JIA 5.2 (2018) 225–239
https://doi.org/10.1558/jia.38017

Journal of Islamic Archaeology ISSN (print) 2051-9710
Journal of Islamic Archaeology ISSN (print) 2051-9729

A Magical Rock Crystal Gem from Apollonia-Arsūf, Israel

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This article discusses an inscribed large crystal rock gem (2.70 x 2.15 x 1.65 cm), retrieved during the excavations at Apollonia-Arsūf. It bears a two-line magical inscription written in linear Kūfic script. It is the first magical rock crystal ever found in a proper archaeological context. Based on its appearance, it can only be vaguely dated between the eighth to the twelfth centuries. A late date would make it contemporary to the associated ceramics in that layer. The relative proximity of the find place to Egypt makes an origin of the talisman from Fāṭimid Egypt likely, as may also be suggested in our analytical appendix.

Early Islamic Arsūf

Arsūf (ancient Apollonia) is mentioned by several Early Islamic authors from the ninth century onwards. According to al-Muqaddasī (d. c. 985 CE) during his lifetime Arsūf was smaller than Yafā, fortified (*haṣīnatan*) and populated (*ʿāmiratan*). He further adds that it was considered to be a *ribāṭ* (a watchstation), where captives of Byzantine ships were exchanged. In that capacity, Arsūf became part of an organized coastal warning system.[1] Arsūf was also part of the country's coastal road network, one day's march to Qayṣāriyya and one day's march to al-Ramla (see in this respect Marmardji 1951, 7, 103, 104; Elʿad 1989, 297). Arsūf also served as an Islamic religious center where a number of scholars congregated for the study and transmission of *ḥadīth*s during the ninth and tenth centuries (Elʿad 1989, 298–301). In 1081 (474 AH) ʿAlī b. ʿAlīm – found his final resting place south of the town. He was conceived as a saint and the Mashhad Sayyidnā

1. For the main Arabic sources relating to the site, see al-Muqaddasī 1967, 174, 177, Le Strange 1890, 399, and Marmardji 1951, 7 (and also pp. 105, 151, 162). A study on Early Islamic Arsūf (based on the written Muslim sources) was published (in Hebrew) by Elʿad (1989, and esp. pp. 297–301; see also Gibb 1960; Gil 1992, 220).

Keywords: talisman, rock crystal, magic, linear Kūfic script, Palestine, Arsūf, Fāṭimid, Crusader, Ayyūbid period

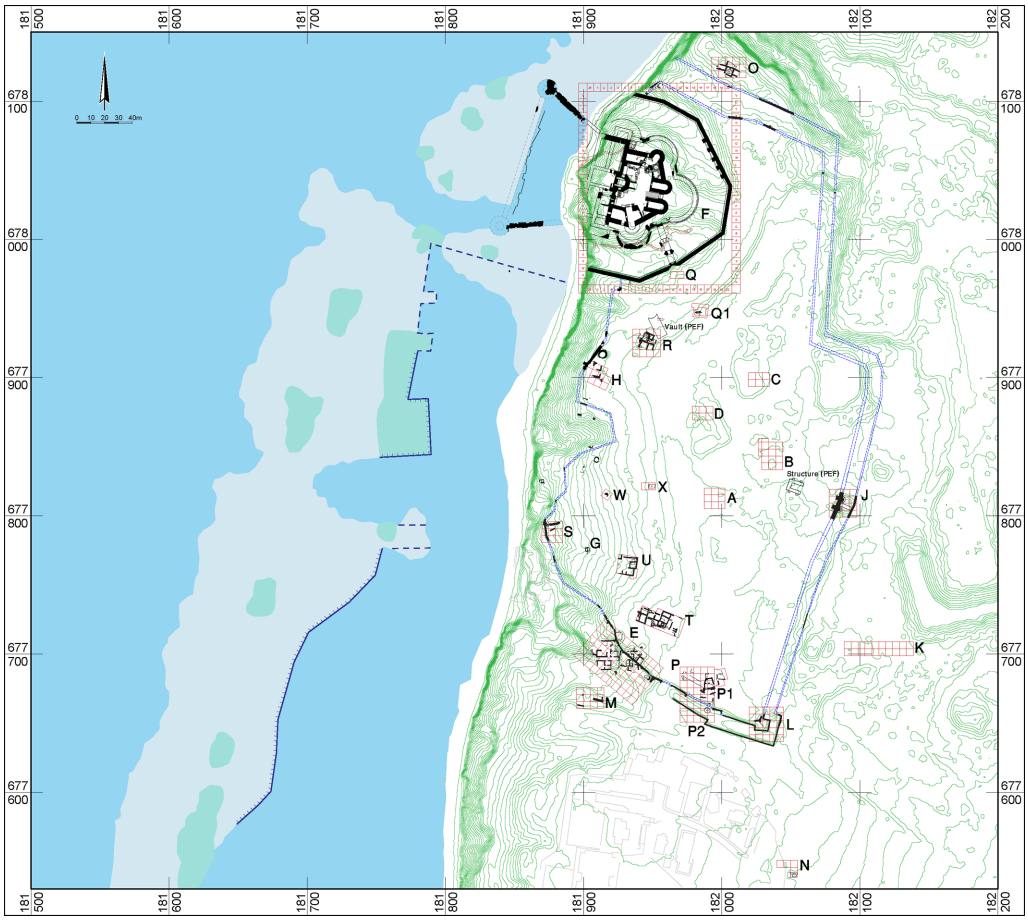

Figure 1. Apollonia-Arsūf: general site plan (drawing: Slava Pirsky).

ʿAlī became a site of pilgrimages until today (Taragan 2004). The historical documentation of Early Islamic Arsūf is supported by several archaeological finds (below).[2] The Fāṭimid coastal town of Arsūf was finally conquered by King Baldwin I of Jerusalem and his army in 1101 CE.

Excavations

Extensive excavations at Apollonia-Arsūf (1977–2016) have uncovered architectural remains of the Islamic and Frankish site. Long stretches of the town wall were uncovered in the southern (Areas L, P and E) and western (Areas S and H) parts of the site and the earliest finds unearthed in the inner adjoining rooms date to the reign of the Umayyad caliph ʿAbd al-Malik b. Marwān (r. 685–705 CE), while the later fortifications show evidence of destruction in 1265 CE.

2. The term "Early Islamic" as an inherent vague character is used as the historical vernacular referring to the authors, spanning the time of the rise of the Islamic Empire and its regionalization from the seventh to the tenth century. Within the field of archaeology it refers to the period between the seventh through the eleventh centuries (c. 638–1099 CE) and follows herewith the accepted periodization system of the Israeli archaeology (cf. e.g. *The New Encyclopedia of Archaeological Excavations in the Holy Land*). The Early Islamic epigraphic evidence of the site was collected and published by Sharon (1997, 112–116).

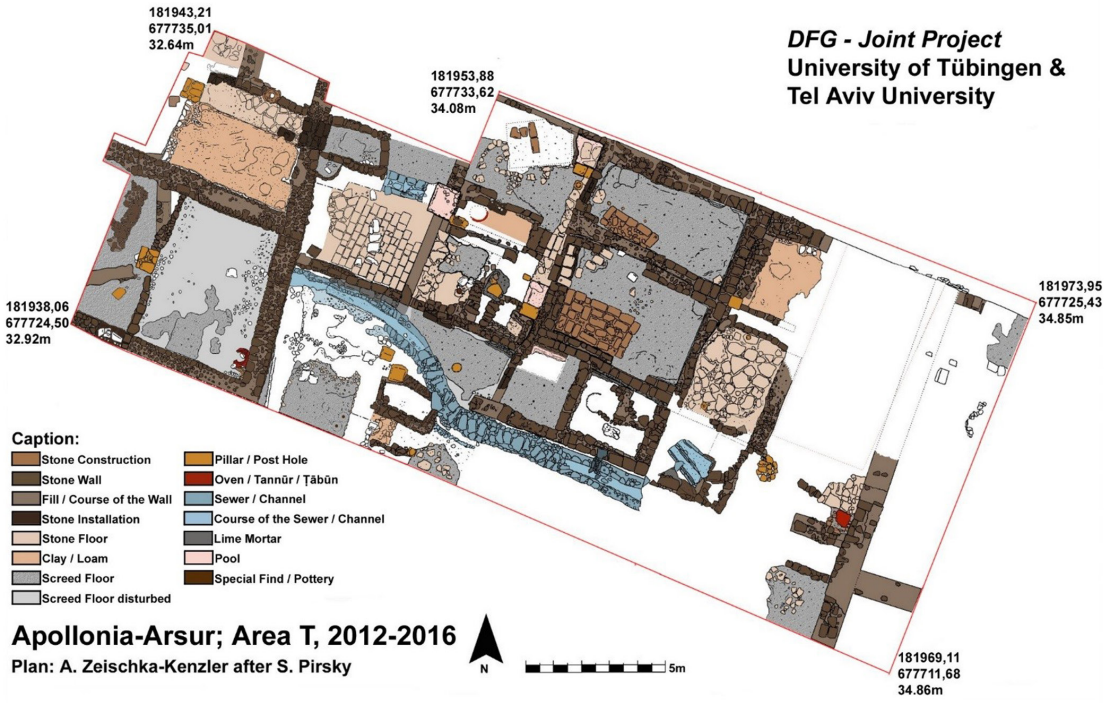

Figure 2. Apollonia-Arsūf: Area T, overall plan, with I5241 after partial dismantle (2012–2016 seasons of excavation; Slava Pirsky and Annette Zeischka-Kenzler).

The initial phase of an Islamic market street (some 65 m long) was excavated in both Areas B and C in the eastern part of the site (Figure 1). Various buildings flanking both sides of the street and serving as shops and food-stalls date to the period between the eighth and eleventh centuries (Roll and Ayalon 1987; 1993).

These architectural remains indicate that Early Islamic Arsūf became fortified, with a large part of it having been rebuilt according to a comprehensive urban plan that existed already in the eighth century, as attested elsewhere in the Levant. Additional architectural remains were discovered also in Areas P1, R, T and U and contribute to the overall understanding of the Early Islamic site plan.

The gem and its archaeological context

The rock crystal gem was unearthed during the 2012 excavation season. It came from Area T,[3] located on the south-western part of the walled medieval town, north of Area E and west of Area P (Figure 1). Excavation in Area T began in 2012 and ended in 2016. An area of 445.50 m² was explored. Excavation in the area provided good evidence on the medieval town development – namely continuity from the Early Islamic phase (ninth/tenth century) to the Mamlūk destruc-

3. Excavations were carried out in the framework of a project funded by the Deutsche Forschungsgemeinschaft: Die kreuzfahrerzeitliche Stadt Apollonia/Arsur in Israel: Struktur—Kulturadaption—Stadt-Umland-Beziehungen, co-headed by Barbara Scholkmann of the Eberhard Karls Universität Tübingen and Oren Tal of Tel Aviv University (GZ: SCHO 520/14–1/14–2). Annette Zeischka-Kenzler was the area supervisor who has also discovered this find. Tamar Harpak was the registrar.

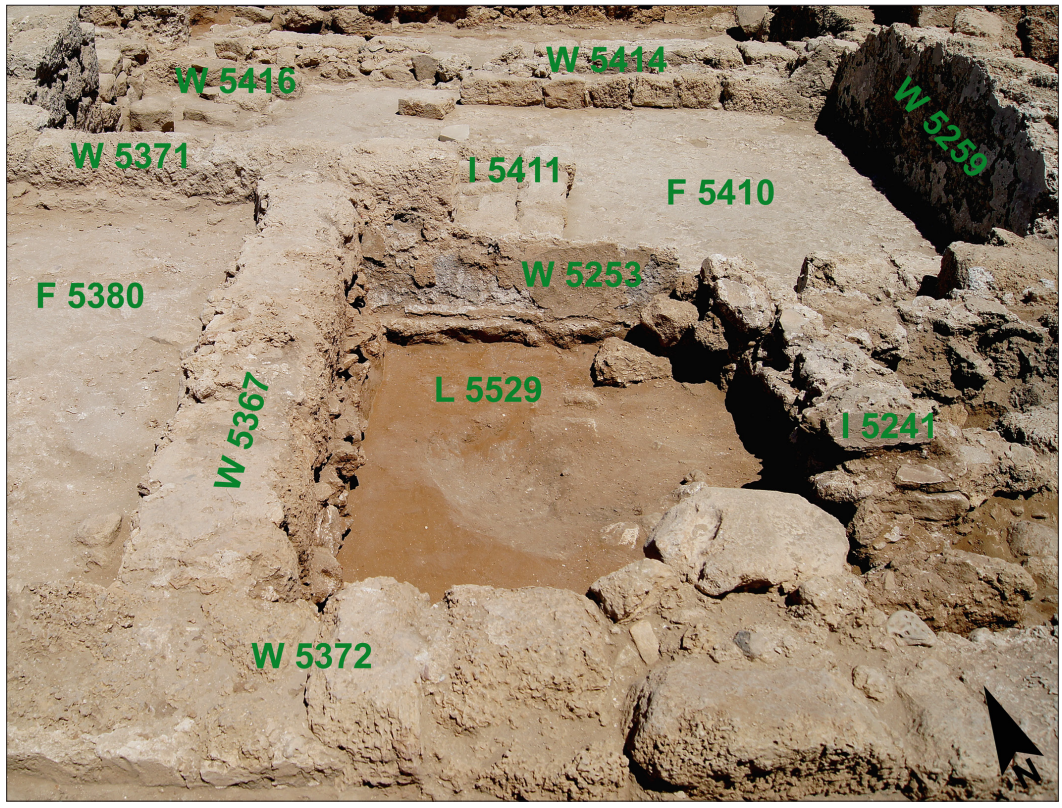

Figure 3. Apollonia-Arsūf. Photograph of I5241 after partial dismantle, looking north (2014 season of excavation; Annette Zeischka-Kenzler).

tion of the town in March-April 1265. The excavations in that area partially unearthed three domestic complexes from the Early Islamic period. The most extensive remains were discovered on the north, where three rooms (two with elevated platforms on the corners), a kitchen area, small plastered pools, a vaulted cesspit and a well-paved courtyard were unearthed. The area's eastern features were largely destroyed, but some architectural remains attest to adjacent dwellings (Figure 2).

With the Crusader occupation early in the twelfth century, some architectural changes in the complexes were made. Nevertheless, the Crusaders just overtake the former structures and adopt them to their use. On the area's southern part a relatively long sewage channel (I5237) in an east-west orientation covered by stone slabs was discovered. It bypasses a cesspit but cuts a screed floor with two big dug-in storage vessels of different types, dated to the tenth/eleventh century. On a whole the domestic complexes features show some regularity with courtyard (open spaces) on their west adjacent to cooking/storage areas. It seems that this section of the town was densely inhabited in the Early Islamic (and probably in the Crusader) period. The pottery finds recovered from the area's Crusader phases reflect use of different wares from the eastern Mediterranean, spanning the Aegean, Anatolia and Cyprus, the Levant and Egypt. Archaeo-zoological remains attest to a significant amount of pig bones in Crusader times (twelfth and thirteenth centuries).

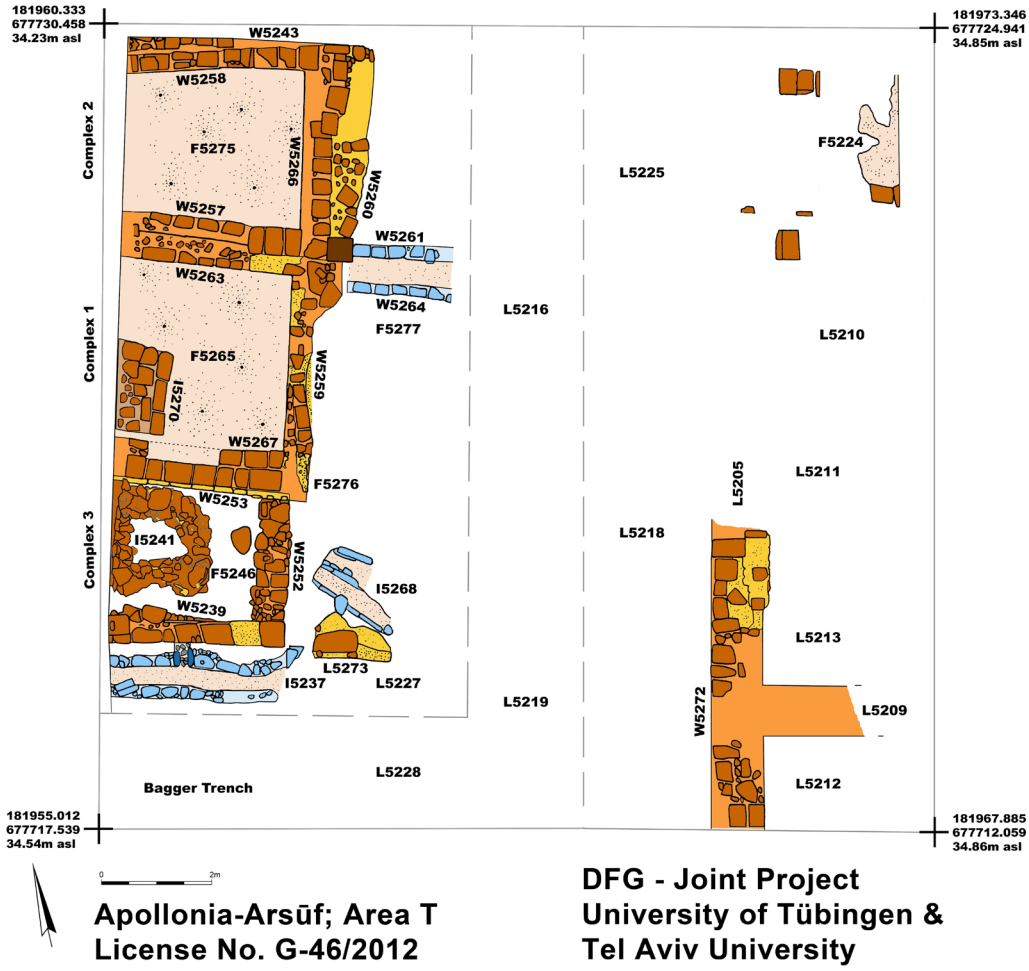

Figure 4. Apollonia-Arsūf. Area T, plan (2012 season of excavation; Slava Pirsky and Annette Zeischka-Kenzler).

A destruction layer with some burnt timbers covered the twelfth century phase in the area. Some balista stones found on that layer may indicate a militant destruction apparently of the Ayyūbid conquest of 1187. On top of this layer a new complex was built in the area's western part. Its orientation is similar but the building technique differs. The complex consists of at least two rooms, a large one (22 m^2) and, a smaller, partially excavated one to its west with a blocked entrance. The area to their north exhibits an elevated platform (some 12 m^2) covered with fine-grained whitish-grey lime-based mortar surface. An alleyway paved by stone slabs leads into a small storeroom. An assemblage of complete and restorable *in situ* pottery vessels, among them a *basmala*-inscribed jug (Tal, Taxel and Zeischka-Kenzler 2018) were recovered from this complex, attesting (together with other finds) an abandonment apparently in the context of the Mamlūk siege of 1265.

The gem (Basket/Reg. No. 52407) originated in the destruction layer of I5241, which is a stone-built installation of a roughly circular shape, set in courses of stones, sand and rubble as

Figure 5. Gem from Apollonia-Arsūf; top) side view; center) upper view; bottom) base view (drawing – Itamar Ben-Ezra; photo – Sasha Flit); (2:1 scale).

binding materials with patches of plaster (Figure 3 and Figure 4). The gem was retrieved from the installation's upper courses. Given its features, the room was identified as a silo (based on the presence of grains and olive pits). Originally, the room had almost the same length as the two adjoining residential rooms with elevated platforms to its north, and contained one or two plastered pools. In either the eleventh or more probably the twelfth century it was divided (W5367) into two units. In the western one, the pool was backfilled and covered by a screed floor. The silo was installed in the eastern unit and destroyed an earlier plastered pool. A small sewer allowed the discharge of liquids into the above-mentioned sewage channel, what makes this unit to be identified as a storage and production facility. Based on its elevation and the few pottery finds recovered in it, it went out of use at the time of the Ayyūbid conquest under Ṣalāḥ al-Dīn (lasting between 1187–1191 CE). Archaeologically, the conquest of the town and its sub-

sequent destruction is well documented in Area T by thick layers of debris with scorch marks, as well as in the adjacent Area E-north (to its south) (see, in this respect, Ayalon, Yehuda and Tal 2013, 280). While we endorse a twelfth century date of use for the gem given its context, we cannot exclude altogether the possibility of an earlier date of manufacture nor the probability that it is an intrusive object given its relative small size and shape. Because of the archaic features of the gem (linear Kūfic script) or similar finds in other archaeological contexts, the object itself does not narrow down this broad dating, based on our current knowledge. According to the stratigraphy the gem's *terminus ante quem* can be placed in the late twelfth century.

The newly discovered rock crystal gem was cut *en cabochon* in a plain-convex oval form with cut angles and a convex bottom (Figure 5; cf. e.g. Porter 2011, 16; and see p. 76, no. 326 for an example). The gem is relatively large—the length of the base being longer than its height. It does not show any traces of mounting, nor has it been drilled as a pendant. Its weight is 13.02 g; maximal length is 2.70 cm; maximal width is 2.15 cm and maximal height is 1.65 cm. It has two engraved lines of linear Kūfic script without diacritical marks on its plain-convex (domed) upper side. The script was engraved in the positive order from the right to the left with a sharp hardened tool (not with a drill, see Appendix). Its letters can be recognized as follows:

Line 1: لسلصكهبعر
Line 2: حعفلمهعطر

Discussion

Ludvik Kalus (1987) and Venetia Porter (2009, 2010) have made significant progress in the study of magical gems and especially rock crystal talismans. Magical gems remain difficult to date. None has ever come from a known archaeological context until the discovery of the present find. The form *en cabochon* is characteristic of Islamic talismanic gems.[4] The linear Kūfic script might have been in use from the eighth to the thirteenth centuries from the Early Islamic up to the Middle Islamic period. Although rock crystal was common in the Late Byzantine period, its manufacture blossomed in Fāṭimid Egypt from the tenth to the twelfth centuries. Fāṭimid art is famous for its large delicate rock crystal vessels and other refined rock crystal objects. The proximity of Palestine to Egypt makes an Egyptian origin of the present talisman likely. A mineralogical characterization does not exclude that possibility (see Appendix). Rock crystal, *ballūr*, was a valuable material believed to have magical powers (Ruska and Lamm 1960; Kiyanrad 2017, 142–149). As *ḥajar al-maṭar* (stone of rain), it was associated with rainmaking, but was also known as having healing properties and associations to paradise (Shalem 1994, 3–5; Porter 2009, 132, 135). The British Museum and other collections, some of them in Israel, keep a small but, nevertheless, significant number of similar shaped amulets *en cabochon*.[5]

Linear Kūfic renders all letters on levelled line, disregarding the conventions of ligature and separation of letters governing Arabic. Linear Kūfic allows multiple layers of meaning, depending on how those letters are grouped into words and how the letters are read giving their polyvalence without diacritical marks. Linear Kūfic was the preferred script of magical objects. Its

4. Sāsānian dome-shaped gems and seals have a different form and their inscriptions and images are usually engraved with drills, see Göbl 1973, 24–25, pl. 40–41.

5. Cf. Derek 1987, 133–137, nos. 100 and 102. Porter 2011, 178–180. For collections in Israel cf. e.g. Amorai-Stark 1993, 167, PBI no. 78; Amorai-Stark and Hershkovitz 2016, 212, no. 192 for cryptic gems written in positive.

use continued probably until the thirteenth century (Porter 2009, 146).[6] Its archaic appearance possibly added to its magical mystique. Talismans were engraved in both the positive and negative form of the script. In either way, they could have been used as magical stones or seals for producing more talismans. The script in the negative (reverse) might even add to its magical properties (Porter 2009, 146–147).

The inscription remains intentionally illegible. Key to the understanding as talisman is the second half of the first line: *ṣād, kāf, hāʾ, yāʾ and ʿayn*. This is only a slightly altered sequence of the usual magical string of letters *kāf, hāʾ, yāʾ, ʿayn, ṣād*. These enigmatic letters (*muqaṭṭāʿāt*) introduce the sūrat Maryam (Q:19). They are repeated on many talismans and regarded as powerful. This and other strings of letters belong to a secret knowledge *al-sīmiyāʾ* or *ʿilm al-ḥurūf* (the knowledge of the letters) (Kalus 1987, 101; Porter 2010, 132). For the rest of the letters, an original meaning can be assumed, but not discerned (Porter 2009, 145). The beginning of the first line might be read as *tubnā* (we have repented) but the common *lillāh* that usually follows is missing. At the end of the first line the letters could be read as *yuʿizzu* (He [God] empowers), overlapping with the magical string. But these suggested readings are just conjectural.

The form and content of the gem are consistent with being a magical talisman. Kalus (1987) and in his wake Porter (2009, 138–142) suggest that some of these objects might be connected with rain making, especially the material *ballūr*, described as petrified rain, might allude to such a purpose. The find spot in a destruction layer of a silo (for grains and/or olives) within a domestic setting and in what we believe is a Frankish (Christian) domestic occupation level is interesting. As stated above, archaeo-zoological finds from the excavations of Area T show considerable presence of pig bones. It is therefore seems likely that the inhabitants of the building prior to the days of the Ayyūbid occupation were most probably Christians. Still, magical practices might have their origin in the believe systems of one religious environment, but talismans as objects of popular magical belief they could have been used by Muslims, Christians and Jews alike. One might speculate about the use of the talisman as a magical work tool for agriculture. But at this stage no such conclusion can be drawn from the first magical rock crystal ever found in an archaeological context.

Appendix

Mineralogical Characterization of the Magical Rock Crystal Gem from Apollonia-Arsūf[7]

Introduction

Quartz is a chemical substance composed of one part silicon and two parts oxygen, known as silicon-dioxide (SiO_2). It has a strong atomic bonds resulting in a crystalline structure built of a continuous three-dimensional framework of Si-O tetrahedrons (SiO_4) (Donaldson and Borm 1998; Rodríguez-Rellán 2016). Therefore, natural quartz is anisotropic material, it is extremely strong in compression; a very hard material (7 on the Mohs scale), and it has good wear resistant combined with brittleness as well as high resistance to chemical dissolution (Deane 2010; Lombard 2011; Peterknecht and Tietz 2011; Ollé *et al*. 2016; Rodríguez-Rellán 2016).

6. The earliest reference for the linear Kūfic as magical script is found in a book from about 655 CE. The Arabic inscribed pottery and glass vessels from the thirteenth century context found at the site appear with *naskhī* script.

7. Dana Ashkenazi, Omri Dvir and Oren Tal.

Quartz does not contain characteristic cleavage planes and therefore its crystalline grains respond to impact with other sediment particles by producing brittle manner fractures (Deane 2010; Tallavaara *et al.* 2010; Peterknecht and Tietz 2011).

During antiquity, properties of raw materials influenced the material selection and the production techniques of manufactured objects (Driscoll 2011; Rodríguez-Rellán 2016). Therefore, different quartz minerals were widely used in ancient times as raw material for the fabrication of small objects such as stone tools (Tallavaara *et al.* 2010; Driscoll 2011; Lombard 2011; Ollé *et al.* 2016). The use of different techniques and tools for the manufacturing of quartz objects can frequently be recognized from the morphology of the surface and the presence of imperfections such as "tool marks" (Sax *et al.* 2008).

Quartz lattice includes contaminations of Al, Fe, Ge, Li, Mg, Ca, Na and K ions (Donaldson and Borm 1998). Presence of such elements may hint at the provenance of the natural quartz raw material.

During the tenth–twelfth centuries CE, prestige artifacts made from a solitary block of rock crystal were manufactured in Egypt using carving and polishing techniques. For that purpose, different traditional tools were used such as a wrought-iron saw, which was used with a mixture of water and abrasive powder. The abrasive material was made of hard stone, such as corundum and diamond. For final polishing of the rock crystal object, a finer and less aggressive abrasive material was employed (Morero *et al.* 2013).

Experimental methods and testing non-destructive testing (NDT) and minimal destructive testing were carried out on the inscribed crystal gem. These included the following methods:

1. Visual testing (VT) of visible details, including tool marks and macroscopic defects that may give clues to the manufacturing process of the examined object.
2. The inscribed crystal gem was analyzed with an environmental scanning electron microscope (ESEM). The measurements were performed at Tel Aviv University with FEI Quanta 200FEG ESEM, equipped with an Everhart-Thonley secondary electron (SE) detector in order to observe microscopic defects and marks that may hint at the manufacturing process of the examined object, as well as the authenticity of the item. NDT chemical analysis of local areas was performed with energy dispersive spectroscopy (EDS) using a Si(Li) liquid-cooled Oxford X-ray detector.
3. The crystal gem was analyzed with laser ablation (minimally destructive) chemical analysis which may hint at the origin of the raw material. In this method, a tiny amount of material is removed from the solid surface by irradiating it with 20 micrometre (μm) laser beam. The measurements were performed at The Hebrew University of Jerusalem, by using an argon fluoride (ArF) excimer laser (wavelength of 193 nm) ablation system (RESOlution M-50), with repetition rate of 8 Hz, fluence of 5 J/cm^2 and spot sizes of 20 μm. The National Institute of Standards and Technology (NIST) standard reference materials (SRM) (NIST SRM 612) were used. The cell was flushed with 6 L/min helium. The element count rate was determined by an AGILENT (7500 CX) ORS quadrupole mass spectrometer with an RF power of 1500 W and injection tube diameter of 2 mm. Data reduction was done with Iolite software (Paton *et al.* 2011), trace element DRS method (Woodhead *et al.* 2007) and NIST SRM 612 (Jochum *et al.* 2011) for element standardization.

Results

Visual testing of the gem revealed it is a well-preserved, colourless and transparent rock crystal item with a slightly cloudy appearance; it bears an inscription on one side. The surface of the entire gem is smooth as typical of polished stones.

ESEM general observation of the two lines of engraved letters (Figure 6) on the left side of the gem revealed tool marks, indicating that the letters were engraved with a hard working tool, which produced letters of a relatively uniform width (between 400–500 µm). ESEM observation of one of the inscribed letters (Figure 7) showed that some of the engraved lines are on top of other engraved lines. Higher ESEM magnification of the letter shown in Figure 7 and its surroundings (Figure 8a) revealed that the surface of the gem outside the engraved letter was polished by abrasive particles (Figure 8b); and the areas inside the engraved letter have rough surface morphology (Figure 8c).

ESEM-EDS chemical analysis of the gem (scanned area of 250 µm x 250 µm) revealed it was made of highly pure SiO_2 (100 at% SiO_2), with a composition of 27.7–40.2 at% Si and 59.9–72.3 at% O outside the engraved letters; and 28.6 at% Si and 71.4 at% O inside one of the engraved letters.

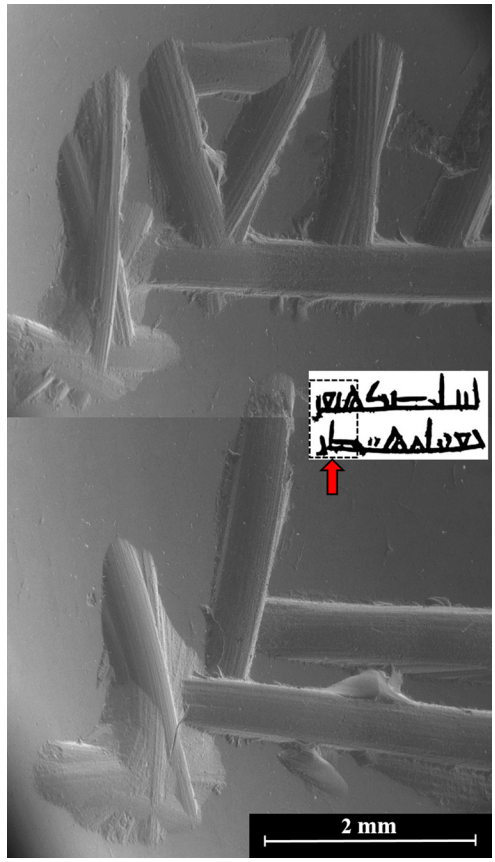

Figure 6. ESEM-EDS general observation of the crystal gem, showing two lines of engraved letters (at the left side of the object, arrow).

Laser ablation chemical analysis of the inscribed object's obverse revealed that the gem was made of SiO_2, with minor amount of Al (194.1±13.9 ppm), Ti (64.3±5.7 ppm), Fe (42.2±2.7 ppm), Li (39.3±3.6 ppm), Cr (6.2±3.1 ppm) and Mn (3.9±1.2 ppm). Laser ablation analysis of the gem's reverse side exhibited similar elemental composition of Al (174.2±15.6 ppm), Ti (71.1±5.1 ppm), Fe (27.2±2.1 ppm), Li (27.4±4.7 ppm), Cr (8.2±2.6 ppm) and Mn (3.1±1.4 ppm).

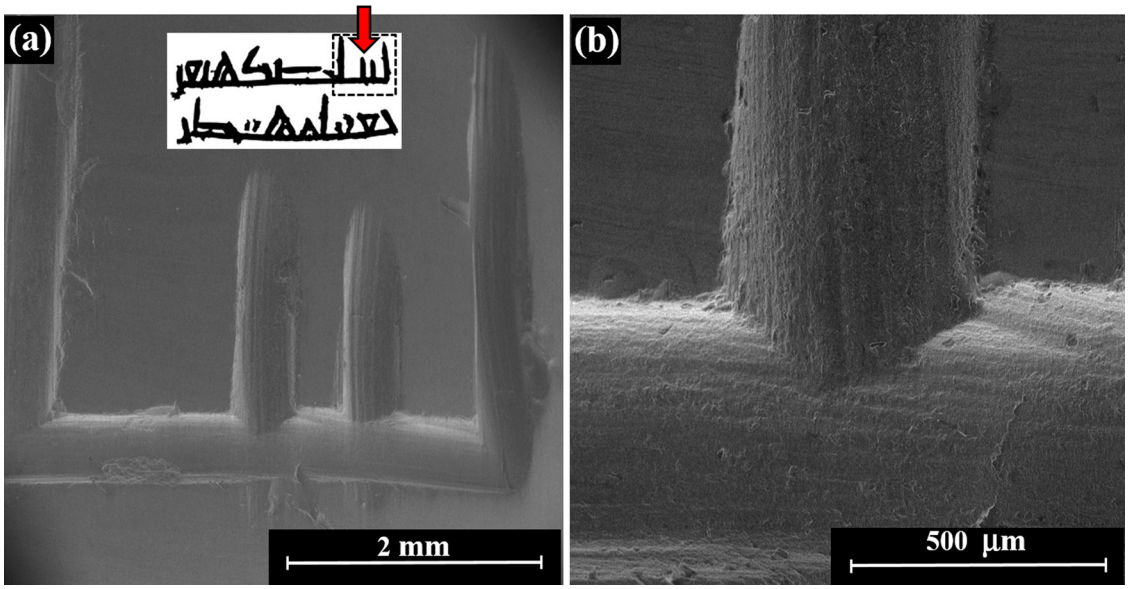

Figure 7. ESEM-EDS examination of the crystal gem: (a) general view of one of the engraved letters (right upper side of the object, arrow); and (b) ESEM higher magnification showing the roughness of the examined engraved letter.

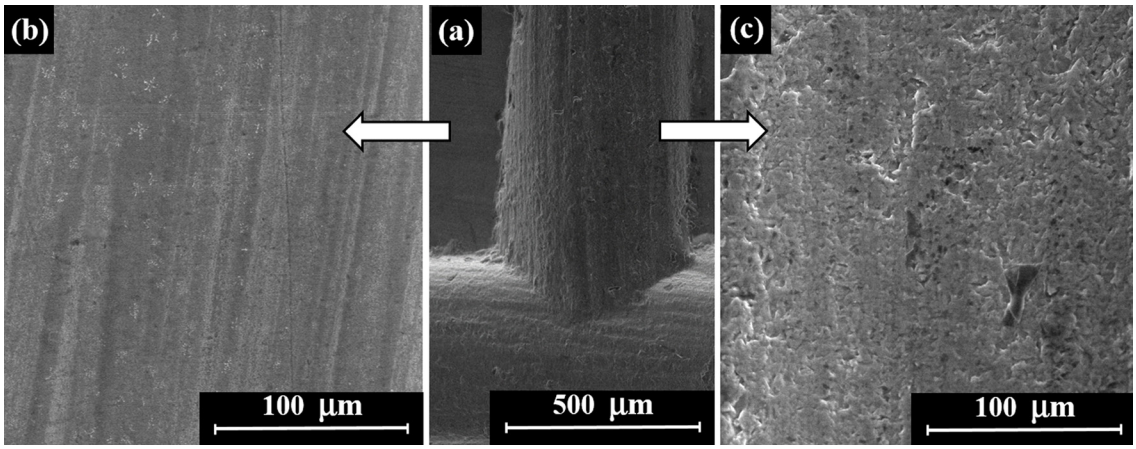

Figure 8. ESEM-EDS examination of the crystal gem: (a) general view of one of the engraved lines (shown in Figure 7); (b) the polished surface of the crystal gem (outside the letter, left arrow) produced by abrasive particles; and (c) the rough surface inside the engraved letter.

Discussion

The inscribed crystal gem from Apollonia-Arsūf was characterized by NDT VT and ESEM-EDS analyses combined with a minimally destructive laser ablation chemical analysis. Quartz was most likely chosen as the raw material for the gem based on its characteristics: transparency and a slightly cloudy appearance combined with mechanical properties, such as high hardness, good wear and high chemical resistance (Deane 2010; Driscoll 2011; Lombard 2011; Peterknecht and Tietz 2011; Ollé *et al.* 2016; Rodríguez-Rellán 2016). Based on the morphology of the surface and the presence of imperfections such as "tool marks" (Sax *et al.* 2008; Morero *et al.* 2013), we learned that the external surface of the inscribed quartz was smoothed with fine abrasives particles, typical of polished stones (Figure 8b). Based on the observed parallel continuous straight lines inside the letters (Figure 7 and Figure 8), the letters were engraved with a hard working tool, probably made of metal (Morero *et al.* 2013), which produced letters of a relatively uniform width (between 400–500 μm). Analysis of the crystal gem revealed it was composed of highly pure silica crystal, with minor amounts of other elements (Al, Ti, Fe, Li, Cr and Mn). The Al, Fe, Li ions are common contaminants in rock quartz crystals, however the presence of the elements Ti, Cr and Mn is less common and may hint at the provenance of the raw material of the quartz (Donaldson and Borm 1998). The pure quartz and the trace element chemistry are evidence of magmatic quartz formation. The relatively high presence of Li and Ti in quartz represents quartz produced by magmatic processes associated with the formation of granites and the high presence of water like pegmatite rocks (Müller *et al.* 2003). There are numerous large igneous provinces in the world; however, the closest sources are located in the Egyptian eastern desert and Sinai desert (Mohamed 1993; Katzir *et al.* 2007).

About the authors

Stefan Heidemann is Professor of Islamic Studies at Universität Hamburg since 2011. Formerly he served as Associate Curator of Islamic Art at the Metropolitan Museum and Professor of Islamic History and Material Culture at The Bard Graduate Center, New York. He received his PhD at the Free University Berlin in 1993 and his Habilitation at Jena University 2001. He has worked with German, British, French, and Syrian archaeological missions.

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