The Lithological Landscape of the Greater Petra Region

Availability of Flint and other Abiotic Resources

Tab. 1 - Lithostratigraphic sequence of the Greater Petra Region. For colours see Fig. 4

		Greater Petra Region – Mapping units after: National Resource Authority (e.g. Barjous 2003)		Bender (1968; 1974)	Group
Quaternary	Holocene	Soil, Alluvium and Wadi Sediments (S/Al/Alf/Als)		Soil	
		Early Holocene Alluvial Fan / Alluvium Sediments (Alfo/Alo)			
		Fluviatile and Lacustrine Gravels (Pl/Plc/Plf/Plg/Pls)		Fluviatile Gravel	
	Pleistocene	Lisan Marls		Lisan Marls	
		Ar-Risha Gravels			
		Basalt (B)		Basalt	
Tertiary	Pliocene	Dana Conglomerate (DC)	Dhira' Ibn Salih Conglomerat (DS); Wadi Bustan Calcarenite (WB)	Upper Syntactic Conglomerate (tt3); Lower Syntactic Conglomerate (tt3)	
	Miocene	*Unconformity*			
	Eocene – Upper, Middle, Lower	Umm Rijam Chert Limestone (URC)		Chert Limestone Unit (tt1)	Belqa
	Palaeocene				
Cretaceous – Upper	Maastrichtian	Muwaqar Chalk-Marl (MCM)		Chalk-Marl Unit (c2)	Belqa
	Campanian	Al-Hisa Phosphorite (AHP)		Phosphorite Unit (c2)	
		Amman-Silicified Limestone (ASL)		Silicified Limestone Unit (c2)	
	Santonian	Wadi Umm Ghudran (WG)			
	Conacian	Wadi as-Sir Limestone (WSL)		Massic / Sandy Limestone Unit (c2)	Ajlun
	Turonian	Fuhays/Hummar/Shu'ayb (F/H/S)		Echinoid Limestoe Unit (c2)	
	Cenomanian	Na'ur Limestones (NL)		Nodular Limestone Unit (c2)	
	Albian	Kamub Sandstones (KS)		Massive White Sandstone (c1)	
	Unconformity				
Jur. – Middle, Lower		*Unconformity*			
Unconformity					
Ordovician		Disi-Sandstones (DI)		Massive Whitish Weathered Sandstones (c1)	Ram Sandstones
Cambrian		Umm Ishrin Sandstones (IN)		Massive Brownish Weathered Sandstones (cb)	Ram Sandstones
		Abu Khushayba Sandstones (AK)	Burj Dolomite Shale (BDS)	White Fine Sandstone Unit (cb1); Dolomite Limestone Shale Unit (cb2)	Ram Sandstones
		Salib Arkosic Sandstones (SB)		Bedded Arkosic Sandstone / Basal Conglomerate (cb1)	Ram Sandstones
"Pre-Cambrian"/ Late Proterozoic		Al Bayda' Quartz-Feldspar Porphyry (BA)		Saramuj Conglomerate / Greywacke Series	Al Bayda Volcanic
		Mufarqida Conglomerate (MC)			
		Musaymir Effusive (MR)			
		Qusayb Rhyolite (QB)			
		Harun Microgranite (HG)			Hrian Granite
		Fidan Syenogranite (FN)			
		Rachel Hornblende Quartz Diorite (RH)		Magmatite (Igneous rocks)	
		Huwar Two-Mica Granite (HR)			Kabira Euladed

Introduction

The "Lithological Landscape of the Greater Petra Region" is part of a Ph.D.-Dissertation which has been completed at Freie Universität Berlin (Purschwitz 2016).

A flint raw material survey was carried out in September 2012 under the auspices of ex oriente Berlin and in collaboration with the Jordanian Department of Antiquities. This research aimed at providing an archaeogeological framework on Flint Raw Material availablity and geological distribution at the Greater Petra Region. It also aims at correlating the Flint Raw Material Group-system (FRMG, Muheisen et al. 2004), which is applied here, with the geological environments of related source areas. The FRMG-system was initially established on base of artifacts from the Basta excavation (FRMG 1-9) and has been later extended according to the flint spectrum found at other sites of the Greater Petra Region (such as Ail 4, Ba'ja, Beidha and Shkârat Msaied, cf. Purschwitz 2013, 2016). The correlation of site-established raw material classifications with their geological availability and distribution is considered a decisive methodological step to investigate the procurement modes involved with specific raw materials and is an important contribution to the reconstruction of prehistoric lithic economies.

According to geological maps of the Greater Petra Region, flint concretions can be embedded in several Cretaceous to Tertiary geological formations (Tab. 1; Barjous 1988, 1995; Bender 1968; Kherfan 1998; Tarawneh 2002). The Eocene Umm Rijam Chert formation (URC) and the Santonian to Campanian Amman Silicified Limestone formation (ASL) are described as abundant in flint layers, while others such as the Na'ur Limestone (NL), Wadi as-Sir Limestone (WSL), Wadi Umm Ghudran (WG), Al-Hisa Phosphorite (AHP) and the Muwaqqar Chalk Marl formations (MCM) can also bear flint concretions, although only in minor quantities.

Methodology

The survey areas (No. 1-15, cf. Fig. 2) were chosen according to their geological settings and their distance and accessibility from the Early Neolithic sites Ail 4, Basta, Ba'ja, Beidha and Shkârat Msaied. The survey was carried out by walking transects through potentially flint-bearing geological formations (Tab. 1, Fig. 2). Additionally, wadis in the site's vicinity were checked for their flint contents. Sources and outcrops of flint and other knappable rocks were recorded as sample points. Each sample point was recorded by GPS, photographs and a site description. The descriptions included a classification of the site (primary source, secondary source, extraction site, knapping ground, etc.), a source description, a classification of the associated artifacts found there including an estimation of their number, and a description of the available raw material spectrum (Raw Material Group, color pattern, shape, dimensions, texture, cortex features, and, for primary sources, geological contexts). When possible, raw material samples were taken for petrographical analysis.

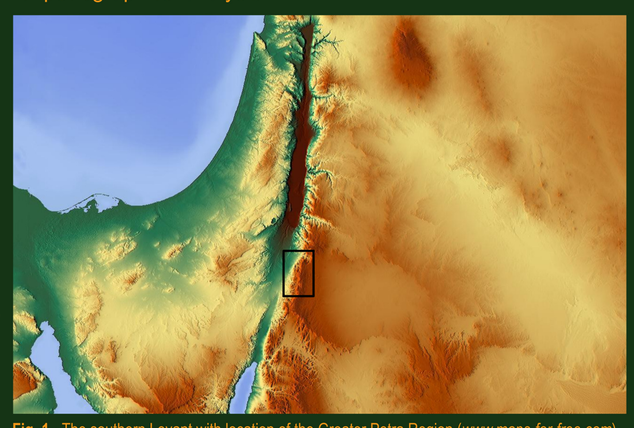

Fig. 1 - The southern Levant with location of the Greater Petra Region (*www.maps-for-free.com*)

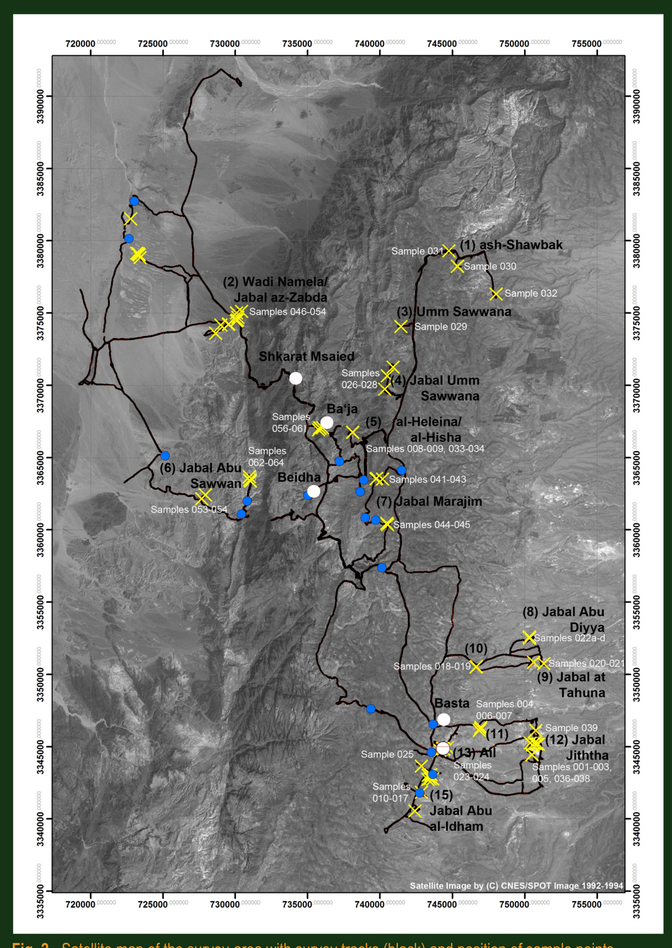

Fig. 2 - Satellite map of the survey-area with survey tracks (black) and position of sample points (yellow crosses); blue circles marks springs (incomplete record); map: N. Rhensius; field records: C. Purschwitz, N. Rhensius, A. al-Suleiman.

		FRMG 1	FRMG 2	FRMG 3b	FRMNG 3D	FRMG 3s	FRMG 3p	FRMG 4	FRMG 5A	FRMG 5b	FRMG 6	FRMG 7	FRMG 8	FRMG 9	FRMG 10	FRMG 11	FRMG 25	FRMG 26	QUARTZITE	ORTOQUARZITE
		frequent / rare																		
	primary	●	●																	
	secondary	○	○																	
Ld	(12) Jabal Jiththa	○	○																	
URC	(1) ash-Shawbak	●	?					?		●										
	(2) Wadi Namela/Jabal az-Zabda		?					●						●						
	(6) Jabal Abu Sawwan	?	?					○	?					○						
	(8) Jabal Abu Diyya	●	?					?						●						
	(9) Jabal at-Tahuna	●			○			?						●	?				○	
	(12) Jabal Jiththa	●					●													
	(15) Jabal Abu al-Idham	●												?						
	(WAT) Wadi Abu Tulayha (NW-Jafr Basin)																	●		
MCM	No flint or other related Raw Materials attested																			
AHP	(11) Road between Basta and Jabal Jiththa																		○	
	(13) Ail																		○	
	(14) Rujm as-Sadaqa																		○	
ASL/ AHP	(3) Umm Sawwana			●									●						○	
	(4) Jabal Umm Sawwana			●									●						○	
ASL	(1) ash-Shawbak			●	●								●			○				
	(2) Wadi Namela/Jabal az-Zabda				○											?				
	(5) al-Heleina/al-Hisha			●	●								●							
	(7) Jabal Marajim			●	●								●		○	○			○	
	(10) Road between Bir Abu Danna and Jabal at-Tahuna			●	●								●							
	(13) Ail			●	●								●							
	(14) Rujm as-Sadaqa			●																
WG	Few Flints (poor quality, no related FRMG identified)																			
WSL	No Flints found during Survey																			
F/H/S	No Flints attested																			
NL	Few Flints (poor quality, no related FRMG identified)																			

Fig. 3 - Surveyed geological formations and attested Flint Raw Material Groups (FRMG). For location of sample areas see Fig. 2.

Results

64 sample points have been recorded during the raw material survey and 234 flint samples were taken from both primary and secondary source areas (Fig. 2). Several FRMGs could be identified within their primary geological settings. These include FRMG 1, 2 (tabular), 3b, 3d, 3p, 4, 5b, 8, and 9 as well as quartzite. Additionally, few flints similar to FRMG 5a, 10, and 11 were found rarely in secondary position. Not attested are FRMG 3g, 6, 7, 25 (pink/ purple flint), 26, and orthoquartzite.

FRMG 3g appears to be a tempered form of FRMG 3d (Purschwitz 2016) and FRMG 5a might be Henrys flint #7 at Ain Abu Nuklayla (Henry et al. 2014), which Henry could identify in URC-layers near Jabal Qalkhan. FRMG 6 (and probably a nodular variant of FRMG 2) might origin in the Negev.

Among the attested FRMG there is a high concordance between geological formation and FRMG (Tab. 2). URC attested flints comprise FRMG 1, 3p, 4, 5b, 9, and 26. ASL/AHP related flints comprise FRMG 3b, 3d, 8 and possibly FRMG 10 and 11. However, there are significant differences in density and regional distribution, particularly for URC-associated FRMG.

Occassionally, flints were also observed at other formations (WG, NL), although they occur in very low density and of poor quality, and do not match any established FRMG. The only exception is Jiththa-Flint (tabular FRMG 2) which is abundantly found - obviously in secondary position - in Pleistocene Lake Sediments (Ld) at Jabal Jiththa. However, its associations with FRMG 1 indicate a former origin from eroded URC layers.

The high degree of correlation of archaeologically established FRMG with specific geological formations of the Greater Petra Region (cf. Fig. 4) makes flint a promising material to study in regard to its acquisition and distribution modes within early Neolithic lithic economies.

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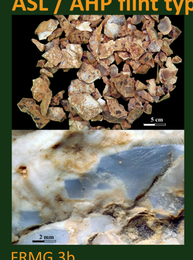
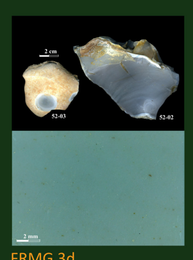
ex oriente

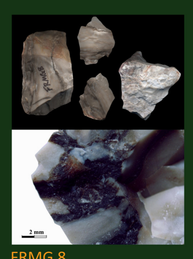
ASL / AHP flint types



FRMG 3b



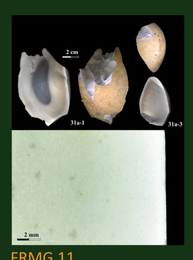
FRMG 3d



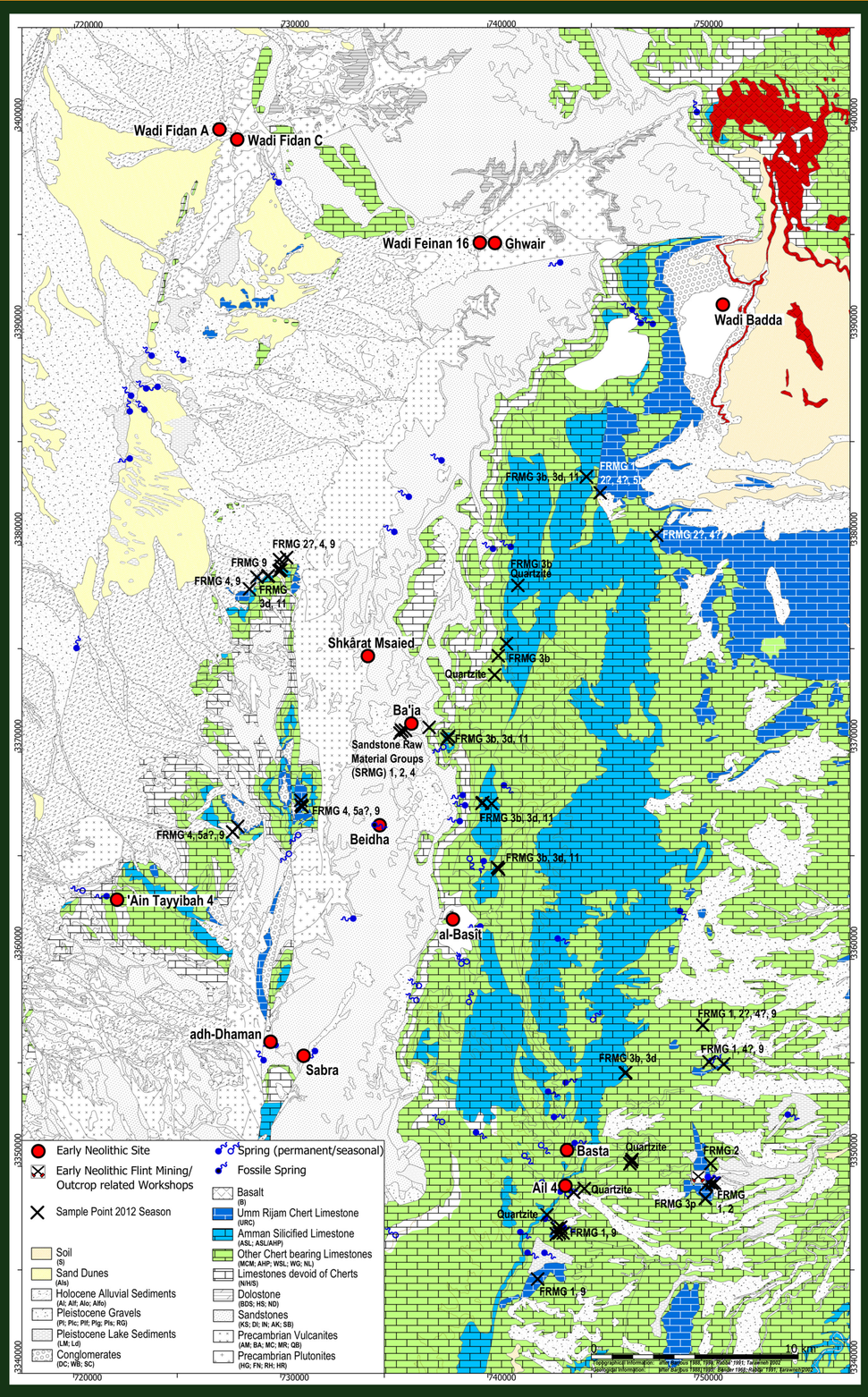
FRMG 8

Probably ASL / AHP flint types (secondary source evidence)

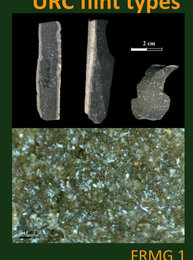
FRMG 10



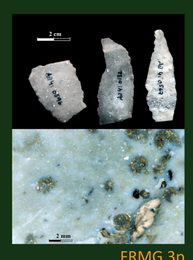
FRMG 11



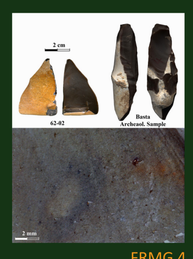
URC flint types



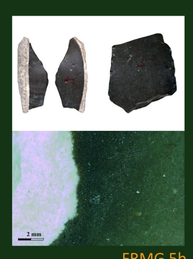
FRMG 1



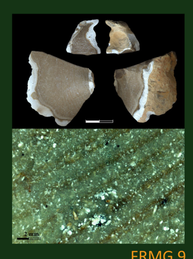
FRMG 3p



FRMG 4

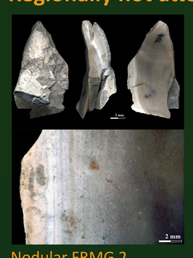


FRMG 5b

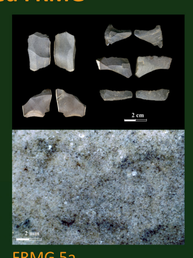


FRMG 9

Regionally not attested FRMG



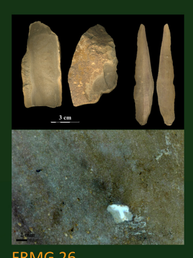
Nodular FRMG 2 (Negev?)



FRMG 5a (Jabal Qalkan?)

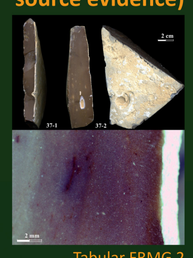
FRMG 6 (Negev?)

FRMG 7



FRMG 26 (Wadi Abu Tulahya)

Probably URC flint types (secondary source evidence)



Tabular FRMG 2 ("Jiththa-Flint")

Fig. 4 - Simplified geological map of the Greater Petra Region with marking of potentially and attested flint-bearing geological formations. The Flint Raw Material Groups (FRMG) are arranged according to their attested or presumed geological origins.

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