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ROYAL INSTITUTE FOR CULTURAL HERITAGE WEB-BASED RADIOCARBON DATABASE

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INTRODUCTION

The radiocarbon dating laboratory at KIK-IRPA in Brussels was founded in the 1960s. From the beginning, dates were reported at more or less regular intervals in the journal *Radiocarbon* (Schreurs 1968) as did most of the other ^{14}C laboratories.

THE KIK-IRPA DATABASE

From 1995 onwards, the ^{14}C laboratory at KIK-IRPA started to publish its dates in small publications, but kept the numbering of the lists as in the earlier publications in *Radiocarbon*. So the first booklet published by the institute became the "Royal Institute for Cultural Heritage Radiocarbon dates XV" (Van Strydonck et al. 1995). This series contains 4 volumes (XV, XVI, XVII, XVIII). The last one, list XIX (2005), was not printed anymore but handed out as a PDF file on CD. The ever-increasing number of dates and the difficulties in handling all the data made us decide to look for a more permanent solution for our data management and consulting. It was then decided to put all our dates in a web-based database.

List XIX was in fact already a Microsoft Access® database that was converted into a reader-friendly style and printed as a PDF file. However, a Microsoft Access database was not the most practical solution to make information publicly available. The structure of the database was thus recreated in MySQL™ and the existing content was transferred into the corresponding fields. A web-based front end was made in PHP/Apache to display the records and a search form with full-text search functionality, which allows for partial word matching. In addition, the records can also be converted to PDF format.

Old records from the printed date lists as well as new records are now added by using the same Microsoft Access back end, which is now directly connected to the MySQL database. The main problem by the introduction of the old data was the fact that in the past not all criteria that we use now were available (e.g. stable isotope measurements). Furthermore, since all the sample information is given by the submitter, the quality of our information totally depends on the willingness of the submitter and the accuracy and correctness of the information given by that person. Sometimes, problems arrive from the fact that a certain investigation (like an excavation) is carried out over a relatively long period (sometimes even >10 yr) and directed by different people, at times even by different institutions. This can lead to differences in the labeling procedures of the samples, but also in a different interpretation of structures and artifacts and in the orthography of the site names. Finally, the submitter may change address or institutions may change names, and even the names of regions and countries may change (e.g. Zaïre to Congo). We adopted the rule that the information in the database reflects the situation at the time that the sample was submitted and analyzed.

At the moment, the database contains ~5000 results, and new dates are introduced at regular intervals, with an embargo of at least 1 yr maintained between the delivery of the report to the submitter and the introduction of the results in the database.

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Figure 1 depicts the search form. The different criteria used can be divided thusly:

- Criteria concerning the geographic localization of the sample, from general (country) to very specific (site name).
- The name of the sample, although this is often not known by people that are not directly involved in the concerned dating project.
- Dated material. One can select from a list containing all the different sample materials dated.
- Period. This can be a specific period (Iron Age, Preboreal, Gothic, etc.) or a date range (e.g. between 2000 and 3000 BP). The archaeological or geological period is only mentioned if this information was given by the submitter.
- Laboratory code.

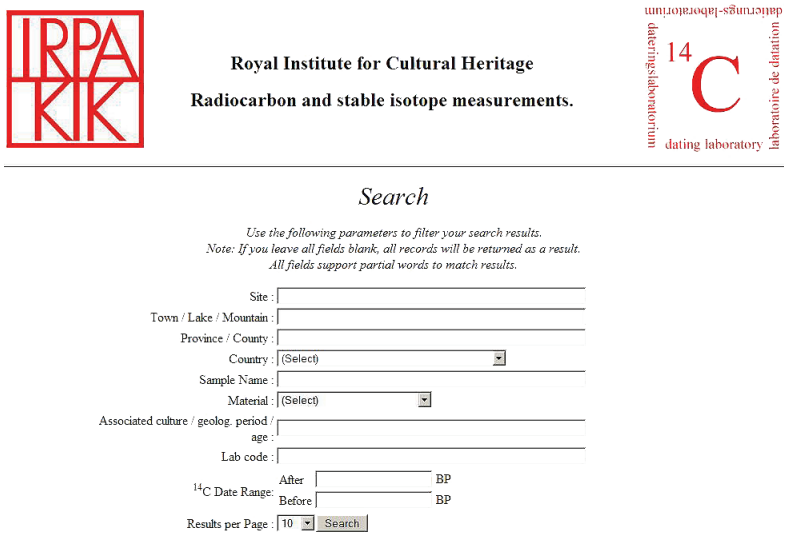

Figure 1 Search form of the database

Figure 2 depicts the result of an inquiry. If a cell is empty, the cell is not mentioned in the report except for the name of the site (9). If the name of the site is unknown or the information is irrelevant, then the report contains the following information: "Provenance: Not defined site at…".

The information on the printout contains the following cells:

1. Research field: This can be archaeology, geology, history of the arts, other.
2. Name of the country.
3. Unique sample name.
4. The ^{14}C date BP ±1 standard deviation (Stuiver and Pearson 1977). If the ^{14}C content of the sample indicates that the sample is younger than AD 1950, the result is given in pMC (% modern carbon) ±1 standard deviation. When a sample has a ^{14}C content that is too low to be statistically different from the background, the result is depicted as >X BP, whereby X is the maximum age that can be measured.
5. Indicates the technique used for the measurement. This can be accelerator mass spectrometry (AMS) or β-decay counting either by liquid scintillation counting (LSC) or gas counting (GC).
6. $\delta^{13}C$ expressed in ‰ can be measured by MS or AMS. If measured by AMS, the value includes the effects of fractionation during graphitization and in the AMS system and, therefore, cannot

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Royal Institute for Cultural Heritage Radiocarbon and stable isotope measurements.

Archaeology 1
Belgium 2

KIK- 2348 8 **St.-Dimpna Church-3** 3 1280 ± 25 BP 4
KIA-18744 Measured by AMS 5
$\delta^{13}C$ = -19.62 measured by MS 6
$\delta^{15}N$ = +12.07 C/N= 3.0 7

9 10
Provenance : St.-Dimpna Church at Geel in the province or region of Antwerpen.
11 Collected by Mathieu Boudin in 2002 and submitted in 2002 by:
X. Cruysberghs
Kerkfabriek St.-Dimpnakerk
Logen 23
2440 Geel
Belgium
12 Sample material: bone (human).
13 14 Associated culture, geological period or estimated age: Medieval, 600 AD according to the legend.
15 Context: shrine.
16 Pre-treatment method: Longin.
17 Sample quality: good.
18 Comment : femur, probably from a man. According to the legend this bone belongs to St.-Gerebernus, murdered in 600 AD.
19 References : M. Van Strydonck, A. Ervynck, M. Vandenbruaene, M. 2006. Relieken: Echt of vals? Davidsfonds, Leuven: 197p. M. Van Strydonck, A. Ervynck, M. Vandenbruaene, M. Boudin. 2009. Anthropology and 14C analysis of skeletal remains from relic shrines: an unexpected source of information for Medieval Archaeology. Radiocarbon 51(2): 569-577.

Figure 2 Example result of a search query

be compared with $\delta^{13}C$ values obtained by a mass spectrometer on CO_2. In the early days of our laboratory, this value was not measured.

7. $\delta^{15}N$ (‰) and C/N (carbon nitrogen ratio) are measured for bone samples. In the early days of our laboratory, these values were not measured.
8. KIK number is the sample number. This value did not exist in the early days of the laboratory; only the laboratory code existed. This laboratory code informs about the laboratory that measured the sample [e.g.: IRPA (β-counting at KIK-IRPA, Brussels); RICH (AMS at KIK-IRPA, Brussels); UtC (R.J. van de Graafflaboratorium, Dept Natuur- en Sterrenkunde, Universiteit Utrecht - NL); KIA (Leibniz Labor für Altersbestimmung und Isotopenforschung, Christian-Albrechts-Universität, Kiel - D)].
9. Site name.
10. Locality. If possible and useful, the geographical coordinates are given.
11. Name of the collector and the name and address of the submitter.
12. Sample material.
13. Sample position. The sample position can be noted as "cm below surface" or "cm TAW" (TAW = "Tweede Algemene Waterpassing" see http://nl.wikipedia.org/wiki/TAW). The latter is only valid for Belgian samples. This cell is not depicted in the example because it was empty.
14. Associated culture. This information is in most cases provided by the submitter.
15. Context. This field informs about the location of the sample. If fact, this can be any type of site description such as a geological layer or an archaeological feature, but also a specific area of a painting, cloth, or statue.

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16. This field refers to the common sample pretreatments such as the AAA method (alkali-acid-alkali) for charcoal, the Longin method for bones, etc. No references are given and the specialized literature concerning these pretreatments should be consulted for further information.
17. This field contains an overall appreciation of the sample quality. During pretreatment, the lab technician notes on the work sheet if the sample resists very well to the pretreatment or if the pretreatment had to be weak because of, for instance, the decomposition of the sample, the size of the sample, etc. The technician also notes if the pretreatment could be considered as successful according to several parameters tested during the pretreatment.
18. Comment. In this field, all information can be included that does not fit into one of the other cells.
19. Literature reference.

The calibrated ^{14}C date is not included because this is already an interpretation of the data. The outcome of a calibration depends on the calibration program as well as on the calibration curve used. Furthermore, dates can be calibrated using the Bayesian approach (stratigraphical models, wiggle-matching, etc.), and this may influence the outcome of the calibration.

CONCLUSION

Although the maintenance of a ^{14}C database is an elaborate and meticulous work, it is the only way to ensure accessibility over a long period to our ^{14}C dates. The link to the database is http://c14.kikirpa.be.

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