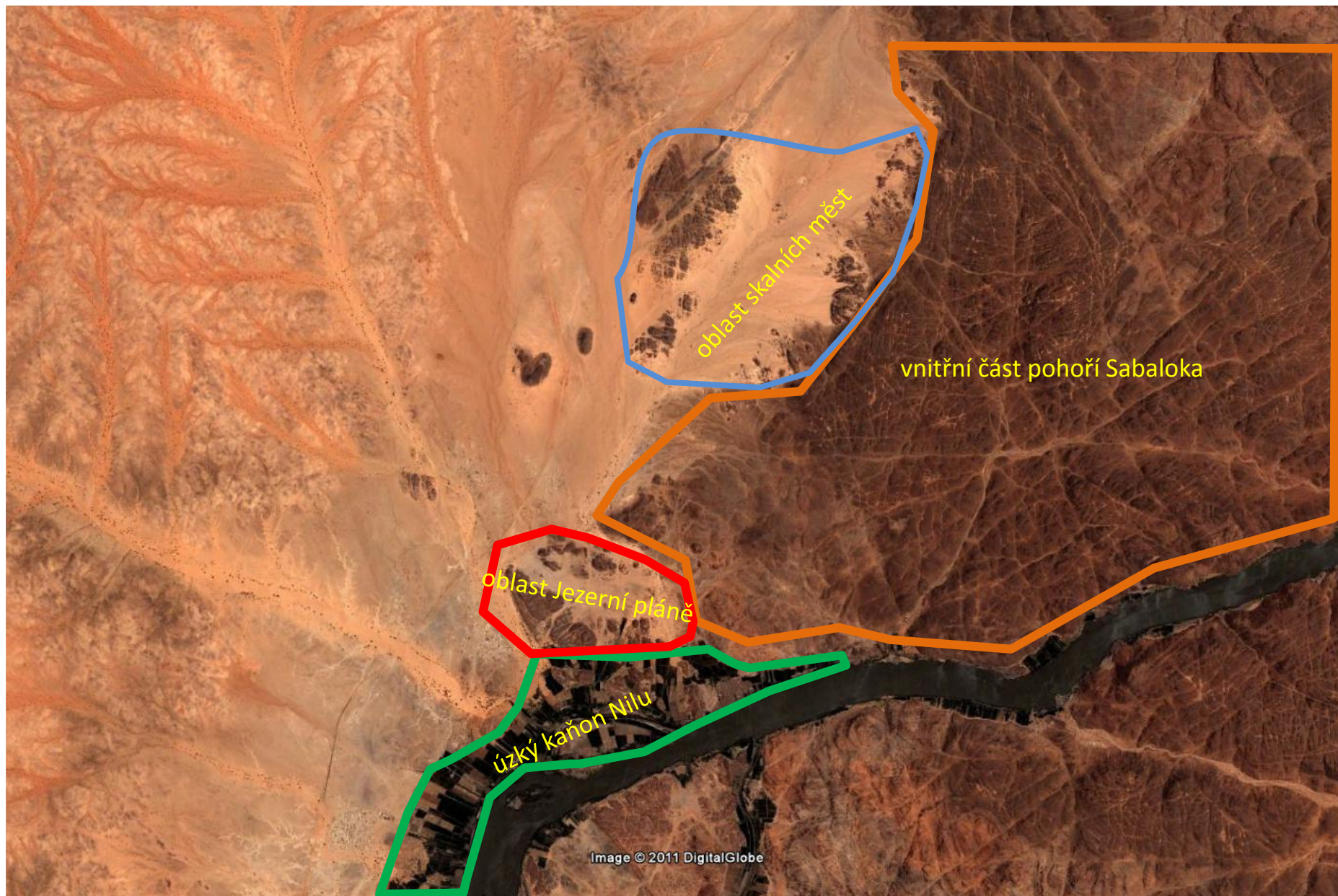
interdisciplinární výzkum pravěkého osídlení a jeho interakce s přírodním prostředím na západním břehu Nilu v rámci záchranné akce **Sabaloka Dam Archaeological Salvage Project (SDASP)**



Oblast zájmu



Charakteristika oblasti





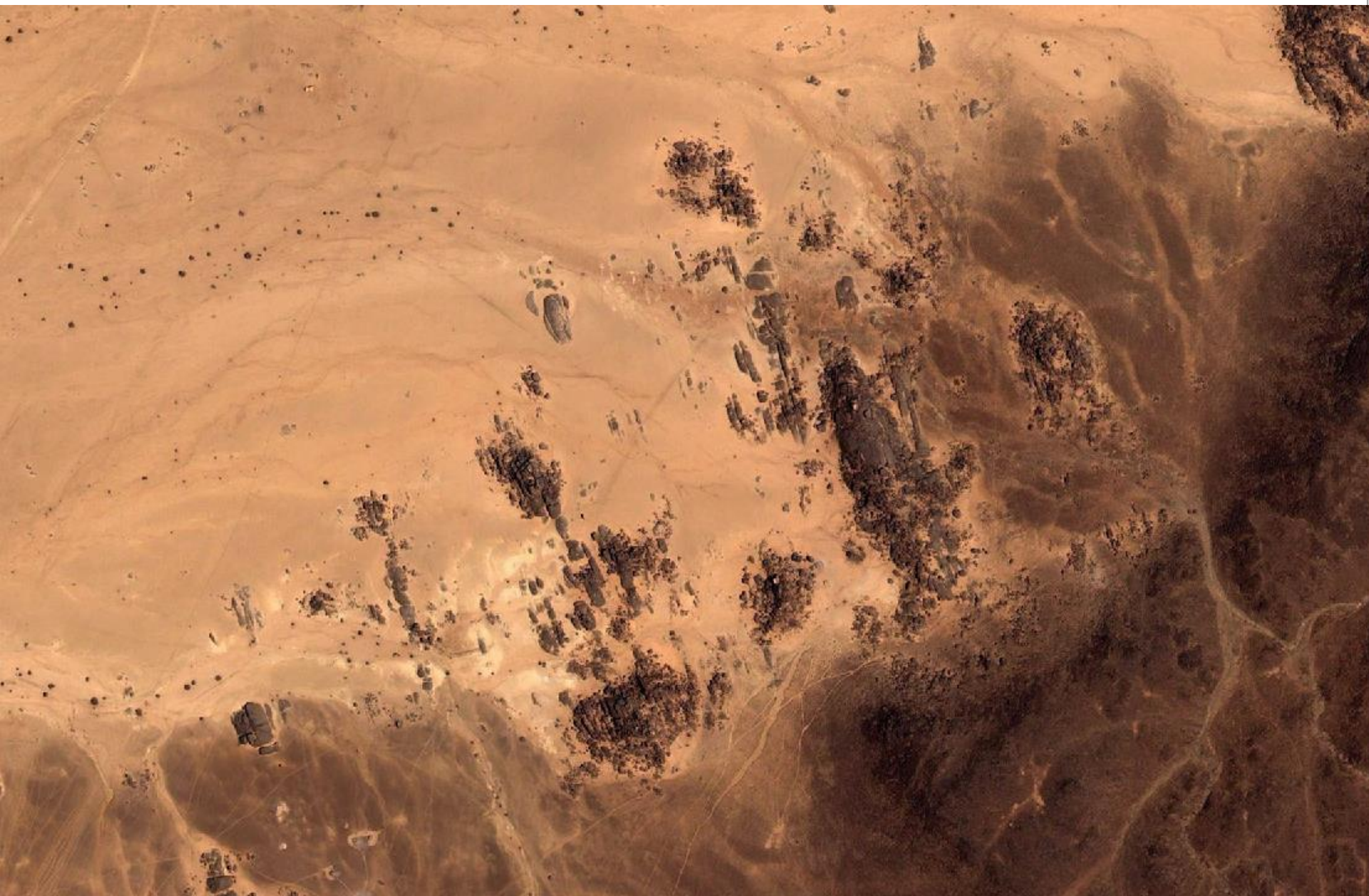








Oblast skalních měst

























Podmínky pro měření – dovoz techniky

- přísné podmínky pro dovoz techniky
- nutné povolení od Sudan National Survey Authority
- platba cla za dovezenou techniku
- v posledních letech zmírnění situace
- pro radiopřijímače nutné povolení z Ministerstva komunikací



Certificate of Payment of Duty in Deposit by Tourists and Travellers
 Name of Person paying deposit: SAN PADINA
 Particulars of Articles Imported.

U.P. 149) C. 500 Bks. 799

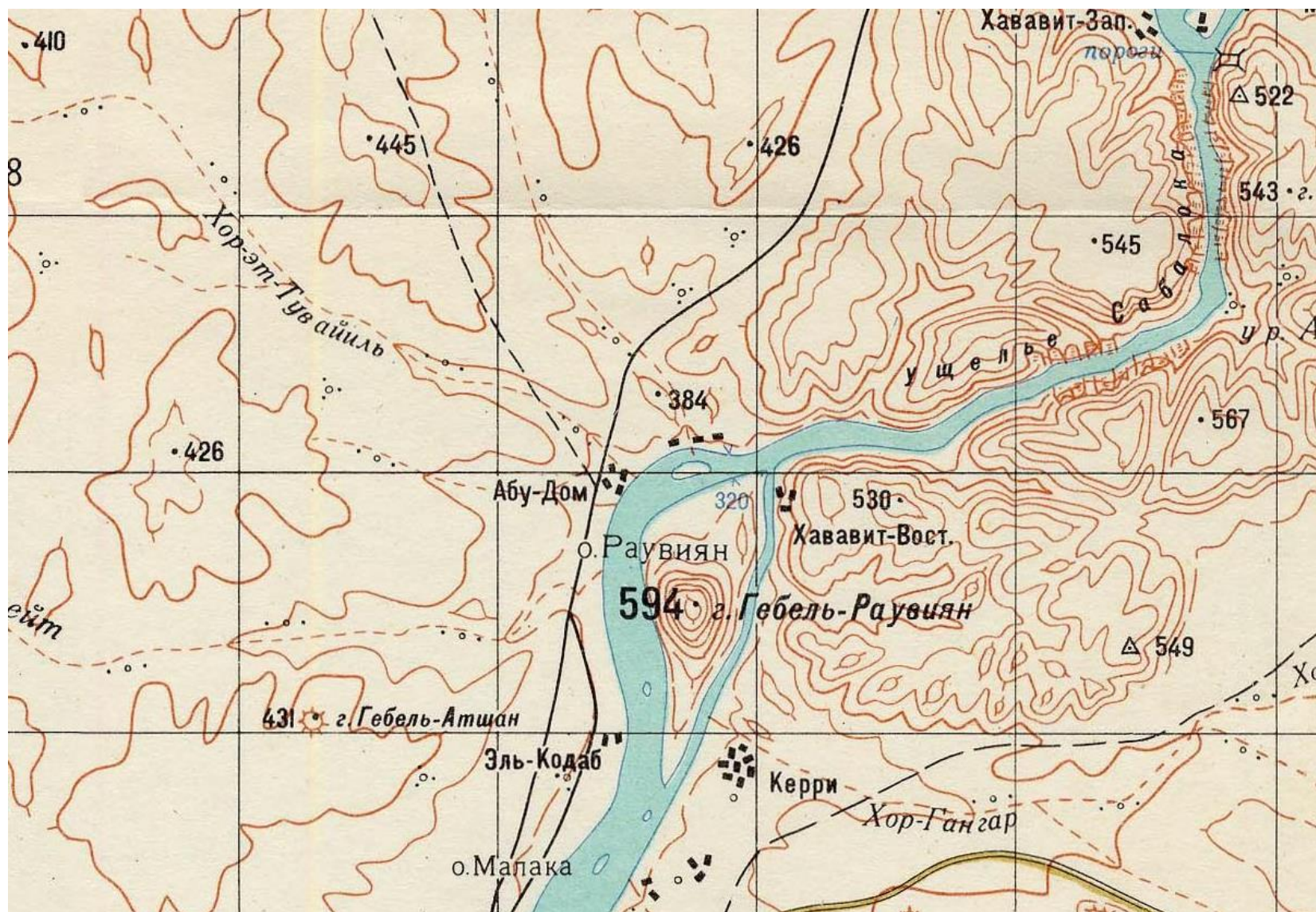
quantity	DESCRIPTION	Weight	VALUE	Numbers and Marks for purposes of identification
	Cips - 100g	1670 =	510	قوس 100g
	TRI H61e			
	9810009120347			
	9810007370762			
	TCR 302			
	641567			
	Cips - 100g			
	EARTIAN			
	21F121663			
		1690 =		

Total Customs Duty Collected in Deposit on Receipt No. _____ of _____
 Date: 19/10/2011

Chief Customs Officer

1. A refund of the deposit collected may be claimed by the depositor provided that the articles are re-exported not later than six months after their importation into the Sudan.
 2. The depositor should make his claim for refund at the time of re-export to the Chief Customs Officer at place of re-export and support the claim by producing this certificate together with the deposit receipt.

Podkladová data - mapy



Současný stav GIS v Súdánu

Table (1): Summary of Status as Collected by the Author

No.	Organization/Department	Availability of Functional GIS System	Availability of Recent Digital Topographic Maps	Availability of Recent Aerial Photography/ Satellite Imagery	Availability of GPS Equipment	Availability of GIS Development Plan	Year
1	Sudan National Survey Authority.	There are several photogrammetric systems: - Analog Photogrammetric stereo plotters. - Aerial Cameras, none of them is working	No	The most recent aerial photography was taken in 1996 for Khartoum State. Plus some satellite images(Landsat and Quickbird)	There are some	Starting	2008
2	Khartoum State (Engineering Issues Department).	There is good hardware setup and some GIS/ Image processing software such as (ArcGIS and ERDAS Imagine)	No	Digital aerial photography/ recent satellite imageries are: - SPOT 2001 - IKONOS 1999 - Raw Aerial Photos 2008	There is a good set of Trimble GPS and at least one base station	Getting better rapidly	2008
3	Sudan Engineering and Digital Information Centre (SEDIC).	A good photogrammetric system and some workstations exist	No	There are color unprocessed aerial photographs taken in 2000.	Use and sell GPS devices	Not clear	2008
4	Sudan National Remote Sensing Authority.	- Analog Photogrammetric lab but not functioning. - There are some PCs and some GIS and Image processing software such as (ArcGIS and ERDAS Imagine) mainly for training and research.	No	Some Landsat imageries (MSS, TM, and ETM+) available	No	Not clear	2008
5	University of Khartoum Faculty of Engineering (Department of Surveying).	- Some PCs and software available for training and research - Photogrammetry equipment: old longoutdated optical and mechanical projection instruments	No	Few stereo Model for teaching purpose	No	Not clear	2008
6	Sudan Central Bureau of Statistics.	None	No	Available maps were prepared for census; and generally they show administrative boundaries. The most recent maps were prepared in 2002 and currently under update	Some handheld GPS receivers which are used by surveyors to collect general locations of settlements	map available for census purpose from satellite imagery	2008
7	Khartoum State Water Corporation	There are several workstations /PCs used for data conversion and collection	There is a project for water network paper map conversion	No	No	Have a GIS project to convert as built CAD data to GIS	2008

Abdullah Elsadig Ali, Director General, Sudan National Survey Authority, Khartoum
Eighteenth United Nations Regional Cartographic Conference for Asia and the Pacific

Souřadnicové systémy a bodové pole

- Adindan – archeologické lokality zaměřené od NCAM
- S42 – sovětské mapy
- WGS 84 – vlastní GPS měření
- bodové pole nebylo v rámci lokality Sabaloka identifikováno – měření v lokálním souřadnicovém systému



Stabilizace bodového pole

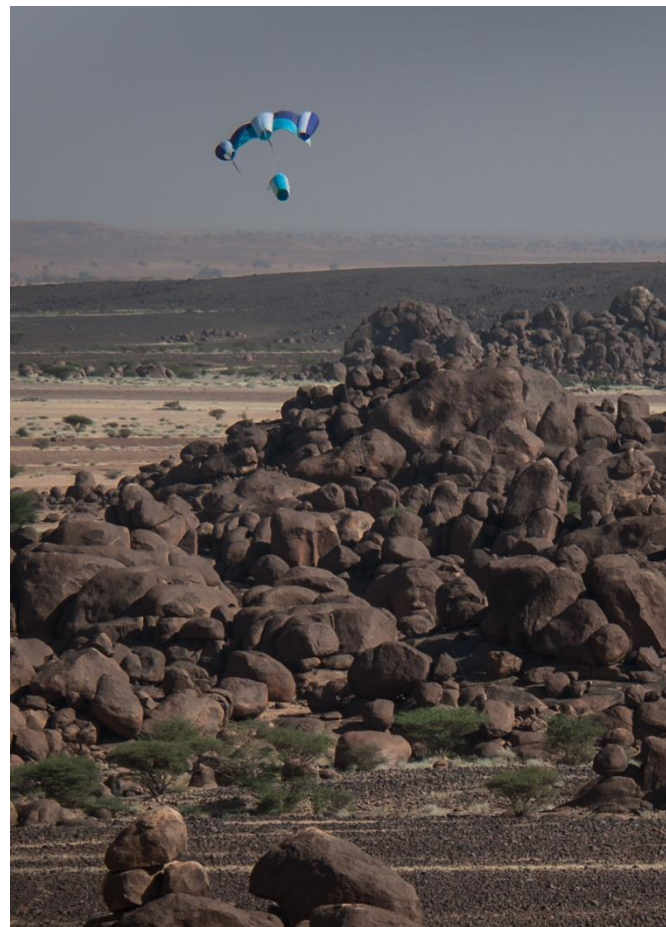


Stabilizace bodového pole



Použité metody

- klasická geodézie
- blízká fotogrammetrie



Metody – použitá technika

Totální stanice TCR 303

- v kombinaci se hranol
- program pro výpočet nepřímé měření délek
- nejdelší měřené záměry
- teplotní limit 50°C

GPS přijímače

- Trimble Juno ST
- Garmin GPSMap 62s
- nedostupné referenční sítě

+ pásma, skládací metry, ...



ů a



Metody – použitá technika

- drak Elliot Rhombus Mega Power Sled o rozměrech 300 × 170 cm, se šňůrou dlouhou cca 200 m, rozsah větru 2–5 Bft + fotoaparát GoPro Hero 3+
- fotoaparát Sony Nex-7



Terénní výzkum a sběr dat

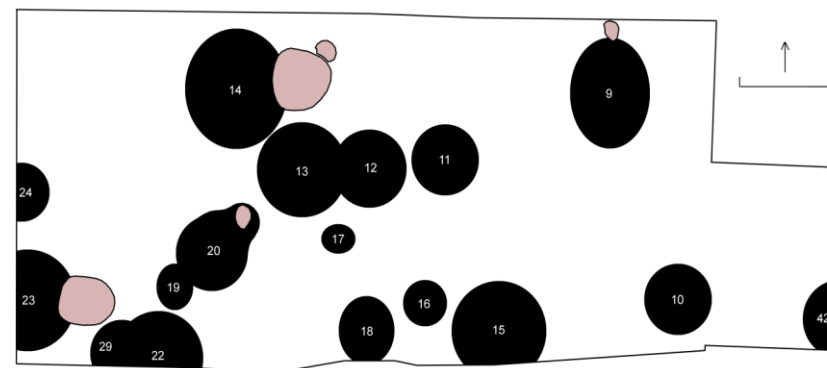
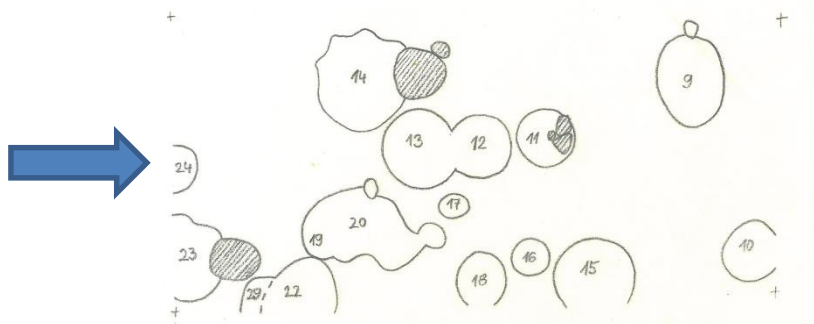
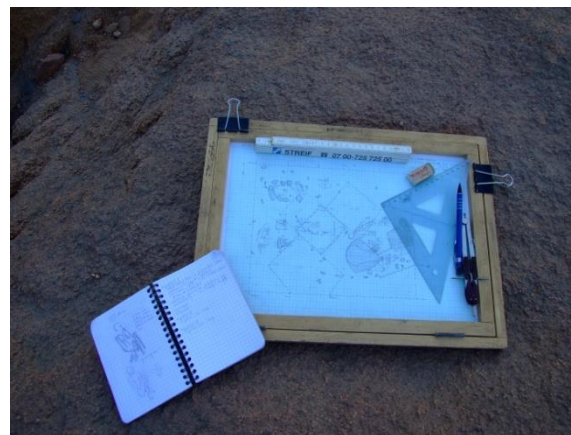
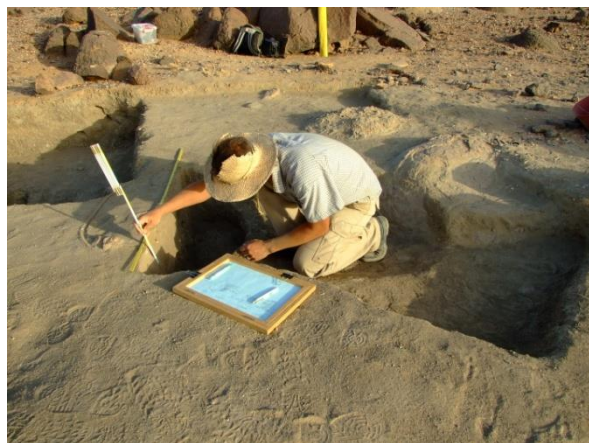


Výstupy měření

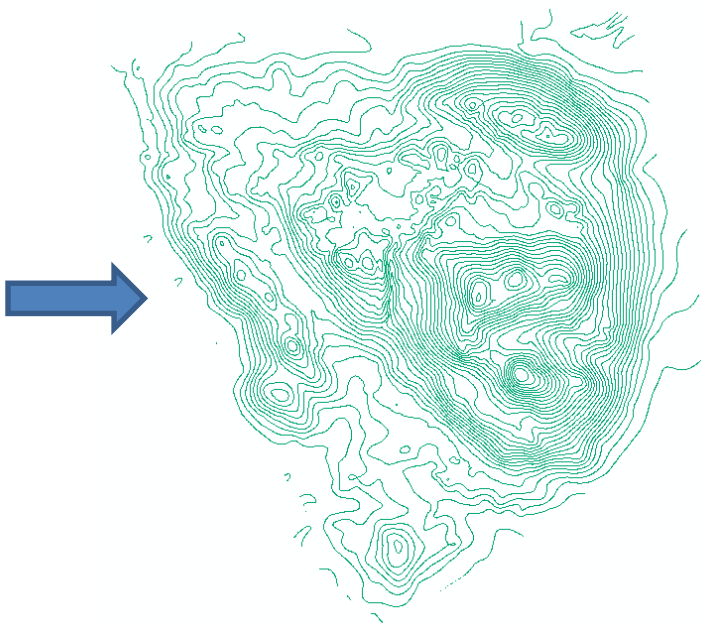
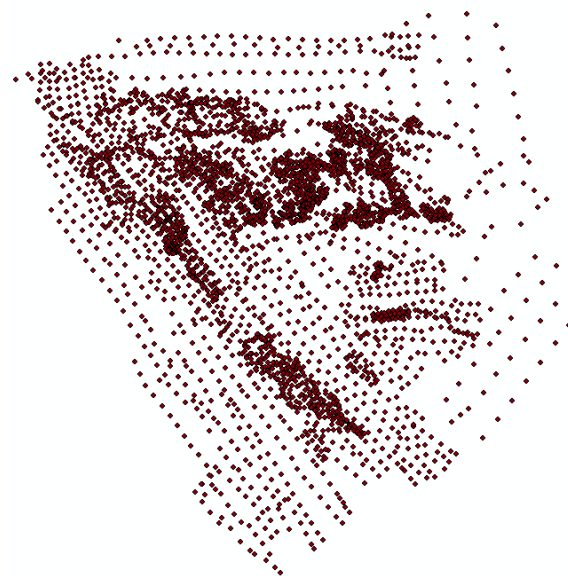
- podrobné body
- 3D modely archeologických lokalit
- podrobné ortofoto vybraných oblastí



Zpracování dat

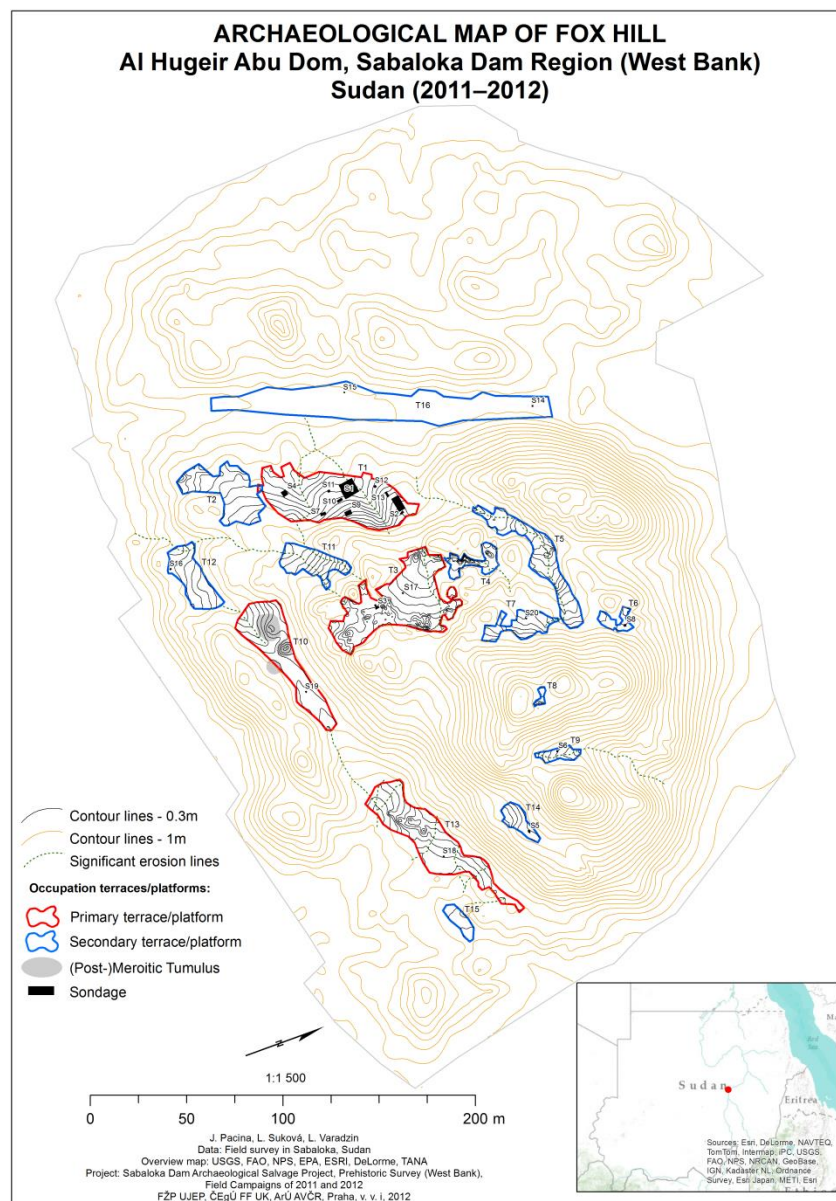


Zpracování dat

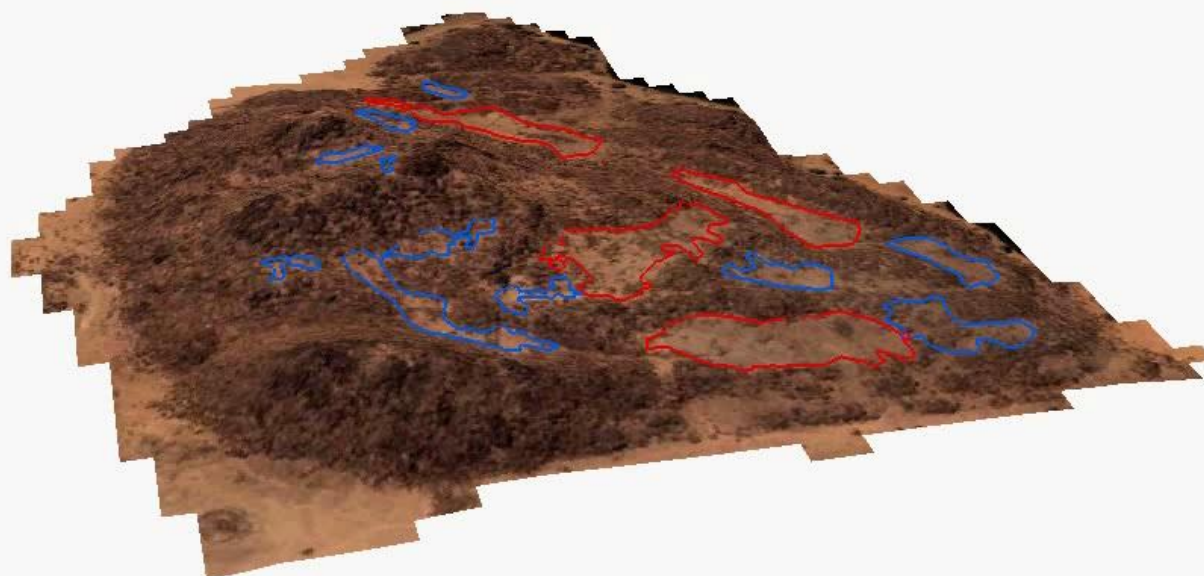


Archeologická data

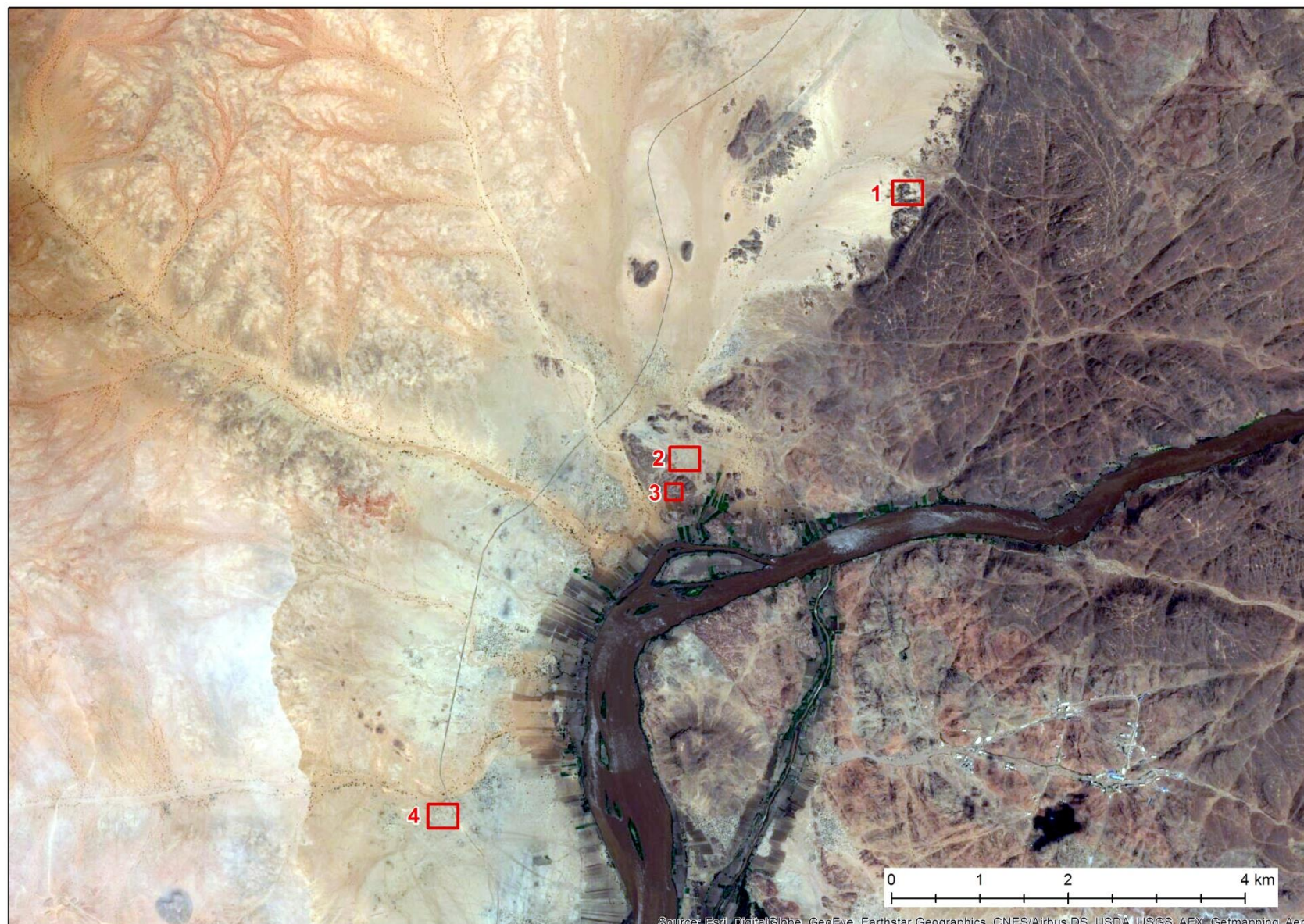
Tvorba archeologické mapy – Fox Hill



Zpracování dat



Použití KAP



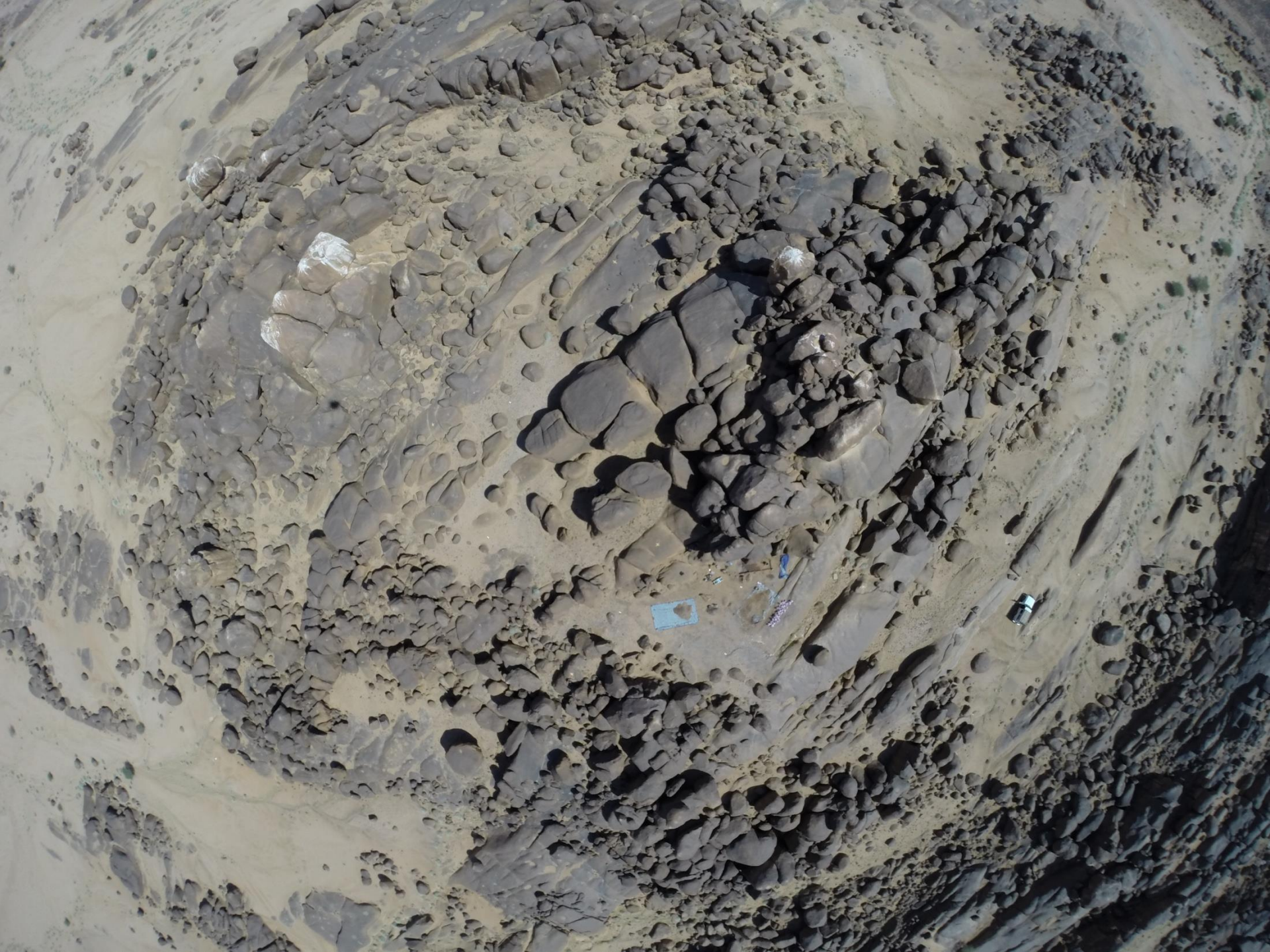
Jezerní pláň



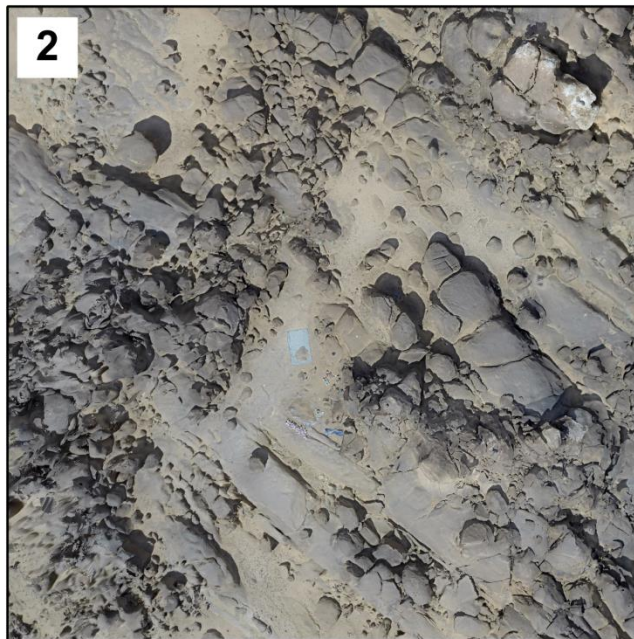
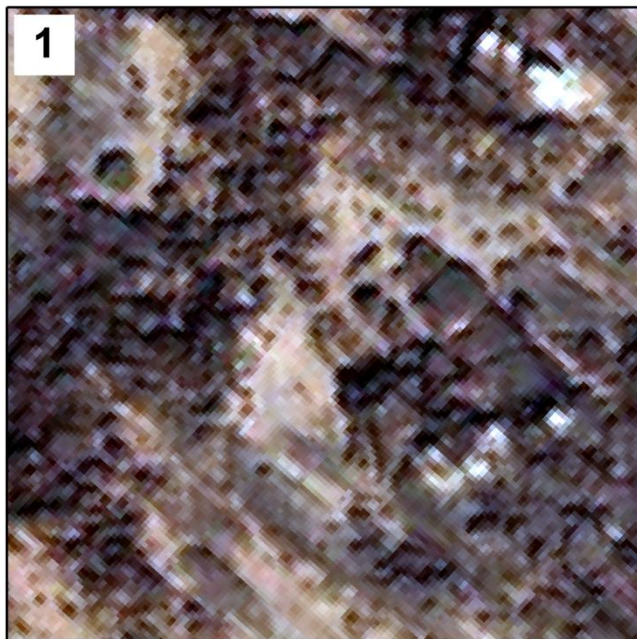


Lokalita Sfinga

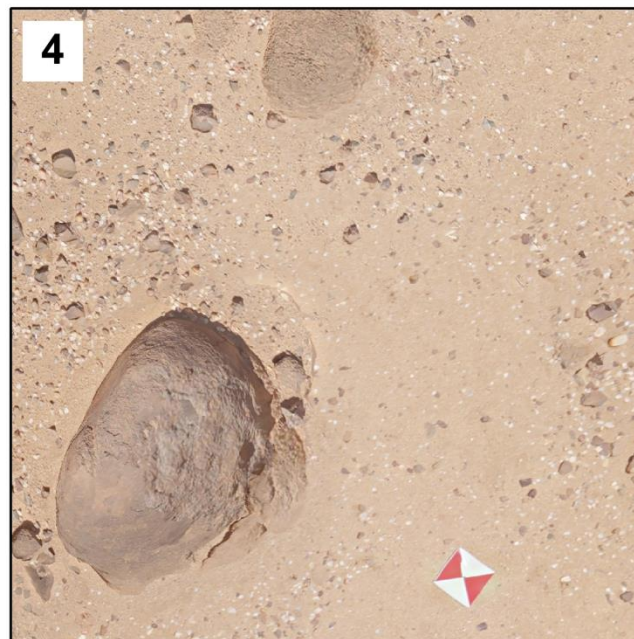




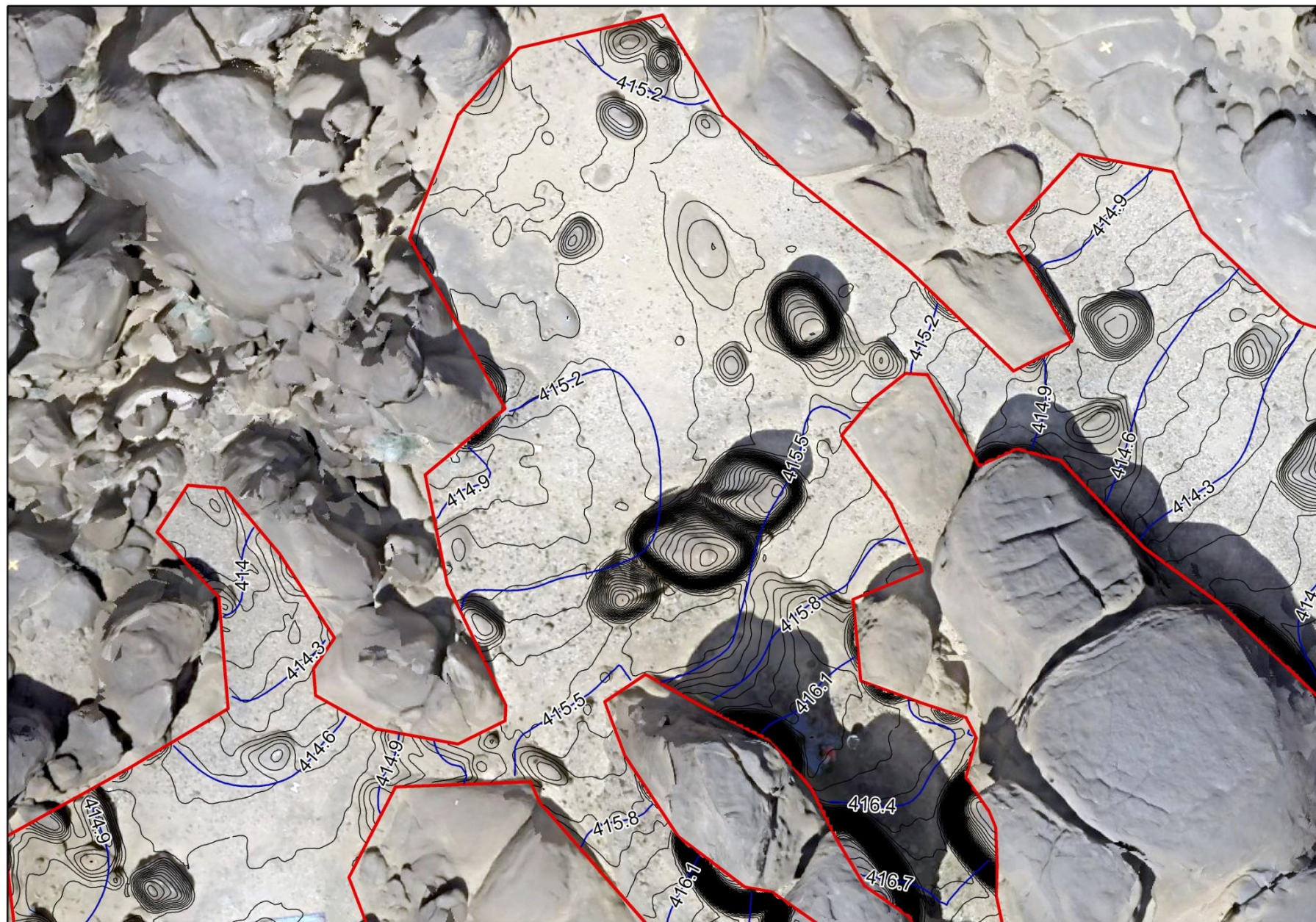




0 25 50 100 m



0 0.5 1 2 m

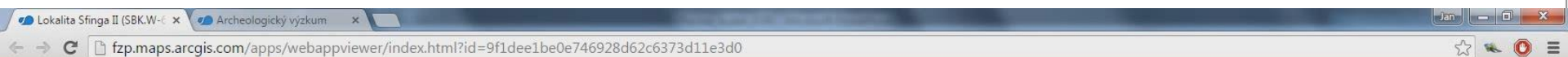


Data prezentovaná on-line

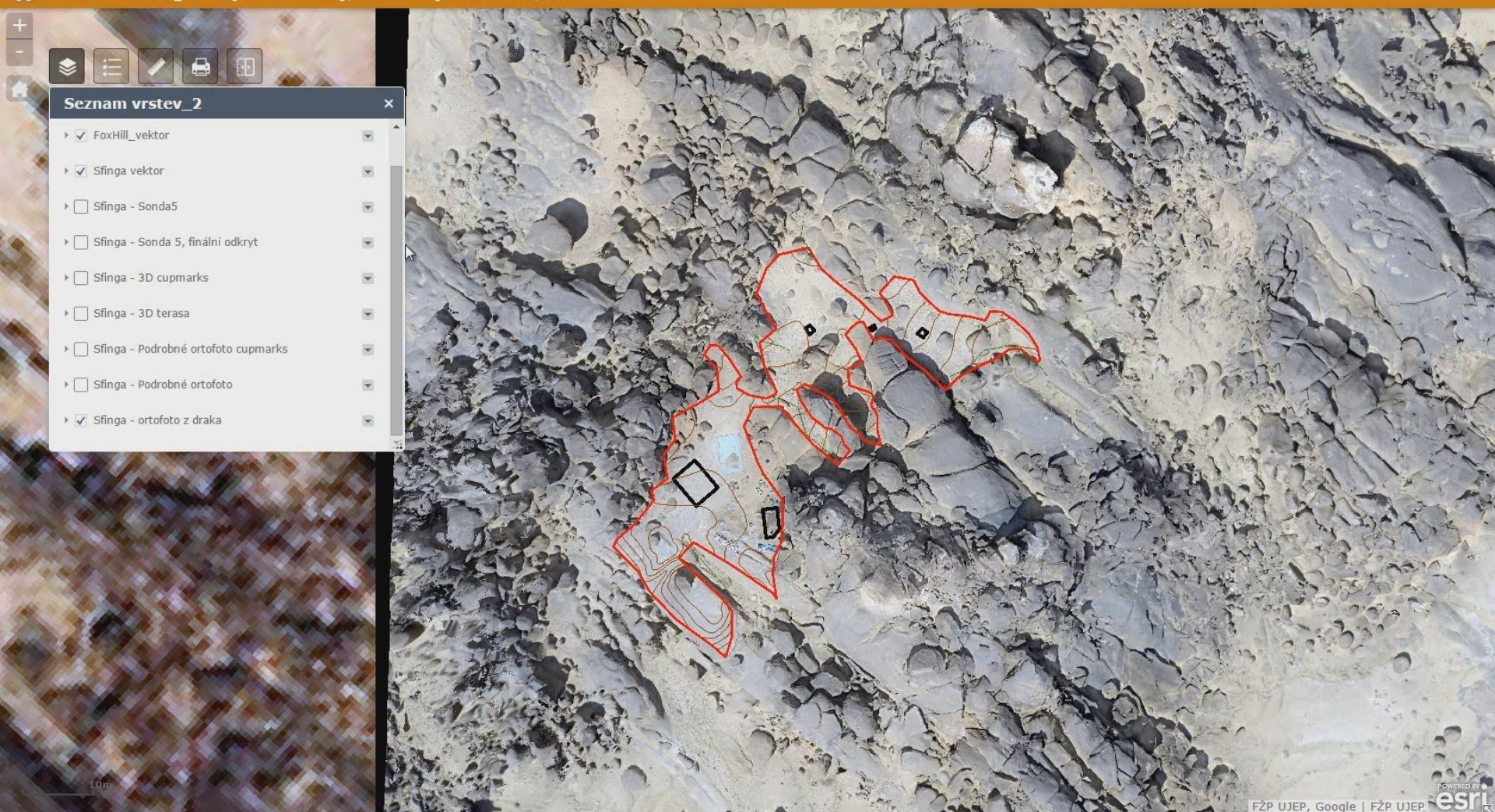


ArcGIS
Online





Lokalita Sfinga II (SBK.W-60), 6. nilský katarakt, Súdán



Browser tabs: Lokalita Sfinga II (SBK.W-...), Archeologický výzkum

Address bar: fzp.maps.arcgis.com/apps/webappviewer/index.html?id=266c4bea261e46838d2061b8bef03fcd



Map interface elements:

- Top left: Navigation icons (home, search, etc.)
- Top right: Map controls (pan, zoom, etc.)
- Bottom left: ESRI logo and 'FZP UJEP, Google, FZP UJEP' text.
- Right panel: Layer list titled 'Seznam vrstev'.

Seznam vrstev

Operační vrstvy

- ☒ 3D modely
- ☒ Fotobody
- ☒ FoxHill_vektor
- ☒ Lokalita
- ☒ Sfinga vektor
- ☐ Sfinga - Sonda5
- ☐ Sfinga - Sonda 5, finální odkryt
- ☐ Sfinga - 3D cupmarks
- ☐ Sfinga - 3D terasa
- ☐ Sfinga - Podrobné ortofoto cupmarks
- ☐ Sfinga - Podrobné ortofoto
- ☒ Sfinga - ortofoto z draka

Děkuji za pozornost

Jan.Pacina@ujep.cz

<http://mapserver.ujep.cz/>