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LATE HELLADIC AND LATER REUSE PHASES OF KASTROULI SETTLEMENT (GREECE): PRELIMINARY DATING RESULTS

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ABSTRACT

A first attempt to date the Kastrouli settlement at Desfina (Delphi Phokis) has been made by optical luminescence dating (OSL) on three ceramic and radiocarbon (C-14) of one bone sample. An initial archaeological reconnaissance of the partially looted site has produced some indication of use during late Helladic and later periods. Our four ages by luminescence and C-14 have shown that this site was used initially in Late Helladic period, and reused during the Middle Geometric, the Early Archaic and the Classical periods.

KEYWORDS: Luminescence, Mycenaean, Late Helladic, radiocarbon, settlement, bone

1. INTRODUCTION

The promontory of Kastrouli is situated in the middle of the Desfina plateau, the so-called Mesokampos, almost 3 kilometers E of the modern village of Desfina in the S-SE of Delphi. The archaeological site has been identified by Dasios (1992, 84), and three Mycenaean graves were partially cleaned and excavated after looting by Sotiris Raptopoulos in the fall of 2005 (Raptopoulos, 2012). Nevertheless, it has never been explored systematically, but only during summer 2016 a new Project has been initiated by the University of the Aegean and the University of California San Diego (Sideris et al., 2016; Levy et al., 2016). (Fig 1)

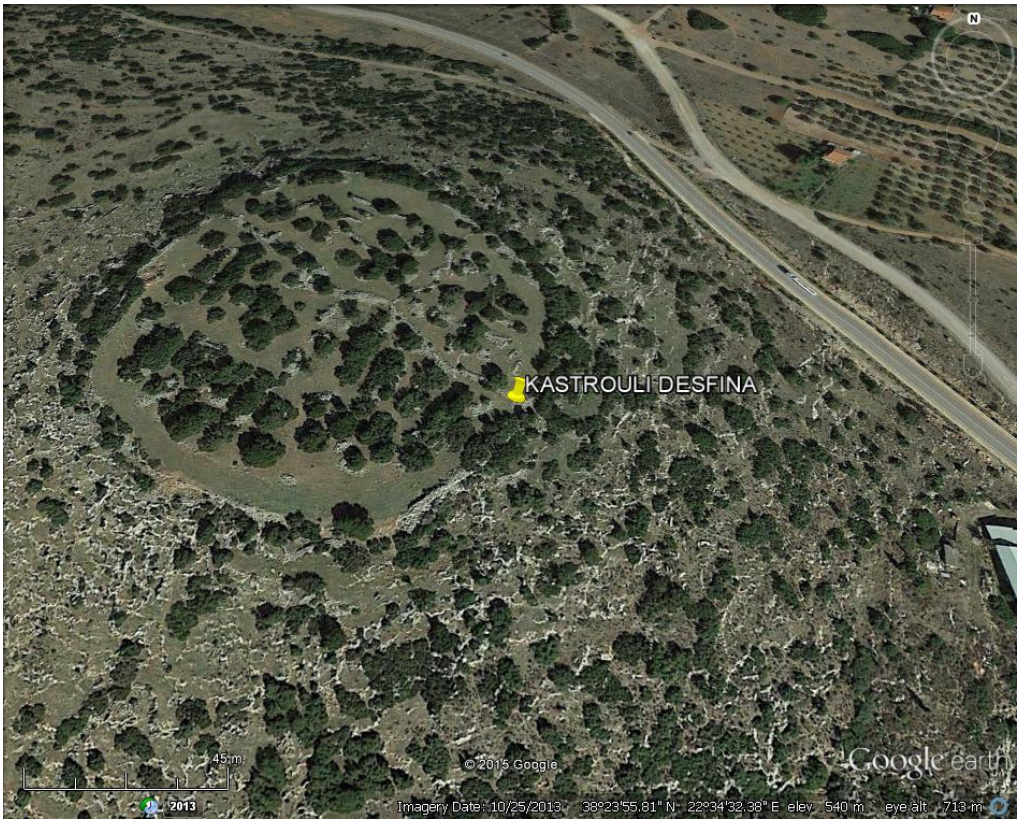


Figure 1: Aerial view from google earth of Kastrouli settlement.

The top of the hill is encircled by a fortification wall, elliptical in plan and made of rough stones, which encompasses an area of approximately 20 *stremmas* (20.000 sq. m). The defensive wall preserved in few courses (max. preserved height 2 m) dates possibly from the Classical period, when Kastrouli was a fort on the boarders between the sacred land, belonging to the Delphic oracle, and the independent city of Antikyra. The sacred land occupied the entire Desfina peninsula and we know its borders only from some Delphic inscriptions of the late Hellenistic and Roman Imperial period (Plassart 1970, 11-14, 55-60; *SEG* 3rd ed. 2. 609-612, 826-827; Ager 1996, 238-247; Rousset 2002, 91-93, 102-105, 120-128, 149-154, 168-69), but we can safely assume that the situation has not changed for centuries, and that the inscriptions describing the borders, according the *hieromnemones*, reflect also the situation during the Classical period, or even earlier. Dasios (1992) in his gazetteer of Phokian sites notes for Kastrouli an uninterrupted sequence of pottery from the Mycanaean to the Roman times.

The wall had only one entrance on its west side, next to a square defense tower, of which only the foundations are preserved (Raptopoulos 2012, 1071). The south wing of the fortification seems earlier, with polygonal masonry and large stones reminiscent of the "Cyclopean" system. At least two tombs were looted between 70s to 90s. The remnants of pottery, unattractive to the looters, led the first excavator to date the tombs in the LH III B2 period (Raptopoulos 2012, 1072). The recent investigation, however, of the tomb A provided proof of long use.

The strategic position of Kastrouli for the control of the Mesokampos plateau, as well as of the entire peninsula, is certainly related to other settlements of the Late Bronze Age in the vicinity. Antikyra itself or one of the adjacent inlets of Agios Isidoros and Steno, if identified with Kyparissos as Pausanias asserts and the scanty finds tend to confirm, was the

main port of the Phokians, from where the fleet of 40 naves navigated to Aulis and then to Troy (Sideris 2014, 24-26, 29-41). The Kastrouli fort controlled in all periods the communication between these two harbors of Itea and Antikyra (Philippson & Kirsten, 1951; McInerney, 1999) (Fig.2).

The importance of Kastrouli led us to initiate a multiscientific and interdisciplinary project. Here are first preliminary data while further thorough results are in progress (Sideris et al., 2016, Levy et al., 2016).

Here the initial preliminary results of a few finds scattered in the site are presented. They consist of three ceramic sherds and one bone.

Figure 2. Central Greece and Peloponnese from google maps. Sites mentioned in the text are shown (Kastrouli, Itea, Antikyra, Mycenae).

2. MEASUREMENTS

2.1C -14 Dating

A single bone sample (right femur) residual of the last looting of Tomb A was collected for radiocarbon dating (Fig.3). The dating of the bone was made by the Italian Center for the Development and Transfer of Innovation for Cultural and Environmental Heritage – INNOVA (Terrasi et al., 2008) (c/o Prof. Filippo Terrasi, Dipartimento di Matematica e Fisica - Seconda Università degli Studi di Napoli, Viale Lincoln 5, 81100 CASERTA, ITALY), as sample code DHS6605. (Fig 4, Tables 1, 2).

TABLE 1 Sample code, C13 and uncalibrated age

Sample Lab Code: DHS6605	
User code:	**KASTR_1**
Radiocarbon age non Calibrated:	**2584±26 yrs BP**
δ13C:	**-22±1‰**

Figure 3. Bone (femur) sampling for C14 dating.

The final obtained calibrated age is 810-760 BC which corresponds to the Greek Middle Geometric period (900-700 BC).

TABLE 2 Ages per probability errors (Based on intcal13.14c # Reimer et al. 2013)

confidence level			cal AD/BC age ranges		relative probability
68.3 (1 sigma)	cal	**BC**	**801**	**781**	100.0%
95.4 (2 sigma)	cal	**BC**	**810**	**760**	99.7%
		BC	**677**	**675**	0.3

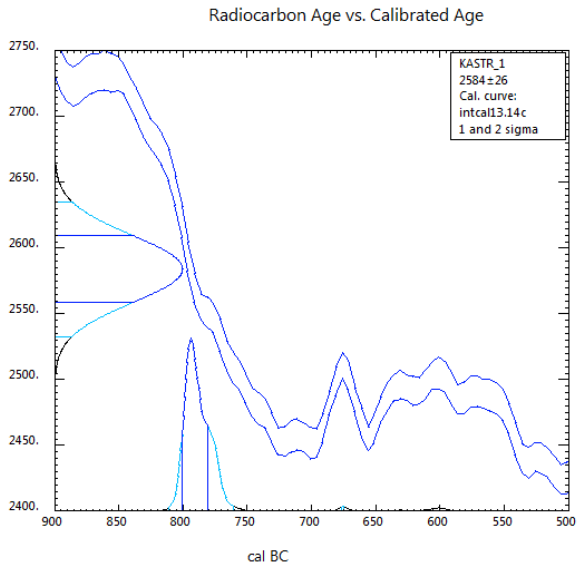


Figure 4 C-14 calibration curves for sample KASTR-1 and probabilities

3. FIRST OSL DATES OF CERAMIC SHERDS

Three (3) surface scattered ceramic sherds were sampled together with surface soil for OSL dating (Fig. 5).

That aim was to provide a preliminary age of non diagnostic ceramic sherds to evaluate the possible occupational phases of the site. The three samples labeled DK-3, DK-5, DK-6 were measured at Hefei and the results of equivalent luminescence dose (De), the Uranium and Thorium concentration, the dose rates and resultant ages are given in Table 3.

Figure 5. The three ceramic sherds dated by OSL.

Table 3 OSL data of three ceramic sherds.

Sample No.	De (Gy)	Pottery sherds			Soil			Dose rate from sherds (Gy/ka)	Dose rate from soil (Gy/ka)	Dose rate (Gy/ka)	Age (ka), BP
		U (ppm)	Th (ppm)	Potassium (%)	U (ppm)	Th (ppm)	Potassium (%)				
DK-3	9.90±1.45	2.80	14.67	1.75	4.80	10.70	2.40	2.50	1.59	4.09	2.42
DK-5	12.82±1.28	2.12	6.79	2.42	4.80	10.70	2.40	2.44	1.59	4.03	3.18
DK-6	10.96±1.84	2.43	6.16	2.48	4.80	10.70	2.40	2.49	1.59	4.08	2.69

The environmental dose rates were derived from measured radioactive element concentrations and radioactivities (Liritzis et al 2013). The U, Th and K contributions of ceramics were obtained using ICP-MS a Thermo Scientific company, XSERIES 2 MS, and X-ray florescence (XRF-1800 SHIMADZU Company) at the USTC Instruments' Center for Physical Science, respectively. Alpha efficiency 0.03 was adopted as suggested by Mauz. et al (2006) when calculating the fine-grain dose rate (Polymeris et al., 2011). The environmental radioactivity of sediment was measured by thick source alpha counting pairs

technique that provided U=4.80±0.18, Th=10.70±0.8 and potassium K-40 by XRF (K=2.4%) (Liritzis & Vafiadou 2012) The value of 21mGy/yr was used for cosmic contribution. Water contents were taken as 10±5% for all samples as an average during the burial period. (Fan et al., 2015)

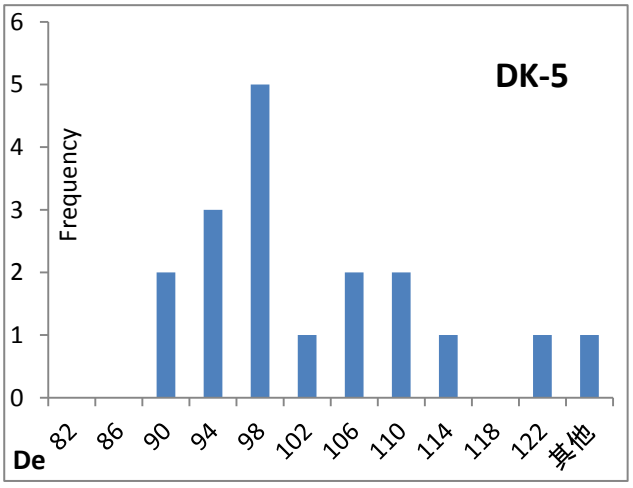
The equivalent doses measurements were carried out using a Risø automated TL/OSL system (TL-DA-20) with a single-grain attachment in the Archaeometry laboratory at University of Science and Technology of China (USTC). The single aliquot regeneration (SAR) protocol formalized by Murray and Wintle (2000) was used for De determination. Fine grain (4-11um) fractions were extracted from the three potsherds for OSL measurements.

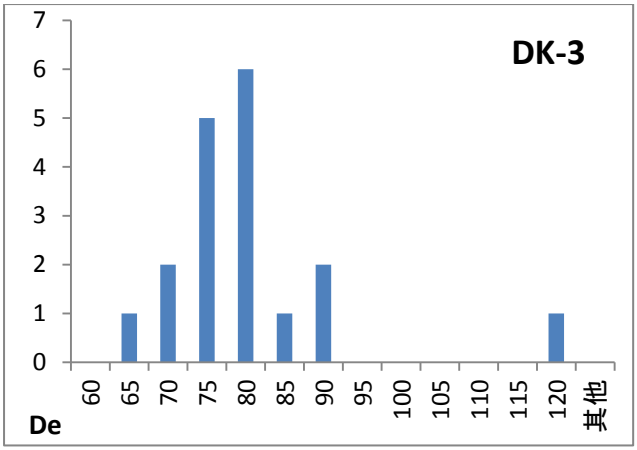
Figures 6 show the frequency plot of De expressed in dose rate in seconds of beta source irradiation time (0.127 Gy/sec) per sherd for three measured sherds: DK-3, DK-6, DK-5 (DK stands for Desfina the nearby town and Kastrouli site). Errors range between 10-16%, expressed as the standard deviation σ, where x is the measured dose, μ the mean weighted value and N the number of readings (the frequency of measured aliquots in Figs.6) (eq.1)

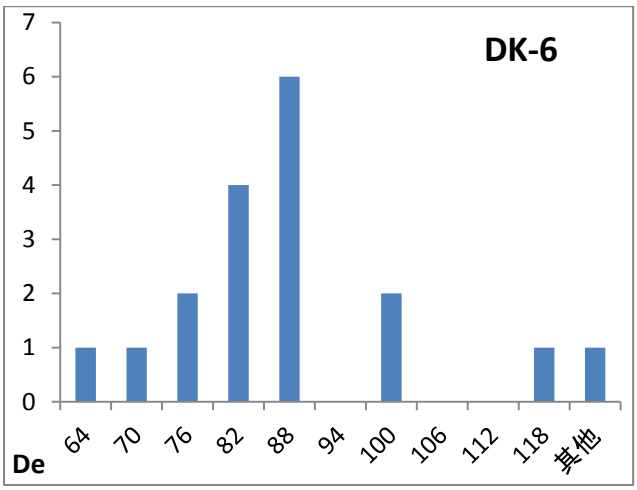
$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{N}} \quad (1)$$

Errors attached to radioactivity measurements, water uptake, internal quartz radioactivity amount to about 7%.

The so far preliminary results of luminescence dating indicate a span of ages during the 1st millennium BC. Within the overall error bars (~10%) the ages 1180 BC, 690BC, 420 BC indicate the periods of first occupation during Late Helladic, then use of the site during Geometric/Dark Ages and Classical/Hellenistic times.







Figures 5 De the equivalent dose, as irradiation time in seconds (0.127 Gy/sec), versus, frequency for DK-5, DK-3, DK-6 potsherds.

4. DISCUSSION - CONCLUSION

The Kastrouli fort in Desfina near Delphi presents a significant site from the first visual relics- scattered artifacts and architectural remains. Amongst others, pottery, grinders, and exceptional sparse ore lumps are found scattered in the surface. For the latter a piece of such an ore analysed by XRF was identified as Fe rich ore piece of slag (with Fe and Ti). Three ceramic sherds and one bone have dated indicating reuse of the site from Late Helladic to Classical period. The large errors especially with the total doses in OSL renders accurate dating with narrower range rather difficult. However, the present data confirm initial archaeological typological evaluation. The central age value for the earlier OSL date coincides with LH III C (early) though within the errors the span covers LH III B-C or the Protogeometric period. The LH III B-C reflects the end of the Mycenaean civilization which fell in the same period when many other civilizations in the Mediterranean crumbled, called the Late Bronze Age collapse. Various possibilities, like natural disasters such as earthquakes, drought, have been put forth as explanations for the

Mycenaean collapse. Here Kastrouli seems to follow up possibly in the Protogeometric and certainly in the Middle Geometric, the Early Archaic and the Classical periods. More detailed luminescence and C-14 ages are needed to examine exact time gap between LH III C and later occupation.

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