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Radiocarbon and archaeology: an innovative alliance in the post-WWII scientific field[1]

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Abstract

This paper evaluates institutional and political motives that led to the collaboration between archaeology and physics in the framework of the implementation of a ^{14}C dating laboratory in Berne during the 1950s. The innovative dimension of the method, the powerful position of nuclear physics in the scientific field and the pluridisciplinary dimension of the partnership looked very attractive for prehistorians. At the same time, ^{14}C dating offered interesting perspectives for physicists too. As an offshoot of nuclear research undertaken in the framework of the 'military industrial complex' during WWII, ^{14}C was perfectly aligned with the agenda of the politics of science regarding the new pacific developments of nuclear research after 1945.

Key-words: *radiocarbon dating, pluridisciplinarity, scientific field, Cold War*

Résumé

Cette contribution évalue les motifs institutionnels et politiques qui ont conduit archéologues et physiciens à collaborer dans le cadre de la mise en place d'un laboratoire de datation ^{14}C à Berne, dans le courant des années 1950. Le caractère innovant de la méthode, la position dominante de la physique nucléaire dans le champ scientifique, de même que la dimension pluridisciplinaire de cette collaboration constituaient autant d'éléments attractifs pour les préhistoriens. Parallèlement à cela, la datation par la méthode du ^{14}C offrait également de nouvelles perspectives aux physiciens et chimistes spécialisés dans le domaine nucléaire. A cela s'ajoute que le développement de la méthode du ^{14}C – en tant que retombée de la recherche scientifique intégrée au 'complexe militaro-industriel' durant la Seconde Guerre mondiale – s'inscrit parfaitement dans les agendas des politiques scientifiques qui cherchent, après 1945, à promouvoir de nouvelles applications pacifiques dans le domaine du nucléaire.

Mots-clés: *datation radiocarbone, pluridisciplinarité, champ scientifique, Guerre froide*

1. Introduction

In the1950s, the innovative dimension of radiocarbon dating (^{14}C), the power of the nuclear physics in the scientific field (Bourdieu 1976), as well as the pluridisciplinary dimension of the collaborations intended, contributed to make ^{14}C very attractive for prehistorians. At the same time, ^{14}C offered interesting perspectives to physicists. Deeply connected to the 'military industrial complex', nuclear physics needed, after 1945, to diversify its applications, especially for non-military purposes (Creager 2013; Joye-Cagnard 2010; Krige 2008). The radioactive isotope of ^{14}C offered an opportunity to broaden the field of application of atomic physics to pacific domains such as medicine, agronomy, botany, geology and the very popular field of prehistory. A close review of the archives and publications related to the project of ^{14}C laboratory in Bern sheds light on the argumentation of the scientists involved in the legitimation process of this innovative project.

2. The ^{14}C laboratory in Bern, a joint venture between prehistory, botany and nuclear physics

The idea of implementing a ^{14}C dating laboratory at the Institute of physics of Bern emerged in 1956. It involved three disciplines: nuclear physics, prehistory and botany. Physics was represented by

[1] See also Delley (2015), in particular, p. 33-41.

Hans Oeschger, prehistory by Hans-Georg Bandi and botany by Max Welten.[2] The responsibility of each actor was clearly defined in a project Bandi and Welten submitted to the Swiss National Science Foundation (SNSF) for financial support.[3] Regarding Oeschger, who would be leading the laboratory, his duty was to develop, test and adjust the devices required in the dating process (chain for the preparation of samples, counters, etc.). He would also supervise measurements and interpret the results obtained before their submission to archaeologists and botanists. The role of Bandi and Welten was to select the archaeological and botanical samples submitted by colleagues and to evaluate the coherence of the results obtained by the method, comparing them with the overall knowledge in the fields.

In addition to their official functions, Bandi and Welten were also facilitators. First, thanks to their experience and strong connections within their respective fields, they provided the laboratory of Oeschger with 'good samples', necessary for pursuing the development of the method, which was still in its early stages. Secondly, as experts, their appraisal of the results contributed to the verification process of the method, ensuring the reliability of the results delivered to archaeologists and botanists. In this way, Bandi and Welten took part in the process of 'stabilization' (Callon 1986) of the ^{14}C method, a process that was instrumental in the recognition of the method as a scientific tool. Thirdly, Bandi and Welten also contributed to the diffusion of the standardized attitude archaeologists and botanists were expected to adopt towards the ^{14}C method. This regarded the sampling in the field, the sampling preservation before their submission to the laboratory and the interpretation of the results obtained. This last aspect turned out to be a crucial step in the recognition process of the method by the archaeological community at large (Delley 2015, 112 ss.).

3. A project perfectly matching the agenda of the politics of science

Bern was an obvious choice for the protagonists of the project of a laboratory in Switzerland. In addition to the fact that Bandi and Welten were both based at the University of Bern, the Institute of physics had since 1951 started to specialize in the domain of isotopic dating. This shift was due to the appointment of Friedrich Houtermans, a brilliant physicist trained in Göttingen. Before coming to Bern, Houtermans had worked as an astrophysicist in prestigious laboratories all around the world and had contributed to the development of isotopic dating tools used for the evaluation of the age of meteorites and the earth crust. His arrival in Bern gave a new orientation to the activities of the Institute of physics.

At the same time, this new orientation coincided with massive investments approved by the Swiss government in the field of nuclear research. Such a support contributed to the diversification, in Swiss universities, of applications of nuclear physics in several domains such as medicine, agronomy and geochronology. From the end of the 1950s onwards, such financial supports were distributed by the SNSF, where a special commission (the most richly endowed) was supporting scientific projects in domains specifically connected with atomic physics and its offshoots (Joye-Cagnard 2010). As in many other countries, the Swiss decision makers defined nuclear research as a national priority. The ^{14}C laboratory in Bern was then fully integrated with the knowledge production regime which was implemented during the Cold War in the framework of nuclear pacification programmes.

4. Knowing the expectations of others

Interestingly, in their funding application to the SNSF, Bandi and Welten did not pay much attention to the heuristic outputs of ^{14}C for their reciprocal disciplines, a point the two scholars were asked

[2] All of them where appointed at the University of Bern – Hans Oeschger (1927-1998) as a young doctor at the Institute of physics, Hans-Georg Bandi (1920-2016) as an ordinary professor in prehistory and paleoethnography and Max Welten (1904-1984) as an extraordinary professor at the Institute of botanics.

[3] Bandi, H.-B., Welten, M. – [Application] 14.5.1956, [to the] Swiss national science foundation. File n°962, Division I. Archives of the Swiss national science foundation, Bern.

to complete in their project.[4] By contrast, they seem to have been particularly attentive to finding arguments that could comply with the expectations of the administrators of science regarding their future collaborations. An important point in the argumentation of Bandi and Welten regarded the figure of Oeschger. In their first application, Bandi and Welten made it clear that the money was required for 'developing the ^{14}C method and practicing age determination by the means of the gas counters the physicist Hans Oeschger developed for archaeology and paleobotany at the Institute of physics of Bern'.[5] Bandi and Welten explained that whilst conducting his research, Oeschger had developed a counter adapted to the measurement of low level natural radioactivity contained in isotopes like tritium and carbon 14. This new method, based on the measure of gas, proved to be more efficient regarding ^{14}C than the classical method developed by Willard Frank Libby, the inventor of the ^{14}C dating method, who prescribed the measurement of ^{14}C activity on solid carbon. Bandi and Welten dwelt on the fact that Oeschger's discovery had been presented to and recognized by the ^{14}C community at the second international ^{14}C congress held in Cambridge in 1955.[6] This favourable context turned out to be an important issue for the success of the project of the laboratory in Bern. When evaluating the application, the experts of the SNSF insisted on the quality of the team at the University of Bern.[7] The competences of the collaborators of the Institute certainly gave credibility to Bandi and Welten's project.

Bandis' activities in the domain of Swiss prehistory attest to a good knowledge of the system regarding scientific research and its promotion within society. He was aware of the decisive arguments that needed to be mentioned in order to be persuasive. In the application he submitted to the SNSF along with Welten, the two scholars insisted on the modernity of the ^{14}C method and the necessity of giving access to such a modern tool to Swiss scientists (archaeologists, botanists, geologists). A direct access to modernity was presented as a necessary condition to the practice of science. Bandi and Welten underlined the fact that every country practicing scientific research had at least one or two ^{14}C laboratories, even more in the case of the United States. But according to the applicants, such foreign laboratories could not carry out the dating of samples submitted by Swiss scholars, unless the latter were ready to wait a long time before receiving their results.[8] The price of the determinations in foreign laboratories was exposed as another problem. If Swiss archaeologists needed to send their samples abroad to be dated, the price would necessarily be higher than if the determination were done in Switzerland. They would need financial support that would probably be submitted to the SNSF. Supporting the project of a ^{14}C laboratory in Switzerland would solve the problem.

Evaluating the project of a laboratory in Bern, the authorities of the SNSF saw Bandi and Welten as experts in the new developments in the field of age determination. The need to provide Swiss archaeologists, botanists and geologists with a modern tool that American and leading European scholars had already adopted proved a convincing argument for the SNSF.[9]

Pluridisciplinarity was another crucial argument used by the applicants that had a decisive impact on achieving the laboratory project. The project of a ^{14}C laboratory was gathering specialists coming from different fields of research, an aspect that the SNSF had been promoting since its creation in 1952. The expertise report underlined that the team of the future laboratory would be composed of a physicist, a prehistorian and a geobotanist. For the experts of the SNSF, such partnerships between

[4] Bandi, H.-G., Welten, M. – [Letter] 15.6.1956 [to the] National research council, File n°962, Division I. Archives of the Swiss national foundation, Bern.

[5] Bandi, H.-B., Welten, M. – [Application] 14.5.1956, [to the] Swiss national science foundation. File n°962, Division I. Archives of the Swiss national science foundation, Bern.

[6] Bandi, H.-B., Welten, M. – [Application] 14.5.1956, [to the] Swiss national science foundation. File n°962, Division I. Archives of the Swiss national science foundation, Bern.

[7] [Report] 23.05.1956, File n°962, Division I. Archives of the Swiss national science foundation, Bern.

[8] Bandi, H.-G., Welten, M. – [Letter] 15.6.1956 [to the] National research council, File n°962, Division I. Archives of the Swiss national foundation, Bern.

[9] [Report] 23.05.1956, File n°962, Division I. Archives of the Swiss national science foundation, Bern.

disciplines 'guarantees the success of the researches and we can trust the applicants'.[10] In the postwar period, pluridisciplinarity had literally become a standard for evaluating the credibility and the quality of research projects,[11] a point on which Bandi and Welten seemed to be well informed.

5. Confirming the authority of nuclear physics in the field of science

Initiating alliances with well-established and authoritative sciences such as nuclear physics would help increase both the visibility and the legitimacy of prehistory among scientists and the general public. Archaeologists, however, were not the only ones to take advantage of the ^{14}C laboratory project. For physicists, establishing partnerships with archaeologists and botanists attested to the wide range of applications they could develop in a variety of fields. In other terms, physicists also had good reasons to support such an innovative alliance. In 1962, when the new department of 'exact sciences' was inaugurated at the University of Bern, Friedrich Houtermans gave an account of the activities of his institute in the Journal of the Swiss universities (*Schweizerische Hochschulzeitung*). Among the research presented by Houtermans, an important place was given to the ^{14}C laboratory, which was entirely funded by the SNSF. For Houtermans, ^{14}C dating corresponded perfectly to his intentions to follow interdisciplinary perspectives. In his presentation, he insisted on the interconnections between experimental physics and other fields of research such as archaeology, paleobotanic, mineralogy, geology, astrophysics, glaciology, oceanography, mathematics and statistics. For Houtermans, the aim of experimental physics was literally 'to find new methods to solve problems encountered by other laboratories and disciplines' (Houtermans 1962, 78). But this stance also brought legitimacy to the new institute which was argued as indispensable for the development of other domains of research.

6. Conclusion

The instauration of innovative alliances between archaeologists and physicists was perceived positively by both categories of actors. However, the motives which encouraged these scientists to cooperate were only partially the same. A common motive was, for instance, pluridisciplinarity, which constituted a new epistemic virtue among scientists from the 1950s onwards and progressively became a new norm.

An important distinction between physicists and archaeologists must however be underlined: since the 1950s, the position of prehistory and physics in the field of science has never been equal. While humanities have started since this date to integrate their role of dominated sciences and tried to establish alliances with authoritative disciplines as an attempt to ascend and gain credibility within the scientific field (Bourdieu 1976), for dominant disciplines like physics, such innovative alliances were merely confirming their central position in the scientific field. Moreover, if developing tools for others contributed to reaffirm one's dominant position, it also tended to present the activity of physicists as essential to the development and renewal of other disciplines such as archaeology, whose credibility would soon largely rely on its capacity to develop such innovative collaborations.

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[10] [Report] 23.05.1956, File n°962, Division I. Archives of the Swiss national science foundation, Bern.

[11] On this point, but from the perspective of molecular biology, see Strasser 2002, p. 557-559.

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