

ESM - Foundation and Early History (ca. 1951-1965)

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The *Rare Metals Foundation (ESM)* was founded on December 15, 1951, with its headquarters in Zurich.^[1] The founder and investor of the *ESM* was Gaston F. Dubois (1880-1953), who was born in Le Locle. Dubois had studied chemistry at the *Swiss Federal Institute of Technology in Zurich (ETHZ)* and emigrated to the USA in 1904 to set up a production facility for vanillin for the chemical company Monsanto.^[2] In the interwar period, Dubois rose to become an executive at Monsanto and in 1944 he was awarded the Perkin Medal by the *Society of Chemical Industry*, the highest award in the US chemical industry. One year later, Dubois retired from active professional life. The *ESM* was founded at a time when research in the field of rare metals was being driven forward in countries such as the USA, China and the Soviet Union and was making great progress. Gaston F. Dubois wanted to promote the research and industrial use of rare metals in Switzerland too. To this end, he sought cooperation with the *ETHZ*, which had already created structures for industry-oriented research in the 1930s.

This article focuses on the development of the *ESM* from its foundation until the mid-1960s. The first part deals with the increasing economic and strategic importance of rare metals over the course of the 20th century. The second section examines the founding and initial activities of the *ESM* and analyzes the reasons for the reorientation of the foundation initiated in the early 1960s. In the final section, the development of the *ESM* after the realignment and up to the recent past is examined in a brief outlook. This period is poorly documented due to the lack of surviving sources.

Rare metals - discovery, research and industrial use

The *ESM statutes* of 1951 list twenty-two rare metals whose research and investigation the foundation wanted to encourage.^[3] These included rare earth elements such as cerium, but also elements known as transition metals: thorium, tungsten and molybdenum. Before the First World War, industry had shown little interest in these elements. Knowledge of their properties was limited, and it was only after decades of basic research that potential applications became tangible. Most of the elements listed in the *ESM statutes* were discovered at the end of the 18th and in the course of the 19th century. However, there were also elements, such as hafnium, which were only discovered in the first half of the 20th century.

At the end of the 19th century, rare metals found their way into industrial production for the first time. In the 1880s, the Austrian chemist Carl Auer von Welsbach (1858-1928) developed a filament for light bulbs, which he soaked in a mixture of 99 percent thorium and 1 percent cerium.^[4] Metallic filaments made of rare metals such as tantalum or tungsten were then used in the further development of light bulbs.^[5] At the same time, experiments with rare metals also began in steel research and development, for

example in the research institute of the German company Fried. Krupp AG. There it was discovered that chromium increased the corrosion resistance of steel and in 1912 the company registered its first patents for stainless steel.^[6] Finally, the industry also began to use rare metals for their pyrophoric properties. Auer von Welsbach, for example, developed an alloy of cerium and iron that was used worldwide as a flint in lighters^[7] and during the First World War, rare metals with pyrophoric properties were used in alloys with steel and iron in the production of weapons^[8].

The strategic importance of rare metals increased with their growing industrial and military use. This fuelled both the mining of already known deposits and new prospecting. The most important source for the extraction of rare metals was monazite, minerals that form deposits in river and coastal sands. Since the late 19th century, deposits have been mined in the US states of North and South Carolina to extract the thorium required by the incandescent lamp industry. After the First World War at the latest, monazite deposits in Brazil and India met the international demand for rare metals.^[9] At the end of the 1920s, Inner Mongolia also came into focus after an international research group discovered rich deposits of raw materials in the Bayan Obo region.

The industrial research and use of rare metals gained new momentum worldwide in connection with the development of nuclear weapons.^[10] In the USA, the "Manhattan Project", the program launched during the Second World War to build an atomic bomb, acted as a catalyst for scientific and industrial progress in the field of rare metals.^[11] As a result, numerous research institutions focusing on rare metals were founded at universities and by companies. The USA also stepped up the search for deposits worth mining in its own country. At the beginning of the 1960s, the USA established itself as the world's most important exporter of rare earth metals thanks to the Mountain Pass Mine in California, which was discovered in 1949. The US government's research and industrial policy in the field of rare metals formed the basis for innovations in communications, aviation and electrical technology and raised the economic and strategic importance of rare metals to a new level.

History and foundation of the Rare Metals Development Fund

Gaston F. Dubois, who headed the research and development department of the US chemical company Monsanto from 1920 and was promoted to the board of directors in 1939, closely observed US government research and industrial policy in the field of rare metals. After retiring from Monsanto at the end of the Second World War, he worked as a consultant. After the fall of 1945, he acted as a technical expert on the staff of General Lucius D. Clay (1898-1978), the military governor of the American occupation zone in Germany, several times in post-war Germany^[12].

During his stays in Germany, Dubois also visited Switzerland. He drew the attention of representatives of industrial companies to the developments in the USA in the field of

rare metals. Arguing that industry was interested in this topic, he approached the President of *ETHZ* in the summer of 1949 and promised him a donation of 220,000 Swiss francs to carry out scientific studies and research on rare metals.^[13] With this, Dubois wanted to contribute to the introduction of new branches of industry in the field of rare metals in Switzerland. Dubois had already discussed his ideas in advance with Prof. Eduard Baumann (1909-1980), the head of the *Institute of Technical Physics* at *ETHZ*.

After consulting with the Zurich lawyer Anton Pestalozzi-Henggeler (1915-2007), Dubois decided that the donation should take the shape of a foundation. On April 13, 1950, the *Foundation for Rare Metals (SSM)* was established in Zurich with a capital of 200,000 Swiss francs. Its purpose was "to carry out and support scientific research and investigations in the field of rare metals [and] to educate scientists [...]".^[14] In the run-up to its establishment, Dubois had emphasized to those responsible at the *ETHZ* that the *SSM*'s research should be carried out at the *ETHZ*.^[15] This made the foundation essentially equivalent to a donation to the *ETHZ*, which is why the Swiss School Board, the university's governing body, demanded a say in the administration of the *SSM*. Because Dubois was opposed to this, the "negotiations [...] were not very easy at times"^[16].

The involvement of the Swiss School Board in the *SSM*, which Dubois ultimately had to accept, was probably one of the reasons why he established another foundation on December 15, 1951: the *Rare Metals Foundation*.^[17] However, the decisive factor for the establishment of the *ESM* was that Dubois wanted to supplement the research-oriented *SSM* with a foundation geared towards the industrial exploitation of research results. In his view, it was "absolutely necessary [...] to encourage industry in Switzerland to concern itself with the utilization of rare metals".^[18] The purpose of the *ESM* was therefore to "support and carry out research and investigations in the field of rare metals with a view to their industrial utilization up to the product maturity stage".^[19] In this way, the *ESM* was to contribute to the "creation of a new branch of industry in Switzerland and thus to the creation of new job opportunities".^[20]

The ESM and the SSM - similarities, interdependencies and differences

There were similarities and interdependencies between the *ESM* and the *SSM*, but also clear differences. Both had the common motive of contributing to the establishment of new industries in Switzerland through research in the field of rare metals and thus creating jobs. During the economic crisis of the 1930s, industrial research as a means of creating jobs had increasingly become the focus of political attention in Switzerland, and from 1940 onward the federal government began to grant loans for industrial research.^[21] The *ETHZ* played a pioneering role in this, as it had created structures for industry-related research in the 1930s with the *Institute of Technical Physics* and the *Department of Industrial Research (AFIF)*, which was affiliated to the Institute. It was therefore no coincidence that Gaston F. Dubois turned to the *ETHZ* with his plans.

The *SSM* was fully integrated into the industrial research structures of *ETHZ* in terms of personnel and organization. In addition to Dubois, the first Board of Trustees included two *ETHZ* professors, Dr. Eduard Baumann, head of the *Institute of Technical Physics*, and Dr. Paul Niggli (1888-1953), Professor of Mineralogy and Petrography. They defined the research fields and work programs, which were examined by the Swiss School Board.^[22] The research financed by the *SSM* was carried out exclusively at the *AFIF* by a working group headed by Dr. Andreas Gäumann.^[23] However, close links with the *ETHZ* led to the dissolution of the *SSM* in 1967. The Swiss School Board justified this decision by stating that the available funds would no longer permit "promising research" and that the activities of the foundation should be "absorbed into those of the Institute of Technical Physics", also in view of the impending move of the *Institute of Technical Physics* to the new campus on the Höggerberg^[24].

In contrast to the *SSM*, Dubois had set up the *ESM* organizationally independently of the *ETHZ*, so that the Swiss School Board could not exert any direct influence on the *ESM*. In terms of personnel, however, there were links between the *ESM*, the *SSM* and the *ETHZ*. Prof. Eduard Baumann, whom Dubois had appointed to both foundation boards, acted as a link between the two foundations. Dr. Otto Hans Caspar Messner (1917-2003), the first and long-standing *President of the ESM Foundation Board*, was also associated with the university and the *SSM*. He had completed his doctorate at *ETHZ* in 1946 with a thesis on the fatigue strength of zinc alloys and lectured at the university from 1951 onwards.^[25] In 1951, the *SSM* also commissioned him to conduct a survey of Swiss companies to provide information on the foundation's future research activities.^[26]

Despite these personal connections, the *ESM Board of Trustees* had an independent profile from the outset, reflecting the purpose of the foundation and distinguishing the *ESM* from the *SSM*. The President, Dr. Messner, operated at the interface between science and industry and thus corresponded to the profile of the *ESM* intended by the founder. In 1946, at the suggestion of several Swiss industrial plants, he had opened his own office as an independent consultant. In 1949, he went on a study trip to the USA on behalf of the Swiss watch industry and was responsible as editor for industry magazines such as *Pro-Metall*.^[27] In contrast, the *ESM Board of Trustees member* Otto Zipfel (1888-1966) had connections in politics and the federal administration. As the Federal Council's delegate for job creation, he played a key role in the launch of government research policy in Switzerland during the Second World War and the immediate post-war period.^[28] When Zipfel joined the *ESM Foundation Board* in 1951, he was also a member of the *Study Commission for Atomic Energy*, which guaranteed the *ESM*'s ability to connect with Swiss atomic energy research.

Development and activities of the *ESM*, ca. 1951-1960

The main activity of the *ESM* in the 1950s consisted of supporting the research work of the *SSM*. In 1952, for example, the *ESM* was involved in carrying out and evaluating the above-mentioned survey of Swiss industry and bought the *SSM* a fine-structure X-ray

machine.^[30] Another area of activity was the procurement of rare metals, primarily for the *SSM* but also for companies in private industry. In addition, the *ESM* participated in studies on the mining possibilities of rare metals in Switzerland. In 1954, for example, the *ESM* was involved in investigations of molybdenum deposits in Valais.^[31] The foundation received public attention in the form of several newspaper reports at the end of the 1950s in connection with the search for uranium deposits in Switzerland.^[32] Beginning in 1956, the *ESM*, together with two other institutions, was involved in the search for materials that could be used for nuclear fission technology.^[33]

In the first few years after its foundation, the *ESM* had neither an office nor permanent staff. Dr. Messner, President of the Board of Trustees, carried out the necessary work in his engineering office at Stauffacherquai 40 in Zurich. He maintained contact with the supervisory authority of the *Federal Department of Home Affairs (FDHA)* and wrote the annual reports. Because he was regularly late in submitting these reports to the *FDHA*, Pestalozzi-Henggeler had to repeatedly ask for extensions. In 1954, the *FDHA* reminded the *ESM* Foundation Council in a letter of the legal obligation to submit annual reports and criticized the prevailing "tardiness."^[34] This criticism possibly accelerated the opening of a permanent office in Zurich shortly afterwards.

Beginning on January 1, 1955, Eduard Fleissig, an engineer and specialist in rare metals, headed the *ESM* office^[35] and his main task was "to keep industry and other consumers of rare metals informed about the properties and possible applications and to assist them in procuring materials". Even after the opening of the office, Dr. Otto Hans Caspar Messner remained the key person in the *ESM*. This was because the office, and therefore Eduard Fleissig's workplace, was located in Messner's engineering office on the Stauffacherquai.

The creation of a separate office *did not* change the dynamic between the *ESM* and the *SSM*. The *ESM annual report* of 1955 states: "The close connection with the *SSM* and the promotion of its work remained the primary concern of the Foundation."^[36] Specifically, the *ESM managing director* carried out administrative and organizational tasks that research colleagues at *ETHZ* were unwilling or unable to perform. This suited the *SSM* because "the invoicing of various external orders via the Development Fund [made] our administrative work easier and Mr. Fleissig relieved us of a lot of work by obtaining offers, searching for certain chemicals and conducting surveys with various customers."^[37] Although the *ESM managing director* worked largely for the *SSM*, he was not working to capacity. For this reason and "in the interests of better utilization of time", Eduard Fleissig repeatedly carried out work for Dr. Messner's engineering office.^[38] In addition, from 1958 Fleissig ran the secretariat of the *Swiss Association for Materials Testing of Technology* from the *ESM* office.

Reorientation of the ESM and closure of the office

At the beginning of the 1960s, the *ESM Board of Trustees* considered a reorientation of the foundation. In the program of activities for 1961, it stated that new "possibilities for the use of our funds [were] to be examined, whereby first and foremost a suitable form of support for young scientists [...] was to be considered."^[39] The Foundation Board justified the reorientation by stating that there was now sufficient money available in Switzerland to support research and that the *ESM* was less and less in demand as a donor for research institutions. As a result, "institutes and research institutions that would have been happy to receive funding from us a decade ago now prefer not to do so, as they prefer other sources that do not require them to be accountable."

In fact, the Swiss research landscape underwent a profound change after the *Swiss National Science Foundation (SNSF)* was founded in 1952 as an instrument for implementing a Swiss research policy. The federal government financed the *SNSF* with annual contributions amounting to millions. In 1952, for example, CHF 2 million in federal contributions flowed into the *SNSF*, by 1961 this had risen to CHF 16 million.^[40] The largest share of this money, 63 percent in 1961, went to natural and engineering sciences and thus to research areas in which the *ESM* was also involved. The *ESM*, which operated with a much smaller budget, was increasingly marginalized with the founding of the *SNSF*. In the 1950s, the *ESM*'s research contributions amounted to little more than 10,000 francs, and in 1959, for example, it supported the *Pharmacological Institute of the University of Zurich* with 9,000 francs^[41].

However, the internal discussion about a reorientation of the *ESM* cannot only be explained as a consequence of changes in the Swiss research landscape. At the time when the Board of Trustees was discussing the realignment, the *ESM* was confronted with political attacks that seriously questioned the future of the foundation. The realignment was therefore also an attempt to evade the attacks and secure the future of the foundation.

The Bonvin affair

In the summer of 1956, the Valais CVP National Councillor Roger Bonvin (1907-1982) accused the *ESM* in a letter to the *FDHA* of not being a foundation of public interest, but a pure business enterprise.^[42] Bonvin and the *ESM* had come into contact in connection with the investigations into molybdenum deposits in the Baltschieder Valley that had begun in 1954. Bonvin was co-owner of the mining concession in the area where the prospecting was to take place. However, negotiations between the concession holders and the *ESM* were broken off due to financial differences. One of the concessionaires, a professor at the *École polytechnique fédérale de Lausanne (EPFL)*, demanded CHF 6,000 from the *ESM* for work already carried out years after the failed negotiations.

However, the *FDHA* could not see any violation of the foundation's purpose and rejected Bonvin's accusations, which seemed to settle the matter. In September 1961, however, Bonvin demanded the publication of the *ESM activity reports*, which

the *FDHA* refused to do. After he was elected to the Federal Council in 1962, Bonvin further increased the pressure on the *ESM*.^[43] In a letter to the *FDHA*, he renewed the accusation that the *ESM* was a business enterprise and also accused the *ESM*'s President Dr. Messner of personally enriching himself with the foundation.^[44] To clarify these accusations, the head of the *FDHA*, Federal Councillor Hans-Peter Tschudi (1913-2002), turned to the President of the Swiss School Board, Dr. Hans Pallmann (1903-1965).

In his letter, Dr. Hans Pallmann defended the *ESM President* as a man of honour, which is why he had difficulty believing "that he was exploiting the fund for his own profit."^[45] At the same time, however, Pallmann distanced himself from the *ESM* and described the foundation as a "miscarriage" that was "also criticized by its own Board of Trustees."^[46] Gaston F. Dubois had allowed himself to be blinded too much by developments in the USA when the foundation was established, Pallmann continued. With a foundation capital of CHF 370,000, the *ESM* was *also* too small to establish itself alongside the chemical companies Lonza AG and Ciba AG, which are also active in the field of rare metals, and the foundation's funds would not be sufficient for scientific research either. The *FDHA* should ask the *ESM Board of Trustees* about the fulfillment of the foundation's purpose, as this "would perhaps trigger a change of course."^[47] Although Federal Councillor Bonvin initially persisted and renewed his accusations, citing an unnamed informant, the matter came to nothing and there were no legal consequences after Federal Councillor Tschudi promised him a thorough review of the *ESM*.

Crisis and reorientation of the ESM

The change in the Swiss research landscape following the *establishment of the SNSF* and the Bonvin affair, which had also highlighted the lack of support for the *ESM* at *ETHZ*, plunged the foundation into a crisis. In 1962, the president Dr. Messner and the foundation board members Otto Zipfel and Dr. Eduard Baumann wanted to resign.^[49] However, as the foundation board would then only have consisted of Peter Sulzer from the Winterthur-based company Gebrüder Sulzer AG, they jointly withdrew their resignation and attempted to appoint new members to the foundation board. In the same year, Fritz Hummler (1901-1980), who had succeeded Otto Zipfel as the Federal Council's delegate for job creation since 1955, was indeed appointed as a new member of *the ESM Foundation Board*.

The crisis at the beginning of the 1960s did not herald the end of the *ESM* *but* became the starting point for a reorientation. The annual report of 1962 stated that the "tasks for the future development of rare metals" were completely different from those of the 1950s and that new paths therefore had to be taken.^[50] A separate office was no longer necessary, which is why the Foundation Board decided "with a heavy heart" to dissolve it. Following the closure of the office in the course of 1963, the contacts with companies such as Lonza AG Basel and Wolfram AG Aarau that had been maintained up to that point also came to a standstill.^[51] On the other hand, this step succeeded in

taking the *ESM* out of the line of fire of Federal Councillor Bonvin, whose criticism had mainly been directed at the activities of the office.

Without an office, from 1963 the *ESM* concentrated entirely on awarding "research contracts to universities and independent research institutes" "in order to give more weight to the importance of rare metals"^[52] The *ESM*'s funds were no longer "tied to a materially usable result", but were intended to promote work on rare metals in general and, above all, to arouse the interest of young researchers in the field.^[53] The *ESM* thus completed a turnaround from research geared towards industrial use to basic research, which was, however, "within the scope of the Foundation's statutory possibilities", as the Board of Trustees emphasized.^[54] In a circular letter in August 1963, the *ESM* informed the universities and research institutes about the Foundation's new direction.

Outlook

After the reorientation, the *ESM* wanted "no activity that cannot be supported by normal funds from the National Fund or similar institutions to come to a standstill" and to ensure that the results of work on rare metals would also be published.^[55] In this way, the *ESM* succeeded in occupying a niche in the Swiss research landscape in the long term. Between 1962 and the end of the 1980s, the Foundation's financial support enabled sixteen dissertations in the field of rare metals to be completed at Swiss universities and colleges.^[56] This also resulted in a number of patents, the use of which was not claimed by the *ESM*.

Dr. Otto Hans Caspar Messner served as Chairman of the Board of Trustees without interruption during this time, and after the closure of the office he took on the administrative and organizational work on a voluntary basis.^[57] Messner succeeded in renewing the Board of Trustees with personalities who were committed to the *ESM* in the long term. For example, Denis Gonseth, who joined the Board of Trustees in 1974, held his position until 2017 and has been advising the *ESM* on financial matters ever since. In 1990, the formative era of Dr. Messner came to an end, and he was replaced as President of the Foundation by *ETHZ* Professor Dr. Hans Böhni.^[58] Prof. Hans Böhni had completed his doctorate at the *ETHZ* in 1967 with a thesis on the corrosion behaviour of rare metals, which was fully financed by the *ESM*. The change was linked to the reopening of the *ESM* office in 1989 under the direction of Dr. Margarethe Hofmann. Dr. Hofmann was also the first woman to hold an official position in the history of the foundation.

When Dr. Hofmann took over the office, the *ESM* had assets of around 1.5 million Swiss francs, mainly thanks to the skilful investment and sales strategy of the foundation's capital, which was mainly invested in shares in Swiss chemical companies, banks and insurance companies.^[59] In the view of the Board of Trustees at the time, these funds obliged the *ESM* to "revitalize and continue the foundation", whereby it believed that the

recycling of rare metals was a new focus of the foundation's activities .^[60]

Dr. Margarethe Hofmann shaped a new era and remained Managing Director of the *ESM* until 2017. While the foundation had primarily supported research projects in the field of life sciences around the turn of the millennium, in some cases with over 200,000 Swiss francs annually, the *ESM* decided in 2007 to focus on personal research.^[61] Under the name *The rare metal research Fellowship*, the foundation supported two young researchers each year with the aim of promoting work on rare metals with an interdisciplinary perspective. The fellowship was also intended as an instrument to make the *ESM* more visible to the outside world. For this reason, the foundation also decided to launch its own website in 2007.

However, the Fellowship was discontinued after just a few years, and the last research projects supported by this program ended in 2012.^[62] Instead, the *ESM* has recently made greater efforts to connect with initiatives and networks in the field of rare metals at European and international level. An expression of this was, for example, the establishment of the *Council for Less Common Elements*, with which the *ESM* attempted to create a forum for exchange on the strategic, economic and scientific importance of rare metals.^[63] Internally, these developments were reflected in the appointment of international experts to the *ESM Foundation Board* from 2012 onwards.^[64]

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