RADIOCARBON DATES OF OLD AND MIDDLE KINGDOM MONUMENTS IN EGYPT

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Between 1984 and 1995, over 450 organic samples were collected from monuments built during the Old and the Middle Kingdom. The purpose was to establish a radiocarbon chronology with samples from secure context and collected with the careful techniques required for radiocarbon samples. This chronology is compared to the historical chronology established by reconstructing written documentation.

Radiocarbon dating of dynastic monuments in Egypt goes back to the very beginning of this dating method. W. F. Libby included three Old and Middle Kingdom samples in his initial set of known-age samples as a test of the method [1]. In the following twenty years, numerous laboratories have followed Libby's lead and analyzed similar samples. From the published results it became apparent that close agreement with the historical chronology was often lacking. A closer study of this disagreement was needed. The American Research Center in Egypt (ARCE) undertook in 1984 the first of the two projects reported here with financial support from the Edgar Cayce Foundation. The Foundation's interest in the project rested on a hypothesis offered by Cayce that the Giza pyramids dated to 10,500 BC.

The Giza pyramids are memorials to 4th Dynasty rulers whose reigns are placed by Egyptologists to around 2500 BC. Our project therefore concentrated mostly on the Old Kingdom. The results [2] confirmed the sequence of the monuments and their ages as they were established by historians, but the match between ^{14}C and historic dates was only approximate and left open the possibility of a difference between the two chronologies. It became clear that more data was needed. Thus a second project was begun in 1995. It was designed to confirm or adjust the difference between the two chronologies. David H. Koch who established the Pyramids Radiocarbon Dating Project provided support for this second project.

In the field we looked for organic materials that were clearly linked to the construction of the monuments. Temples and pyramids built with mud bricks yielded grass, straw and reed fragments, which had been mixed into the clay and soil before shaping the bricks. Finding suitable materials in stone monuments was of a greater challenge. In most of these monuments the stone building blocks were leveled and secured in place with mortar that was manufactured locally. This required massive fires to heat gypsum or limestone. The roasted minerals and the ashes from the fires were added to the mortar mix along with remaining charcoal fragments. These usually very small fragments (1-2 mm) constituted the datable material. While searching the monuments we examined seams between stone blocks for mortar filling and for black specks of charcoal inside the mortar.

44 samples were large enough for conventional radiocarbon dating by liquid scintillation counting (LSC) first at Southern Methodist University (Dallas, Texas, USA) and later at Desert Research Institute (Las Vegas, Nevada, USA) [3]. 226 small samples were dated with AMS at the PSI/ETH AMS laboratory in Zurich [4].

Figure 1 shows the calibrated monument ages. 1σ errors were used with the averaged monument dates and each calibration range is displayed. The length of a solid black bar corresponds to the BC time span, and the width of the bar is proportional to the statistical weight of the range. For comparison, the historical chronology of the monuments is shown as hatched rectangles. Applying 2σ errors to the monument ages results in wider time spans but does not significantly alter observed differences between the two chronologies.

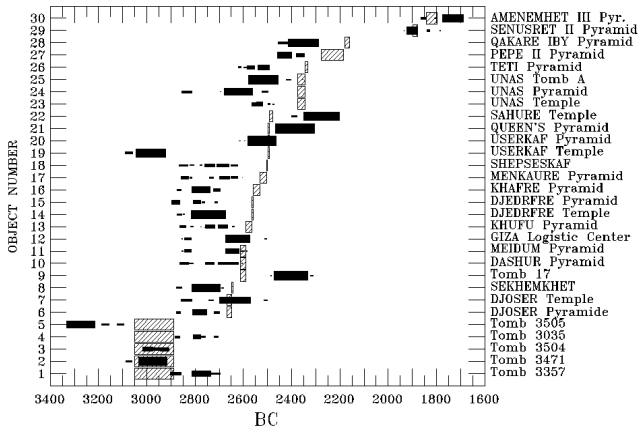

Fig. 1: Comparison of the calibrated 1σ ^{14}C ranges (horizontal black bars) with the historical chronology of the monuments (hatched areas). The lengths of the solid black bars corresponds to the BC time span, and their width is proportional to the probability to find the true age within the corresponding 1σ range.

REFERENCES

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