

KADERO

Comments on radiocarbon dates

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Introduction

Radiocarbon dates from the site at Kadero (Central Sudan) are based on 14 samples made in different periods in four different laboratories - Trondheim (T), Köln (KN), Dallas (SMU) and Poznań (Poz) (Table 1). Dates obtained from laboratories of Trondheim, Köln and Dallas are conventional ones, whereas those from the Poznań Radiocarbon Laboratory are AMS dates.

In most cases the material dated consisted of freshwater mollusk shells, in 6 samples described as 'Nilotic bivalves' (Krzyżaniak 1982:38). Two other samples consisted of shells of *Aspatharia* Sp. Two further dates were made on charcoal and in the case of last two, made in Trondheim it is not specified in publication what was submitted for dating - charcoal or shells (Haaland 1987). Of the 14 samples 6 come from graves and 8 from the settlement middens.

The calibrated ^{14}C dates shows a substantial spread of dates within the range of ca. 5000 years BC¹. That is due to 2 much younger AMS dates made on charcoal (Table 1). The youngest came from grave 132 where only undetermined human bones were found. The date - 370±40 years AD (Poz-4164) points to the Late Meroitic or Post Meroitic Period. The second date comes from grave 243. It contained human bones of undetermined sex and age only. Charcoal from the

grave gave a date of 2760±80 years BC (Poz-4308) which would place that inhumation in the terminal Neolithic Period.

The remaining twelve dates are related to the main occupational phase recorded at Kadero, namely to - to Neolithic Period. The dates range from ca. 4600 to 3800 years BC covering most of the Early and Late Neolithic of Central Sudan (Fig. 1).

Radiocarbon chronology of the Neolithic occupation at Kadero

The twelve dates related to the Neolithic phase came from different archaeological contexts. Eight dates from materials were made within the settlement (Table 1): five came from the northern part of the site (Northern midden) while three others from the southern extension of the occupation area were made the so called Southern midden.

The distribution of dates points to a chronological diversity of both middens. The settlement remains recorded within the Northern midden are considerably older and related to the Early Neolithic phase (Fig. 2). Occupation starts here around 4600 years BC and continue to ca. 4300-4200 years BC. The oldest date from this part of the site is 4560±110 BC (T-2188) and the youngest 4210±100 years BC (KN-2823).

After 4300/4200 BC the northern part of the site was most probably abandoned and the settle-

1 All the age determinations used in this text are calibrated dates BC with the exception of date from grave 132 that is an AD one. Calibration with CalPal, version March 2007 (Weninger, Jöris 2007; Weninger et al. 2007).

Table 1. List of radiocarbon dates for Kadero site.

No.	Lab. No.	Radiocarbon age BP	Calibrated age BC	Location	Material dated	References	Remarks
1	Poz-4164	1660±30	370±40 (*)	grave 132	charcoal		Late Meroitic Period (?)
2	Poz-4308	4150±30	2760±80	grave 243	charcoal		terminal Neolithic (?)
3	T-2189	5030±70	3830±90	settlement, Southern midden	shell (Nilotic bivalves)	Krzyżaniak 1982	
4	T-2188	5260±90	4110±110	settlement, Southern midden	shell (Nilotic bivalves)	Krzyżaniak 1982	
5	SMU-482	5280±90	4120±100	settlement, Southern midden	shell (Nilotic bivalves)	Krzyżaniak 1982	
6	Poz-4057	5380±40	4230±80	grave 203	charcoal		
7	KN-2823	5380±65	4210±100	settlement, Northern midden	shell (Nilotic bivalves)	Krzyżaniak 1982	
8	Poz-4165	5415±40	4290±40	grave 202	shell of <i>Aspatharia</i> Sp.		
9	T2189	5460±70	4310±70	settlement, sq. C-15, Northern midden	charcoal/shell ?	Haaland 1987	
10	KN-2821	5500±70	4360±70	settlement, Northern midden	shell (Nilotic bivalves)	Krzyżaniak 1982	
11	Poz-4012	5550±35	4400±40	grave 202	shell of <i>Aspatharia</i> Sp.		
12	Poz-4014	5565±35	4410±40	grave 220	shell of <i>Aspatharia</i> Sp.		
13	KN-2822	5610±55	4440±60	settlement, Northern midden	shell (Nilotic bivalves)	Krzyżaniak 1982	
14	T-2188	5700±100	4560±110	settlement, sq. C-12, Northern midden	charcoal/shell ?	Haaland 1987	

(*) calibrated age AD

ment was moved to the south where the occupation continued until ca. 3800 BC. The oldest date from the Southern midden is 4110±110 years BC (T-2188) while the youngest is 3830±90 years BC (T-2189).

Besides the dates from the remains of the settlement, four dates were obtained from three graves. The oldest date, from *Aspatharia* Sp. shell - 4410±40 years BC (Poz-4014) came from grave No. 220. It contained bones of a small child (Infant I) and analysis of the grave inventory points toward the Early Neolithic phase.

Two samples of *Aspatharia* Sp. shell from grave 202 gave dates of 4400±40 years BC (Poz-4012) and 4290±40 years BC (Poz-4165) respectively. The grave was the burial of a small child (Infant I) and furnished with pottery that suggest a Late Neolithic chronology of the grave.

The last analysis was made on charcoal taken from the grave 203 and it is dated to 4230±80 years BC (Poz-4057). Also this grave is an inhumation of a child (Infant I) and the inventory found in the grave pit strongly suggest the Late Neolithic period.

Plotting the dates from the graves against chronology of the settlement (Fig. 3) suggest a contemporaneous use of the cemetery with the occupation of the Northern midden and with the beginning of occupation of the Southern midden. However very limited number of available dates from the cemetery (6 dates), as compared to total number of graves found (248 burials), force us to consider this hypothesis with caution. The dates from inhumations correlated with the inventories indicate ca. 4300 years BC as a border between Early and Late Neolithic.

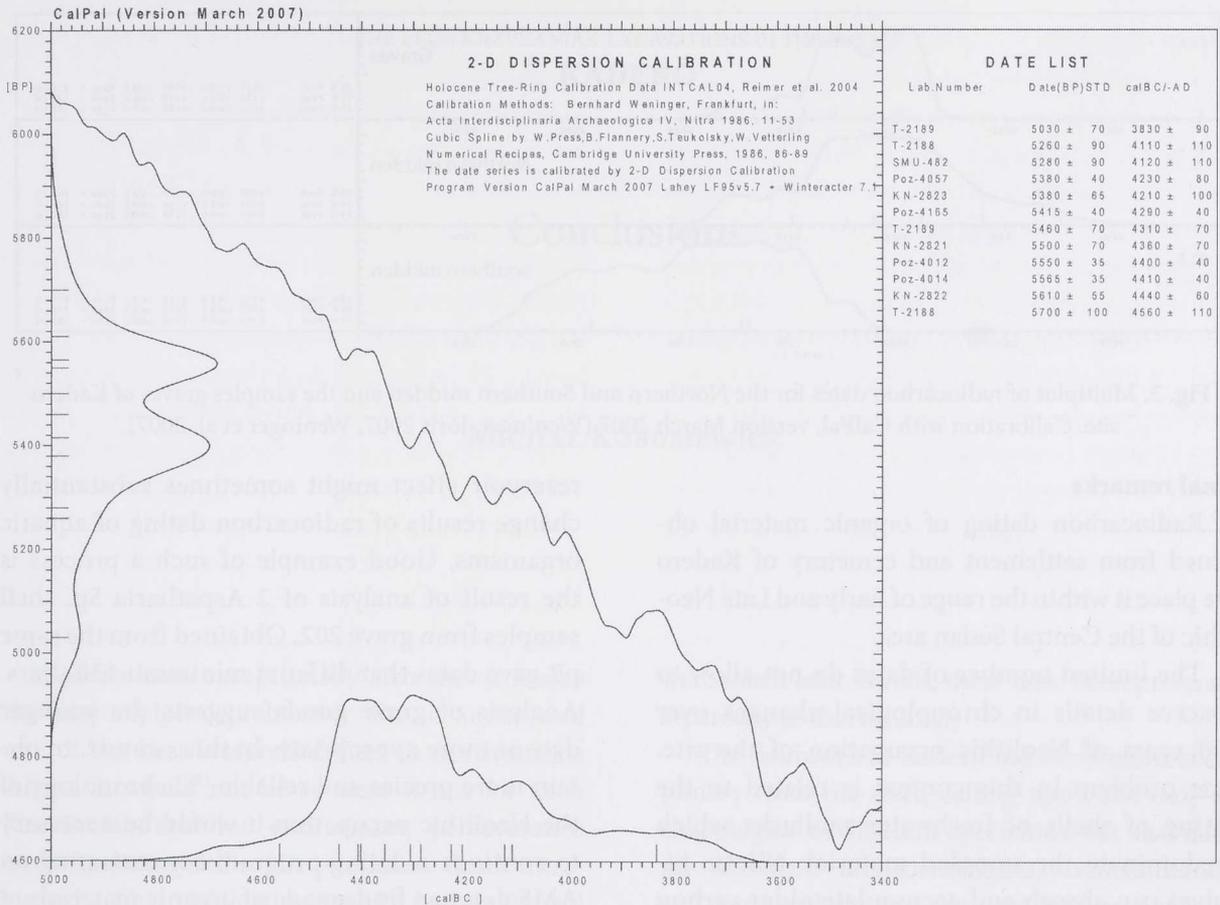


Fig. 1. Calibration of dates from Neolithic occupation at Kadero. Calibration with CalPal, version March 2007 (Weninger, Jöris 2007; Weninger et al. 2007)

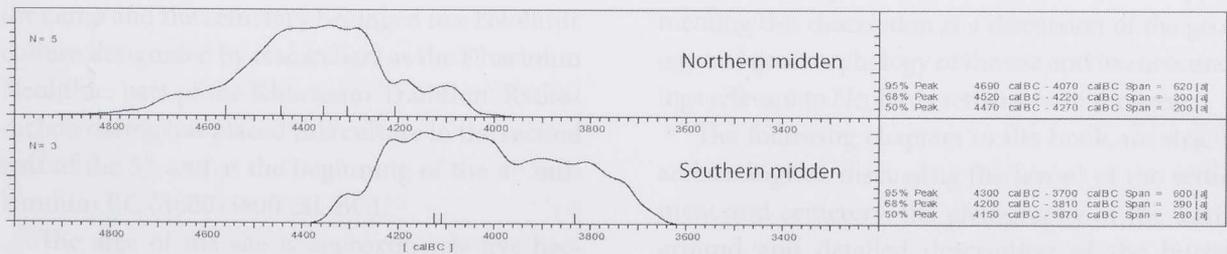


Fig. 2. Multiplot of radiocarbon dates for Northern and Southern midden of the Kadero site. Calibration with CalPal, version March 2007 (Weninger, Jöris 2007; Weninger et al. 2007)

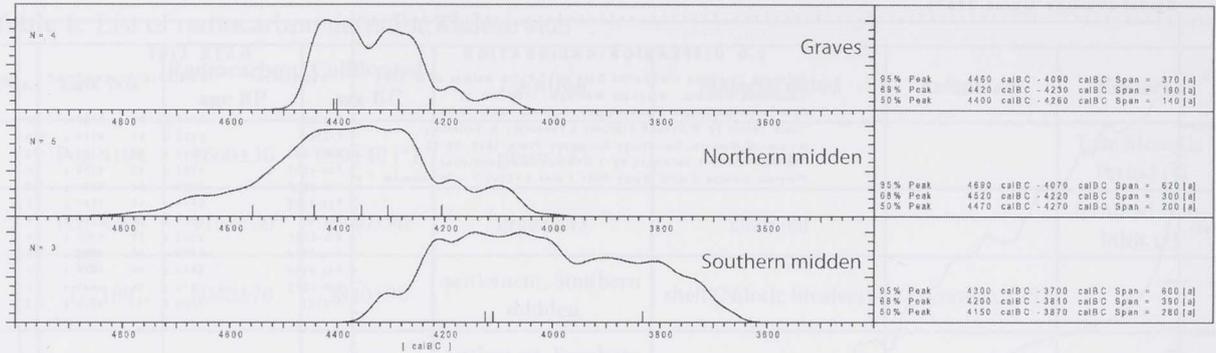


Fig. 3. Multiplot of radiocarbon dates for the Northern and Southern midden and the samples graves of Kadero site. Calibration with CalPal, version March 2007 (Weninger, Jöris 2007; Weninger et al. 2007).

Final remarks

Radiocarbon dating of organic material obtained from settlement and cemetery of Kadero site place it within the range of Early and Late Neolithic of the Central Sudan area.

The limited number of dates do not allow to observe details in chronological changes over 800 years of Neolithic occupation of the site. One problem in this context is related to the dating of shells of freshwater mollusks which predominate the sampled material. Nilotic bivalves can absorb and accumulate older carbon dissolved in and carried by Nile waters. That

reservoir effect might sometimes substantially change results of radiocarbon dating of aquatic organisms. Good example of such a process is the result of analysis of 2 *Aspatharia* Sp. shell samples from grave 202. Obtained from the same pit gave dates that differ at minimum 130 years. Analysis of grave goods suggests the younger date as more appropriate. In this context, to obtain more precise and reliable ^{14}C chronology of the Neolithic occupation it would be necessary to continue a dating program concentrating on AMS dates on finds made of organic materials of terrestrial origin.