Tomb of İsa Sofi with Shamanastic Motifs: Plaster Characterization and C-14 Analysis

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Research Paper

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Şamanistik Bezemeleriyle İsa Sofi Türbesi: Sıva Karakterizasyonu ve C-14 Analizi*

Tomb of İsa Sofi with Shamanastic Motifs: Ğlaster Characterization and C-14 Analysis

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Özet

Bilecik ili, Söğüt ilçesi, Borçak köyü sınırları içerisinde yer alan İsa Sofi Türbesi'nde 2018 yılında restorasyon çalışmaları yapılmıştır. Bu çalışmalar kapsamında gerçekleştirilen sıva raspası sonucu, türbe duvarlarında Gök Tanrı inancına yönelik Şamanist bezemeler tespit edilmiştir. Bu çalışmada, sıva ve boya tabakalarının niteliği ve bu tabakalardan yola çıkarak bezemelerin yapım dönemini belirlemek amacıyla gerçekleştirilen analizlere yer verilmiştir. Türbe'den alınan sıva ve boya örneklerine; malzeme niteliğini belirlemek için kimyasal analizler ile XRF, SEM –EDS gibi ileri teknik analizler uygulanmış, tarihlendirme amacıyla radyokarbon yaş tayini yapılmıştır.

Sıva örneğinin üzerinde görsel analiz, basit spot testler, kızdırma kaybı, asit kaybı ve asitle reaksiyona girmeyen agregaların stereo mikroskop altında görsel analizleri ile agrega/ bağlayıcı türü ve oranları belirlenmiştir.

Sıva üzerinde bulunan boya tabakasının kimyasal içeriğinin tespiti için ise p-XRF cihazı ile analiz yapılmıştır. Ayrıca numunenin SEM görüntüsü alınarak EDS analizi ile elementel içeriği belirlenmiştir.

Yapıdan örneklenen kıtıklı (hayvan kılı) sıva numunesi üzerinde C-14 tarihlendirmesi yapılmıştır. Harcın içindeki kıtıktan yola çıkarak gerçekleştirilen analizle numune 18. veya 19. yy'a tarihlendirilmiştir. Bu tarihlendirmeden dolayı türbe içindeki bezemelerin günümüze yakın bir dönemde yapıldığı sonucuna varılmıştır.

Anahtar Kelimeler: Restorasyon, Sıva Analizi, Radyokarbon Yaş Tayini, SEM-EDS, p-XRF

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Abstract

As a result of the plaster scraping within the scope of the restoration works on The Tomb of İsa Sofi, located within the borders of Bilecik province, Söğüt, Borcak Village carried out in 2018, shamanistic motifs related to the belief of Sky God Tengri have been identified. In this study, the analysis made for determining plasters and paint layers quality and the production date of motifs based on these layers are explained. C-14 analysis was carried out for dating the plaster and paint samples taken from the tomb. To determine the quality, chemical analyses and advanced technical analyses such as XRF, SEM-EDS were carried out.

The aggregate/binder type and ratios were determined on the plaster sample, loss on ignition analyses, simple spot tests, reaction with acid and visual analysis of the aggregates that don't react with acid under the stereo microscope.

p-XRF analysis was performed to determine the chemical content of the paint layer on the plaster sample. Also, SEM image of the plaster sample was taken and elemental content was carried out with EDS analysis.

C-14 dating on the mortar sample taken from the building was based on the tow (animal hair) in the morter. As a result of the C-14 dating, it was determined as the 18th-19th century. Based on this analysis, it was concluded that the motifs inside the tomb were made recently.

Key Words: Restoration, Plaster Analysis, Radiocarbon Dating, SEM-EDS, p-XRF.

Introduction

Very little scientific research has been conducted on this tomb, which is referred to in sources as the Tomb of İsa Sofu, İsa Sofi, and İsa Dede. This tomb was constructed in the style of Early Ottoman architecture and features pre-Islamic ornamentation. In addition to the tomb analyses presented here, a limited number of scientific publications and research discovered through a literature review are also included. The building's construction date is depicted on the decorations. One of the objectives of the investigation is to determine whether the structure was constructed as early as the 14th century or more recently. Based on the plaster sample taken from the tomb, the characterization of the material was determined through chemical analysis, and radiocarbon (C-14) dating was performed.

1. İsa Sofi Tomb

The tomb is located nine kilometres east of the centre of Söğüt, province of Bilecik. It is situated on a steep hill to the north of the village of Borcak (Figure 1). According to the "Foundation Monuments and Ancient Artefacts in Türkiye" by the General Directorate of Foundations, the tomb belongs to a person named İsa Dede, but it is unknown when and by whom it was constructed. Nonetheless, it is believed that this structure also dates to the early Ottoman period (General Directorate of Foundations, 1977: p.99). Due to the absence of an inscription on the tomb, it was attempted to be dated based on the architectural features of the building; it was described as a classical Turkish-Islamic structure from the 14th century and the Early Ottoman Period due to its square plan, rubble stone walls, octagonal pulley, and brick dome. Although a zawiya in Söğüt and its villages is identified as the İsa Sofi Zaviye Foundation in the 1860 record of the General Directorate of Foundations (Aydn and Aydn, 2021: p.181), there is currently no structure surrounding the tomb (Figure 1).

Although the architecture of the tomb resembles Early Period Ottoman tomb architecture, the decorations-that emerged after plaster scraping done during the restoration work initiated in 2016, after its destruction by treasure hunters-do not resemble their contemporaries or any other tombs in Anatolia. Various techniques were used to apply stone, wood, tiles, and plaster to the architectural decorations of the Early Ottoman Period. Stone decoration, openwork with plaster, and malakari are some of the most employed decoration techniques of the period. The hand-drawn ornaments featured floral motifs from the Hatayî group, motifs such as vases and columns, rumi on the free-curved branch, and inscriptions embellished with curved branches (Demiriz, 1979: p.24).

The Tomb of İsa Sofi stands apart from its contemporaries in terms of decoration technique and motifs. It is believed that the hand-drawn decorations in the tomb are completely distinct from the botanical and geometric motifs used by contemporary architects and artists, which originated from the belief in the Sky

God (Gök Tanrı). All walls of the tomb and the skirts of the dome are predominantly decorated with red and grey colours (Figure 2).

Shamanic motifs are used to explain topics such as the Turkish universe narrative, the ascension of the shaman, and the tree of life in the tomb's interior decorations (Arıkan, Çetin and Kahraman, 2019: p.148). There are two important ship motifs among the decorations. It has been theorised that one of these ships carried the soul of the deceased to Ülgen (a god living on the sixteenth floor of the sky), while the other ship depicted the confluence of seventeen seas, and that the two ships were a narration of a death ritual (Figure 3-4). The decorations, which are divided into horizontal and vertical sections on the dome drum, are ornaments belonging to the shamanic thought system, which depict the earth, its inhabitants, and the underworld, or the nature of the universe in general. In Turkish mythology, the sun and the lightning motifs, which are frequent embellishments, represent the gods (Arıkan, Çetin and Kahraman, 2019: p.144), (Figure 5). The motif of a tree with a long trunk and thin branches was frequently used in ornamentation. These motifs are associated with auspicious trees such as the apricot and the juniper. The stylized animal motif bird may represent the spirit bird named Bucu or Koarı that Gold Shaman employed during his journey to the afterlife (Arıkan, Çetin and Kahraman, 2019: p.147), (Figure 6). Regarding the construction date of the ornaments in question, there are two contradictory viewpoints. The first is that the people brought by İsa Sofi, who was one of Osman Gazi's commanders who contributed to the foundation of the Ottoman Empire, came from outside Anatolia (it is unknown exactly where he migrated) and settled in Borcak village, may have imbued the tomb with these motifs under the influence of Central Asian Shamanism (Arıkan, Çetin and Kahraman, 2019: p.148). The second theory presented in the tomb's art history report is that the motifs may have been created at the turn of the twentieth century by a nearby resident or residents (Buğdaycı, 2018: p. 14).

It is remarkable how dissimilar these ornaments are to traditional ornament motifs, which are not found in similar examples in Anatolia. The lack of definitive information about the period in which it was created makes the research on the determination of the decoration dates, which is the focus of this article, even more important.

2. Experimental Studies and Method

In the context of dating, plaster, and pigment analyses of the Tomb of İsa Sofi, a plaster sample was taken from a surface that had been scraped and on which decorations were discovered.

Through chemical and advanced technical analysis, the characteristics of the sample were determined in this study. Based on the hair sample of tow (animal) origin found in the plaster sample, C-14 analysis was attempted to determine the date of construction of the decoration.

2. 1. Sampling and Visual Analysis

Before beginning the chemical and physical analysis, the sample was examined for its texture, colour, condition (solidity), type, colour, size, and approximate amounts of aggregates, visible organic additives, and pollution. It was defined alongside the section from which it was sampled, and the results can be found in Table 1 (Figure 7).

2. 2. Chemical Analysisv

2. 2. 1. Calcination (heating a chemical compound to a temperature below its melting point)

With this analysis, the amount of CaCO3 (calcium carbonate) was calculated from the loss of CO2 (carbon dioxide) by determining the amount of moisture and organic matter by utilising the weight change in the sample as a result of the continuously increasing temperature (Güleç, 1992; Ersen and Güleç, 2009: pp. 65-72). A ground sample measuring 0.5-1.0 g was placed in the porcelain crucible and weighed with an accuracy of 0.1 mg before being heated at 105±50C, 550±50C, and 1050±50C in the muffle furnace. The moisture, total organic, and carbonate contents of the samples were calculated based on the weight difference, and the results are presented in Table 2.

2. 2. 2. Acid Loss and Sieve Analysis

The purpose of this analysis is to determine the characteristics of silicate aggregates in the sample that

are distinct from those of the binder and carbonate aggregates. A 10% HCl acid solution was applied to 20 to 25 grammes of sample on average. The portion of the sample that did not react with the acid was filtered through a determined weight of filter paper, and the residues were washed. The undissolved aggregates and the filter paper containing the clay-sized aggregates were dried for 24 hours at 105±50C and weighed. Then, the size distribution of the aggregates, which were sieved and weighed separately using a sieve set of 125, 125, 250, 600, 1000, 2500µ by filtering the acid-insoluble portion of the sample, was examined under a stereo microscope and their visual qualities were determined, with the results listed in Table 2.

2. 2. 3. Analyses of Salts Soluble in Water

This analysis was performed using simple spot tests of Chlorine (Cℓ-), Sulphate (SO4=), and Nitrate (NO3-) salts to determine the properties of the water-soluble salts in the sample, and the quantity analyses were determined by measuring conductivity. The sample of plaster was ground into powder, one g of the powder was dissolved in 100 ml of ionised water, and it was analysed using the stock solution extracted from the clear portion of the solution. The results of the analysis are presented in Table 1.

2. 3. Advanced Archaeometric Analysis

2. 3. 1. X-Ray Fluorescence Spectrometer (XRF) Analysis

Using a portable Hitachi X-MET 8000 ExpertGEO (Oxford Instruments), an elemental analysis of the red-brown paint layer on the plaster sample was performed. Figure 8 provides a photograph of the measured area and the measurement results.

2. 3. 2. EDS Analysis and Scanning Electron Microscopy (SEM) Image

The plaster sample's microstructure and semiquantitative chemical composition were determined via SEM-EDS analysis using a Carl Zeiss/Gemini 300 instrument. Figure 9 depicts the SEM image and EDS analysis measurement results of the plaster sample, as well as the SEM images of the animal-origin hair in the plaster sample.

2. 3. 3. Analysis of Radiocarbon Age Determination

The interior plaster sample of the Tomb of İsa Sofi was analysed for radiocarbon at the TUBITAK Marmara Research Centre National AMS Laboratory (Doan et al., 2021). Figure 10 depicts the detection of animal hairs in samples submitted to a laboratory. The animal hair material was extracted from the mortar and analysed. Physical cleaning was performed with tweezers in the microscope to remove contaminants from the collected samples. To eliminate any potential carbonates from the plaster, the samples were washed twice with 1 M HCl (hydrochloric acid) at 700C for 30 minutes. It was washed at 700°C for 30 minutes with 0.1 M NaOH (sodium hydroxide) to remove humic acid and other possible organics. The sample was then washed with distilled water until it reached a neutral pH level (Figure 10) (Mook et al., 1983) after being washed with 1 M HCl acid at 700C for 30 minutes. The dried sample was weighed to be 1 mg of pure carbon, and the IonPlus Brand AGE III model device was used to graphitize the graphite process. The NEC Model 3SDH-1 (UAMS) system was used to measure the samples. Using the OxCal (Bronk, 2009) programme and the Intcal20 (Reimer et al., 2020) database, the results were calibrated. Using the Oxcal programme, the measured radiocarbon age was converted to the calibrated calendar age. The results measured before today (BP) as 141±24, with a probability of 1 Sigma 68.3% and a distribution of 2 Sigma 95.4, are shown in Figure 11 and Table 3. Although the exact date range spans the years 1672 to 1944 A.D., it was calculated as 1846±50A.D. with a probability of 40.9% and 1725±53 A.D. with a probability of 36.5%.

Evaluation and Conclusion

Included in this study's analyses are the binder, additive types, and weight ratios of the plaster and paint sample obtained from the wall of İsa Sofi's tomb, the

chemical properties of the paint layer, and the dating of the decorations.

The fact that the SEM-EDS analysis of the tomb sample revealed a high concentration of calcium (51.4%) suggests that lime was used as a binder in the plaster sample. In addition, the calcination analysis performed to support this result revealed that the sample contained 91.82 percent calcium carbonate, while the acid treatment resulted in a 95.39 percent loss. When all the analysis results were considered together, it was determined that lime was the plaster sample's binder.

Based on the stereomicroscope analysis of aggregates that do not react with acid, it was determined that the aggregate on the 2500 sieve was composed entirely of hair of animal origin. The spot tests did not detect any Chlorine (Cℓ-), Sulphate (SO4=), or Nitrate (NO3-) salts.

To determine the content of the red-brown paint layer on the plaster sample, p-XRF analysis was performed. Considering that the paint layer is not of sufficient thickness due to abrasion, it is thought that the calcium (36.17%) element obtained as a result of the measurement may be from the lime binder used, and the iron (1.58%) element may originate from hematite (Fe3O4).

To determine the date of construction of the decorations, a radiocarbon dating analysis of animal-origin hair in the plaster sample was conducted, and it was determined that the plaster layer on which the decorations are located can be dated to the 18th or 19th centuries.

Therefore, although there are theories that the motifs were embellished onto the tomb by the people İsa Sofi brought with him-under the influence of the Shamanism belief of Central Asia-the radiocarbon dating analysis revealed that the motifs were created approximately 300-400 years after the Early Ottoman Period, during which İsa Sofi lived.

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Appendix

Figure 1: External View of the Tomb (Eskişehir Regional Board of Cultural Heritage Protection Archives).

Figure 2: General View of the Decorations (Eskişehir Regional Board of Cultural Heritage Conservation Archives)..

Figure 3: Ship Motif at the Confluence of Seventeen Seas (Eskişehir Regional Board of Cultural Heritage Conservation Archives).

Figure 4: Ship Motif in the Sky (Eskişehir Regional Board of Cultural Heritage Preservation Archives).

Figure 5: The Lightning and the Sun Motif (Eskişehir Regional Board of Cultural Heritage Preservation Archives).

Figure 6: Botanical Embellishments and Stylized Bird Motif
(Eskişehir Regional Board of Cultural Heritage Preservation Archives).

Figure 7: Plaster Sample.

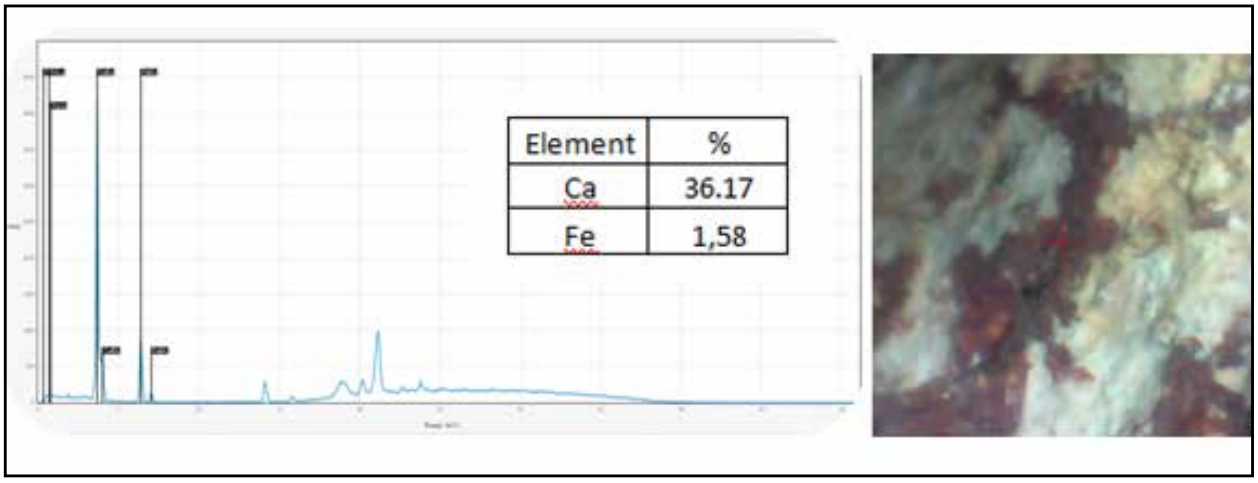

Figure 8: XRF Measurement Results and XRF Measurement Area.

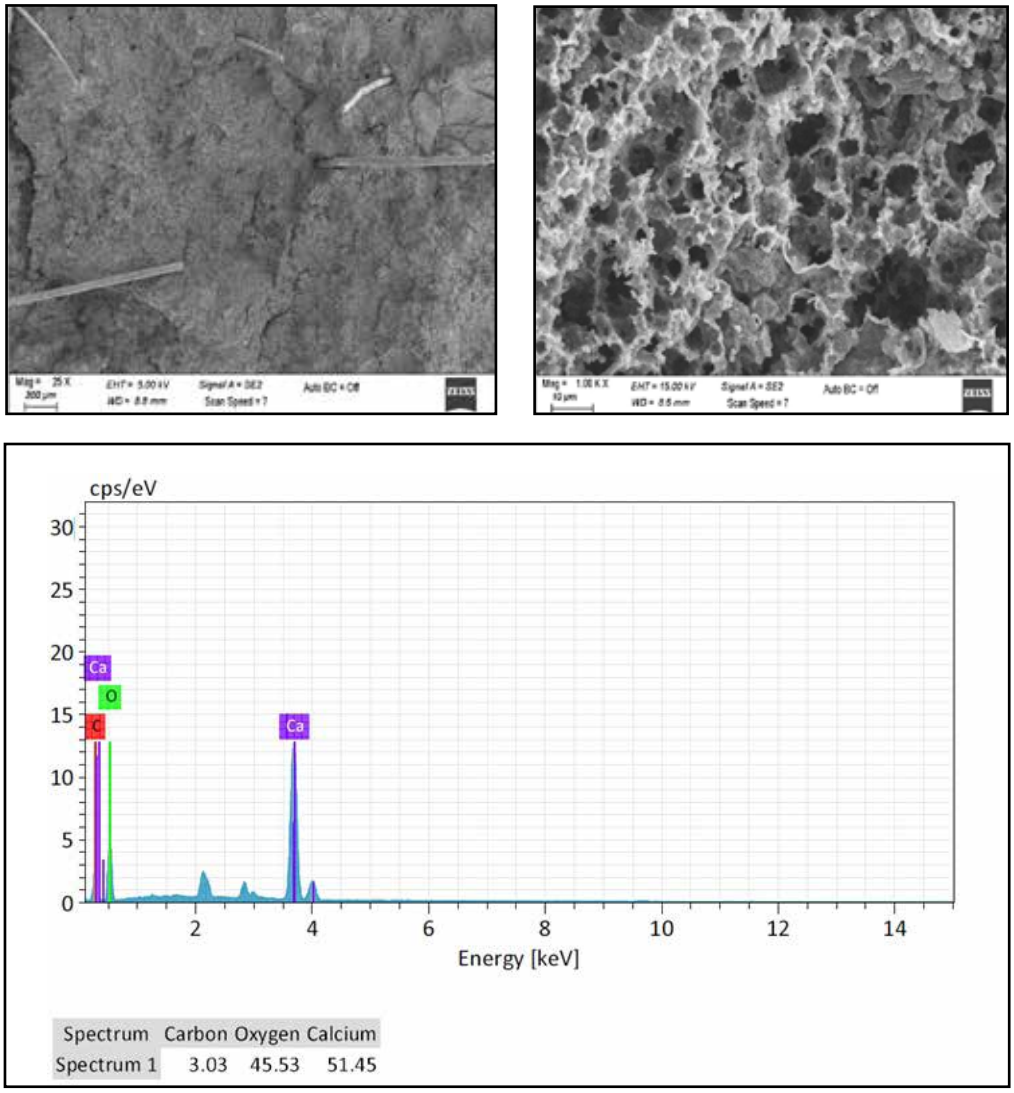

Figure 9: SEM Image of Hair of Animal Origin in Plaster (a), SEM Image of Plaster Sample (b) and EDS Analysis (c).

Figure10: Mortar Sample Sampled (a), Sample of Completed Physical and Chemical Cleaning Process (b).

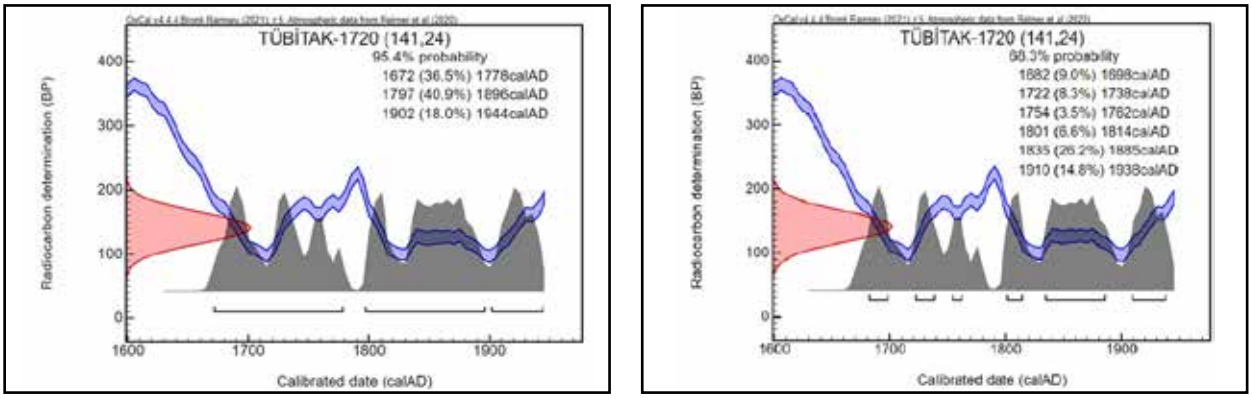

Figure 11: 2 Sigma (a) and 1 Sigma Probability Distribution Graph of Radiocarbon Age (b).

Sample No	Sample Type	Sample Area	Colour	Fibre Additive	Condition	Cl^-	SO_4^{2-}	NO_3^-	Conductivity (µS)	Amount of Total Salt Dissolved in Water (%)
1	Mortar	Interior Wall	White	Animal Hair	Medium Robust	-	-	-	126	0,70

-:No, ±:Yes-no, +:There is little,++:Yes,+++:There is too much,++++:There is too much

Table 1: Visual Properties of Plaster Sample and Qualitative and Semi-Quantitative Analysis of Water-Soluble Salts.

Calcination (%)				In Acid (%)		On the Sieve (%)					
Sample No	Humidity	550℃	$CaCO_3$	Loss	Remainder	2500µ	1000µ	600µ	250µ	125µ	<125µ
1	0,50	2,81	91,82	95,39	4,61	9,5	6,97	16,66	22,47	18,13	26,26

Table 2: Calcination, Acid Treatment, and Size Distribution of Non-Acid-Reacting Aggregates of the Plaster Sample.

Sample Lab Code	Calibre Calendar Age (M.S.)						
	1 Sigma %68,3 Distribution			2 Sigma %95,4 Distribution			Medium
	Date range		%	Date range		%	
TÜBİTAK-1720 (141,24)	1682	1698	9,0	1672	1778	36,5	1828
	1722	1738	8,3	1797	1896	40,9	
	1754	1762	3,5	1902	1944	18	
	1801	1814	6,6				
	1835	1885	26,2				
	1910	1938	14,8				

Table 3: 1 and 2 Sigma Probability Distribution Graph of Radiocarbon Age.