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Science and Technology (Austria-Hungary)

By Andreas Gottsmann

Thorough research has been carried out only on some subfields within the history of science related to the Habsburg Monarchy during World War I. The most well-documented innovations are those in the fields of medical science (traumatology), meteorology, and ethnology, as well as the research conducted at the Vienna University of Technology, which was essential for the war effort. For Austrian universities in general, these were years of deprivation and large losses in teachers and students. Due to the devastation caused by the war, the death and brain drain of scientists, and the destruction of the financial resources, the First Austrian Republic was unable to build on the high level of scientific research reached before the outbreak of First World War.

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Introduction

Compared to other countries, the importance of the First World War for science in the Habsburg

Empire has been explored in relatively few studies to date. The best overview was presented in an anthology on science, technology, and the military in the period 1914-1918 published in 2014.[1] Building on this and a few other publications from the fields of medicine, anthropology, and university studies, the following will provide an overview of the situation for universities and research in the Habsburg Empire during the war years.

The war years were marked by great privations in all areas of daily life. Public finances were devastated and shortage management predominated. Many professors and students had been called up for active service. As a result of both this and the fact that the universities' recruitment area was massively reduced, the numbers of students fell sharply. However, no adjustments to the curriculum were made as a result of the war, except for a few lectures in medicine. Although scientists were also feeling the effects of difficult living conditions, many were able to continue their work. These include the physician Julius Wagner-Jauregg (1857-1940), who won the Nobel Prize in Physiology or Medicine in 1917, the neurologist Otto Loewi (1873-1961), who was awarded the same prize in 1936, and the scientist who discovered cosmic radiation, Victor Franz Hess (1883-1964), who received the Nobel Prize in Physics in 1936. The neurobiologist Robert Bárány (1876-1936) – the first Austrian to be awarded the Nobel Prize in Physiology or Medicine in 1914 – treated patients with head injuries at the front and was able to make use of this for his research on the inner ear. He was released from captivity as a Russian prisoner of war in 1916 in order to receive the Nobel Prize. He returned to Vienna only briefly, emigrating to Sweden in 1917. The quantum physicist Erwin Schrödinger (1887-1961), who was awarded the Nobel Prize in Physics in 1933, was an artillery officer. After the war he left Austria and worked in Germany, Switzerland, England, and Ireland. The chemist Fritz Pregl (1869-1930), who had been a professor at the Institute of Applied Medical Chemistry of Graz University since 1913, was a member of the "*Wissenschaftliche Beratungsstelle für den Gaskampf*" (Scientific Advisory Board for Gas Warfare), but after the war worked for soldiers returning home who found themselves in need. He was awarded the Nobel Prize in Chemistry for his work in 1923. These are just a few examples of successful scientists who continued their work in the difficult conditions imposed by the First World War. However, very few of them benefited from the war. For the majority, the war was extremely burdensome; many had to pursue their careers abroad after the war and no small number lost their lives on the battlefield.

Lorenz Böhler: Trauma Surgeon in Wartime

The most prominent example of scientific progress made in the Austro-Hungarian Empire during the First World War came from Lorenz Böhler (1885-1973), who later became a trauma surgeon. In 1914, while travelling to an international surgeons' congress in New York, the budding young doctor first encountered new methods for treating broken bones at the Mayo Clinic in Rochester (Minnesota). After the outbreak of war he became a military doctor in Neumarkt/Egna (now South Tyrol), where he was responsible for examining newly arrived soldiers. He then moved to a military hospital in Linz, where he garnered his first experience of dealing with the wounded. Even here, he divided the injured according to the type of injury, whether to the thorax, the abdomen, or the extremities, in order to be able to offer better and more specific treatment. Shortly afterwards, he was appointed to run the military hospital for minor injuries in Bozen/Bolzano, which at that time had 240 beds. Böhler criticised the poor treatment of broken bones and injuries to the joints and introduced a system which dealt with the injuries according to their type: breaks to the upper arm, breaks to the lower arm, thigh fractures, and broken hips – each type of injury was treated in a separate room. Between August 1914 and January 1916, he treated 30,000 patients, which meant he acquired a wealth of experience far beyond what would be possible in a normal hospital during peacetime. He formulated three objectives: firstly, to preserve life, then, to preserve the injured body part and its functionality, and, finally, to mobilise the rest of the body.[2] Each stage in the treatment was precisely documented and recorded for subsequent analysis, with the most important information being written directly on the plaster cast. During his earlier employment in field hospitals, Böhler had seen that there was no system to where patients were accommodated, which not only made oversight difficult, but also made specialised treatment more difficult. His aim was to heal broken bones with minimal or no shortening and to retain movement in the limbs. He also stressed the economic relevance of these methods of treatment, and encouraged doctors to train in his methods, which, he claimed, would result in a reduction of between 70 and 80 percent in the payment of armed service invalidity pensions. Over the course of the war years, he healed a total of around 10,000 broken bones and took around 70,000 x-rays. After the war, Boehler was able to use the knowledge he had gained when treating wounded soldiers and applied it to treat people who had been injured in workplace accidents. In 1925, with the support of the city of Vienna, the first accident and emergency hospital opened in Vienna, with Lorenz Böhler as its medical director. The hospital and its methods became a model for similar clinics around the world.

Thomas Schlich sees Böhler's methods as consistent with rationalisation concepts regarding the body and as part of a general scientification.[3] At that time the concept of Taylorism, named after the American engineer Frederick W. Taylor (1856-1915) – breaking the production process down into the smallest steps in order to introduce maximum efficiency in these subdivisions - was spreading from the United States of America to Europe. Böhler's "rationalised treatment of broken bones" was a European variant of this idea. It also suited the interests of the military leaders in the Austrian Empire, as it resulted in a reduction in mortality rates. Böhler broke away from an individualised treatment approach and designed his methods for mass application. He thought in terms of industrial mass production and planned his treatment equipment according to this principle: everything was standardised. His hospital in Bozen/Bolzano (South Tyrol) was organised like a well-functioning machine, according to principles of efficiency and productivity, and all similar injuries were treated using the same methods. Even the nursing staff were highly specialised and trained to treat specific injuries. Maximum objectivity was to be achieved by means of photography and the statistical recording of the success of his methods using quantifiable data, with patients becoming a kind of industrial mass product.[4] Specialisation and standardisation of treatment and economic considerations were at the heart of his thinking. In this way he implemented modern ideas of rationality, objectivity, and functionality in the field of medicine.[5]

Lack of Raw Materials as an Incentive for Technical Innovation

Under the special circumstances of the First World War, raw materials acquired additional importance, because economic production and daily life as a whole were directed towards meeting the needs imposed by the war. This applied to science and technology as well. At the start of the 20th century, the Habsburg Monarchy operated within a system based on the international exchange of raw materials, intermediate products, and finished goods. As a result of the war, the traditional flow of trade dried up and new options and methods had to be found to replace those materials that were vital to the war effort but in short supply. This primarily meant metals, as the need for metals rose immeasurably during the war due to the production of aircraft, ships, bridges, telegraph systems, railways, guns, armaments, steel helmets, and so on. Of particular importance were copper and brass, which were used for shell cases; nickel, which was used for steel alloys and gun barrels; and aluminium, zinc and lead. Existing metal stocks were recycled by means of smelting and electronic processes and electrolytic plants were set up to recover copper from existing pipes and cables. New bauxite deposits within the empire were opened up especially in the Balkans (Mostar in Bosnia-Herzegovina) and later on even in the occupied Serbian territories in order to meet the demand for aluminium, which was an important material in the production of airships and boats due to its light weight. A committee for the patriotic collection of war materials was set up right at the start of the war to send metal household goods for recycling; in the course of the war, cooper roofs, church bells, and organ pipes all fell victim to the hunger for metal caused by the war and were converted for military purposes through processes of galvanisation.[6]

Benzene, creosote, naphthalene, and methylated spirits were substituted for urgently needed petrol. It was no longer possible to import cotton, and only limited amounts of sheep's wool were available, as the major wool markets were located beyond the borders of the Habsburg Empire. Consequently, many indigenous plants were investigated to see if they might prove to be possible alternatives, with nettles in particular appearing promising. The Faculty for Textile Engineering in Reichenberg/Liberec (Bohemia) and a spinning mill in Lambach (Upper Austria) specialised in this, but the cultivation of nettles was encouraged everywhere. In 1917 alone, 2,700 tonnes of nettle stalks were harvested. Another replacement material was wood cellulose, which accelerated deforestation.[7] The First World War also saw the introduction of synthetic resin production in Austria. It was used to replace natural resin, rubber, and even glass panes during the war, and became an innovative sector afterwards.[8]

One important technical innovation can be traced back to the lack of fats, namely the development of a process to extract corn oil. As it was known that cornflour had a short shelf life and that this was due to the high oil content of maize seeds, the first efforts concentrated on separating the seeds from the maize. A similar process was, admittedly, used in the United States of America before the war, but this process relied on steam and required significant coal-fired energy reserves, which was not possible in Austria-Hungary, due to the shortage of coal. As a result, a mill-based technique was devised, in which the maize was first ground down into polenta. The elastic seed was then rolled into small cakes and could thus be separated from the hard grain. Austrian corn oil was a high-quality product and was primarily used for technical purposes, but also as a foodstuff, to dilute linseed oil, and, hardened, as a cooking fat. A new technique was also discovered in sugar production, whereby caramelisation at low temperatures and in a short time was made possible. Further innovations from the war years included the manufacture of a new pickling salt, packet soups, vanilla sugar, and ready-made cakes – all areas which have remained important for civilian production from after the war right up to the present day.[9]

In view of the risk of an epidemic, immunology, which had already been pursued at the highest scientific level in Austria before the war – for example by Karl Landsteiner (1868-1943), Clemens von Pirquet (1874-1929), and Ernst Pick (1872-1960) – was accorded a high level of importance. The focus of research during the First World War was on the prophylactic immunisation of the troops against infectious diseases and the development of vaccines against pathogens such as typhoid, paratyphoid, cholera, tetanus, diphtheria and many others. As a consequence, the Habsburg Empire's dependency upon the German chemical and pharmaceutical industry increased. Quinine, which was used to prevent the spread of malaria, was particularly important. In the summer of 1917, numerous investigations into the behaviour of quinine in the blood were conducted at the Institute of Pharmacology of the University of Vienna in order to achieve production of the most neutral tasting but high-quality quinine preparation possible.

The global impact of the First World War on pharmaceuticals was considerable. The lack of raw materials for the production of medicines not only rendered investigation into alternative materials necessary but also led to increased cultivation of medicinal plants, for example at the Vegetable-Seed-Cultivation Station near Feletto Umberto (Veneto) in 1918. Ready-made medicines in the form of ampoules or tablets became commonplace and research into substances with an antibacterial effect intensified. The imperatives of war also resulted in pharmaceutical studies becoming more scientific, in the sense that they entailed modern training in the natural sciences, and in a massive increase in the number of women working in the field, so that in 1916 more than 40 percent of students were female.[10] This is mainly connected to the dominant role played by women in the assistance of wounded soldiers. Before the war, women students were an exception, but the situation changed during war:

> In the 1914 summer semester only seven per cent of the student body were women. By 1917-18 women made up thirty-six percent of those regularly attending the university… The number of women studying medicine in 1917 was over forty percent.[11]

Unfortunately we still have little detailed information about gender dynamics in universities at the time.

The Importance of Meteorology in Warfare

Another branch of the sciences that was important during the war was meteorology. The Viennese

Central Institute for Meteorology and Earth Magnetism (from 1904 onwards the Central Institution for Meteorology and Geodynamics, ZAMG) had been in existence since 1851; there was a similar institution in Hungary, a naval meteorological station in Pula (on the Istrian coast), and Bosnia-Herzegovina had its own meteorological service. Before the war, complaints about lack of funding were common. That changed during the First World War, when targeted scientific balloon flights enabled important information about air movements and the structure of higher atmospheric levels to be acquired. The central institute had already been advanced in this field, even before the war, and had been part of an international research network, for example in connection with sending up unmanned gas balloons carrying meteorological measuring equipment, which had enabled significant improvements to be made in weather forecasting. What the war particularly achieved, however, was a general recognition of the practical use of meteorological data and forecasts. Eight months before the end of the war, the director of the ZAMG, Felix Maria von Exner-Erwarten (1876-1930), said in a lecture:

> Within our Empire, prior to 1914, the state weather service had a very small sphere of influence; many people doubted the value of weather forecasts, and, as far as the public was concerned, since they were mostly only familiar with the weather forecasts in the newspapers, this science, more than any other, was an object of criticism, and frequently of mockery.[12]

Compared to other countries, Austria had a head start in the field of meteorology. Nonetheless, the start of the war meant that many meteorological stations had to cease their work as the staff were called up or because they were located within a war zone. By 1915, seventy of the meteorological network’s stations had already closed and information could no longer be transmitted as before, as the telegraph system was reserved for military use only. The lack of information caused major problems during the first year of the war in particular; from 1915 onwards the strategic importance of meteorology increased in connection with the establishment of an air corps. From the middle of 1915, the wartime authorities assumed the costs for establishing an evening weather service and a field weather service under military leadership was set up at the ZAMG. The Austro-Hungarian Aviation Troops also employed a meteorologist. The data received from the field weather stations was evaluated in the newly established flying weather headquarters in order to draw up weather charts and forecasts. As a result of the increasing number of German Zeppelins flying over towards the Balkans, this service had to be continuously expanded during the war years, and a permanent information service, subsidised by the War Ministry, was set up at the ZAMG. A wide range of weather charts showing the currents in the atmosphere at different heights were drawn up several times a day.

Information on expected air currents was vitally important, not only for air traffic, but also for the troops on the ground. Wind was mostly measured for this purpose using paper balloons. These could only attain low altitudes, but a lack of raw materials meant that the rubber balloons used previously were no longer available. Knowing wind speed and direction was important to the troops because of gas warfare. A warning could be given if the weather conditions were favourable for an attack by the enemy, thereby saving the lives of many soldiers. During the night, measurements were taken regularly and illuminated balloons sent up, as the winds which were most suitable for a gas attack were most common at night. Although it was the practical applications of meteorology that were at the forefront during the First World War, many observations were made during this time which had not previously been available and were of relevance to the civil sector, for agriculture for example. After the end of the war, Director Exner-Erwarten advocated for the retention of the weather service, which had expanded considerably during the war. In his opinion, civil aviation was the major prerequisite for future developments in meteorology. He took a pragmatic view of the use of his science for the purposes of war: "The monstrous World War sends out its feelers on all sides and strives to draw from everywhere whatever means it can find to facilitate its efforts."[13]

Research on Technical Innovation During the War

Meteorology was the branch of science in which the war actually had a positive impact and resulted in technological advances. The same cannot be said for many other branches of science. In a study on the Technological University in Vienna, Juliane Mikoletzky concludes that the impact of the war on technological innovations has, if anything, been overestimated, but that the war did bring about an increase in the level of esteem in which engineers were held by the public.[14] Initially, however, the war brought disadvantages for everyone: both students and lecturers were called up to active service, so from around 3,000 students at the Vienna University of Technology before the war, the numbers fell to just over 500 in the autumn of 1914, and it was only later that the numbers slowly began to rise again.[15] Many items of technical equipment and telescopes had to be handed over to the military, while the facilities at the university were partly used for military purposes and it was only in 1917 that civilian use was resumed, due to an increase in student numbers.

The intellectual resources which the military administration appropriated, to draw up expert opinions, for example, or through research collaborations with companies which were suppliers to the military, should not be underestimated. All departments of the Viennese polytechnic were involved in research to support the war effort, some of them in a very specific manner, as in the case of the department for shipbuilding and marine engineering. Possibilities for locating U-boats by means of ultrasound were explored. A wind tunnel that was also used after the war was designed at the Vienna University of Technology. There was also intensive collaboration in the chemical-technical field, especially with regard to designing protective masks for gas warfare or the recycling of air in U-boats. Among other things, a heating appliance for foodstuffs was devised which could also be used in tourism. Overall, a wide range of war-related contracted research was carried out, which was reflected in dissertations even after the end of the war. Study visits to war zones were undertaken, in particular in connection with the building of bridges and tunnels. Collaboration between the scientists at the polytechnic and state and military institutions was thus common in the First World War, although it was always through individual contacts. The relationship between the military and the university can be described as a symbiosis, as the scientists were able to use military resources and funding for their own research, which, in view of the permanent underfunding of the polytechnic, was very important. Nonetheless, given the financial, staffing, and material straits that the university found itself in during the war years, we cannot speak of a boom in innovation.[16] The situation at other polytechnics within the Habsburg Empire, such as in Graz, Brünn/Brno, and Prague, was very similar.

Similar poor conditions were also in evidence at the University of Vienna.[17] Shortly after the start of the war, the Rector's Office had to provide accommodation for a military hospital with a maximum capacity of 800 beds. The university's ceremonial hall was converted into a canteen and the small ceremonial hall became an operating theatre. By the autumn of 1916, when the hospital was closed, a total of 15,000 people had received medical care at the University of Vienna.

The Importance of War Camps for Linguistic and Ethnological Research

Prisoner of war camps provided a source for scientific field studies for anthropologists. From 1916 onwards, anthropologists took body and skull measurements, photographed, and made plaster casts of the faces of prisoners of war. Within the context of his work for the censor, the linguistics and literary studies scholar Leo Spitzer (1887-1960) also undertook linguistic research. Every day, tens of thousands of letters from Italian prisoners of war had to be checked, which provided the basis for several studies by Spitzer. One study, for example, related to euphemisms for the term "hunger", which the prisoners of war were not allowed to use. In the field of linguistics, this work is considered the first discourse analysis study. Together with the biologist Paul Kammerer (1880-1926), Spitzer devised several cultural sciences research projects, for example, by analysing the designs on postcards.[18]

For ethnology and ethnography, the First World War is considered a real "milestone", especially as regards the professionalization and institutionalisation of the subject.[19] A major role was played by the "colonial" experiences which ethnology had acquired in Bosnia-Herzegovina in the decades before the war, which were extended to the Balkans during the war years, in particular the Albanian region. Consequently, in the middle of the war, an "art history, archaeological, ethnographic, linguistic expedition" to the occupied Balkan area was planned with the support of the Education Ministry and the Academy of Sciences, demonstrating both scientific interest and the Austrian cultural mission in this area. During this expedition, the director of the *Volkskundemuseum* (Museum of Folk Life and Folk Art), Arthur Haberlandt (1889-1964), bought around 120 items for his museum. Likewise, the "Orient Department", established within the War Ministry, the main purpose of which was to ensure supplies to the troops, subscribed to the idea of a "cultural mission" and supported and organised the purchase of objects for the *Volkskundemuseum*. Haberlandt himself took advantage of the opportunities thus afforded to him and evaluated the knowledge he gained during the war in two academic publications in which he, entirely in line with the Habsburg notion of an empire, stressed the importance of multilingualism and interculturalism for achieving a higher level of civilisation. In the service of the Habsburg Empire, even before the war, ethnography both supported and shaped the narrative of a multi-ethnic empire, and it was now also accorded a legitimising function for the cultural appropriation of additional areas in the Balkans, in particular Albania.[20]

The Viennese Anthropological Society engaged in intensive research into the songs, traditions, and physical characteristics of the prisoners of war.[21] These research projects were mostly the result of private initiatives but were supported by the state. For example, Viennese professor of anthropology Rudolf Pöch (1870-1921) received financial support from the Anthropological Society, the Academy of Sciences, and the War Ministry for his project recording the songs and dances of thousands of prisoners of war. These recordings, like the recordings of folk music made by the musicologist Robert Lach (1874-1958), were left to the *Phonogrammarchiv*.[22] Many research papers were written based on the data collected from the prisoner of war camps, but the hoped-for breakthrough never came. The material has been preserved and is available to researchers.[23]

Conclusion

The importance of the increase in innovation in science, the universities, and research triggered by the war is easy to understand. However, we cannot speak of a “scientific boom” unleashed by the First World War, at least as far as the Habsburg Empire is concerned.[24] Progress was made in some areas and the war provided opportunities for research which would have been much more difficult, or at least more time consuming, in peacetime. However, this could not compensate for the destruction of resources caused by the war. This applies to both the loss of material and financial resources and the loss of the scientific “*Hinterland*” in a small state. It may have had three universities with a rich history in Vienna, Graz, and Innsbruck, but there were now very few students from the former regions of the empire. However, the most serious long-term impact was the departure of many young scientists to other countries, and this already before the Austrian fascist dictatorship and National Socialism. Most of the researchers who went on to be successful left their homeland either during or immediately after the First World War, because the Republic of Austria did not have a functional research structure. The First World War thus resulted in an intellectual bloodletting and the decline of Austrian academic institutions and traditions.

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Notes

1. ↑ Matis, Herbert / Mikoletzky, Juliane / Reiter, Wolfgang (eds.): Wirtschaft, Technik und das Militär, Berlin 2014. Unfortunately, there has been no similar research done on other universities in the Cisleithanian part of the Habsburg Monarchy.
2. ↑ Hartung von Hartungen, Christoph: Lorenz Böhler e l'Ospedale militare per feriti leggeri di Bolzano (1916-1919), in: Spada Pintarelli, Silvia / Stampfer, Helmut (eds.): Domenicani a Bolzano, Bolzano 2010, p. 256.
3. ↑ Schlich, Thomas: Die Rationalisierung der Knochenbruchbehandlung im Ersten Weltkrieg durch Lorenz Böhler, in: Feurstein, Thomas (ed.): Lorenz Böhler, Pionier der modernen Unfallmedizin, Graz et al. 2010, pp. 117-172.
4. ↑ Ibid., pp. 133-140.
5. ↑ Ibid, p. 159.
6. ↑ Weitensfelder, Hubert: Metalle, Sprengstoff, Pflanzenfasern. Kriegsbedingte Ersatzmittel und Ersatzverfahren, in: Matis et al., Wirtschaft 2014, pp. 227-251.
7. ↑ Ibid., pp. 244ff.
8. ↑ Ibid, p. 249-250.
9. ↑ Vojir, Franz: Ersatzlebensmittel im Ersten Weltkrieg in Österreich, in: Matis et al., Wirtschaft, p. 153; Johler, Reinhard / Marchetti, Christian / Scheer, Monique (eds.): Doing Anthropology in Wartime and War Zones. World War I and the Cultural Sciences in Europe, Bielefeld 2010, p. 283.
10. ↑ Rehor, Thomas: Die k.u.k. Militärpharmazie im Ersten Weltkrieg, in: Matis et al., Wirtschaft 2014, pp. 285-305.
11. ↑ Haag, John: Students at the University of Vienna in the First World War, in: Central European History 17/4 (1984), pp. 299-309, quote on pp. 305-306.
12. ↑ Hammerl, Christa: Meteorologie und militärischer Feldwetterdienst im Ersten Weltkrieg, in: Matis et al., Wirtschaft 2014, pp. 325-347, citation p. 330.
13. ↑ Ibid., p. 347.
14. ↑ Mikoletzky, Juliane: “An der Seite der Heerführer steht der Ingenieur.” Hochschulen, Technik und Krieg 1914-1918 am Beispiel der Technischen Hochschule in Wien, in: Matis et al., Wirtschaft 2014, pp. 349-368, here p. 350.
15. ↑ Ibid, p. 353.
16. ↑ Ibid., pp. 357-367.
17. ↑ Taschwer, Klaus: “Ein seltsamer Körper war diese Universität im Krieg.” Über die Alma Mater Rudolphina in den Jahren 1914 bis 1918 und danach, in: Pfoser, Alfred / Weigl, Andreas (eds.): Im Epizentrum des Zusammenbruchs. Wien im Ersten Weltkrieg, Vienna 2013, p. 387; Johler et al., Doing Anthropology 2010, p. 393.
18. ↑ On Spitzer's work in the First World War, see ibid., p. 391-392. Of his many publications, the following is particularly worthy of mention: Spitzer, Leo: Italienische Kriegsgefangenenbriefe. Materialien zu einer Charakteristik der volkstümlichen italienischen Korrespondenz, Bonn 1921.
19. ↑ Marchetti, Christian: Austro-Hungarian Volkskunde at War. Scientists and Ethnographic Mission in World War I, in: Johler et al., Doing Anthropology 2010, pp. 207-230, here p. 208.

20. ↑ Marchetti, Volkskunde 2010, pp. 211-230. On this, see the publications of Arthur Haberlandt, Haberlandt, Arthur: Kulturwissenschaftliche Beiträge zur Volkskultur von Montenegro, Albanien und Serbien, Vienna 1917; and Haberlandt, Arthur: Volkskunst der Balkanländer in ihren Grundlagen erläutert, Vienna 1919.
21. ↑ Scheer, Monique: Captive Voices. Phonographic Recordings in the German and Austrian Prisoner of War Camps of World War I, in: Johler et al., Doing Anthropology 2010, pp. 279-309, here p. 287-288.
22. ↑ Berner, Margit: Large-Scale Anthropological Surveys in Austria-Hungary, 1871 1918, in: Johler et al., Doing Anthropology 2010, pp. 233-253, here p. 234.
23. ↑ Ibid, p. 309. The homepage of the *Phonogrammarchiv* can be accessed here: Phonogrammarchiv, issued by Österreichische Akademie der Wissenschaften, online: https://www.oeaw.ac.at/phonogrammarchiv/home/ (retrieved: 23 October 2019). The recent publication is available here: Tondokumente aus dem Phonogrammarchiv der Österreichischen Akademie der Wissenschaften. Gesamtausgabe der historischen Bestände 1899-1950. Series 4. Soldatenlieder der k. u. k. Armee Soldier Songs of the Austro-Hungarian Army, issued by Verlag der Österreichischen Akademie der Wissenschaften, online: https://verlag.oeaw.ac.at/tondokumente-phonogrammarchiv-oesterreichischen-akademie-wissenschaften-gesamtausgabe-historischen-bestaende-1899-1950-series-4-soldatenlieder-k-u-k-armee-soldier-songs-of-the-austro-hungarian-army(retrieved: 23 October 2019).
24. ↑ Marchetti, Volkskunde 2010, p. 208.

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