

MÜLLER VON REICHENSTEIN AND THE TELLURIUM

OSSI HOROVITZ¹

Abstract. Tellurium is the only chemical element whose discovery is related to a mineral found on the territory of today's Romania and which was discovered by a Transylvanian, Franz-Joseph Müller von Reichenstein (1740 or 1742–1825). Mineralogist, chemist, mining engineer, holding high positions in the administration of mines in Transylvania and Banat, Müller von Reichenstein is one of the few scientists whose name is intrinsically tied to that of an element. The history of tellurium discovery is exemplary for the long and intricate way, not devoid of failures and errors, leading to the identification of a new element. To the discovery of tellurium other well known scientists contributed also: Ignaz von Born, Anton Ruprecht, Paul Kitaibel, Martin Heinrich Klaproth, but Müller's priority is above doubt. The most fruitful years of Müller's life were those spent in Sibiu, the residence of Transylvania's governor baron Samuel von Bruckenthal.

SHORT BIOGRAPHY

Franz-Joseph Müller Freiherr von Reichenstein (O. Horovitz, 1996, p. 249) is one of the outstanding Transylvanian personalities in the epoch when the baron Samuel von Brukenenthal was governor of Transylvania (1777–1787). It was the time when Christian Friedrich Samuel Hahnemann, the founder of homoeopathic medicine, was house physician and librarian of the governor (1777–1779) or Ignaz von Born, a native of Transylvania, was a famous scientist and writer in Vienna.



Fig. 1. – Stamp issued to honour Müller von Reichenstein.

¹ Babes-Bolyai University Cluj-Napoca, Faculty for Chemistry and Chemical Engineering

His place and date of birth are not definitely known: in Sibiu (Hermannstadt, Nagyszeben) on July 1, 1740, or in Poysdorf (Niederösterreich, Austria) on April 10 or October 4, 1742. The Austrian Mail issued in 1992 a special stamp to honour “the 250th anniversary” of his birth (Fig. 1). His parents were Sebastian Müllner and Clara Lettner (J. Peyer, 1992). In 1759 his name appears in the registers of the University of Vienna as „Müllner Franc, Aust. Boystoffensis Poeta”. There he studied philosophy and law, but eventually specialised in mining, mineralogy and chemistry.

He continued his studies (1763) at the newly founded Mining Academy in Schemnitz (Selmezbánya, former in Upper Hungary, now Banská Štiavnica in Slovakia (J. Vozar, 1992). In 1765 he accompanied the court counsellor Alexander von Hohengarten, a former hero of the wars between the Austrian and Ottoman Empires (1736–39), then manager of the mining office of Banat in Oravitza (Oravița), in a study trip in Kärnten (Carinthia) and Niederösterreich (Lower Austria). In the same year, Franz-Joseph Müller married the counsellors daughter, Margarethe (born 1744 in Oravița, dead 1784 in Schemnitz).

His professional career is typical for a high Austrian official, leading him over from a place to another through the Empire. On 1768 (August 1) he was appointed as engineer for mining surveys in Schemnitz, and two years later, in 1770 (October 20) he came in the Banat, as mining engineer. Here he lead, together with Joseph Desiderius Redange the construction of the first two furnaces in Reschitza (Reșița), but also the foundation (1773) of the charburner colony Steierdorf (Stájerlak, Anina) (D. Perianu, 2007).



Fig. 2. – Coat of arms of baron Müller von Reichenstein.

On April 21, 1775, he was appointed in the mining direction in Schwatz in Tirol (G. Mutschlechner, 1992), but in 1778 he returned to Sibiu and occupied high positions in the Transylvanian administration of mines in Karlsburg (Alba Iulia) and Sibiu. In 1788 he became governmental counsellor and overseer of mines and ironworks in Transylvania and Banat (I. Dordea, 1992), and was knighted as *Edler von Reichenstein* (Fig. 2). He headed a commission which inspected the Banat: Reșița, Oravița, Bocșa (Bokschan), Sasca Montană (Deutsch-Saska), Moldova Nouă (Neumoldowa).

After his nomination as court counsellor, he left definitively Transylvania and the Banat for Vienna. He was created a baron (*Freiherr*) by the emperor Franz I on December 7, 1820. He was elected member in the Society for Natural Sciences in Berlin and in the Mineralogical Society in Jena (I. Tringli, 1992). He died on October 12, 1825 and was buried in the Central Cemetery in Vienna.

SCIENTIFIC ACTIVITY

While in Tirol, Müller discovered the presence of tourmalines in the Zillertal (*Nachricht von den in Tyrol entdeckten Turmalinen*, 1778).

In Transylvania, Müller continued his mineralogical studies (P. Huber, 1992). One of his visitors, the Dane Jens Esmark, relates about Müller presenting him his vast collection of minerals (J.Esmark, 1797). Several mineral species discovered in the Carpathian area were first described by Müller von Reichenstein, among them alabandite, a manganese blende, MnS, discovered in Săcărâmb (1784) or sylvanite, discovered 1785 in Baia de Arieș (von Reichenstein, 1785).

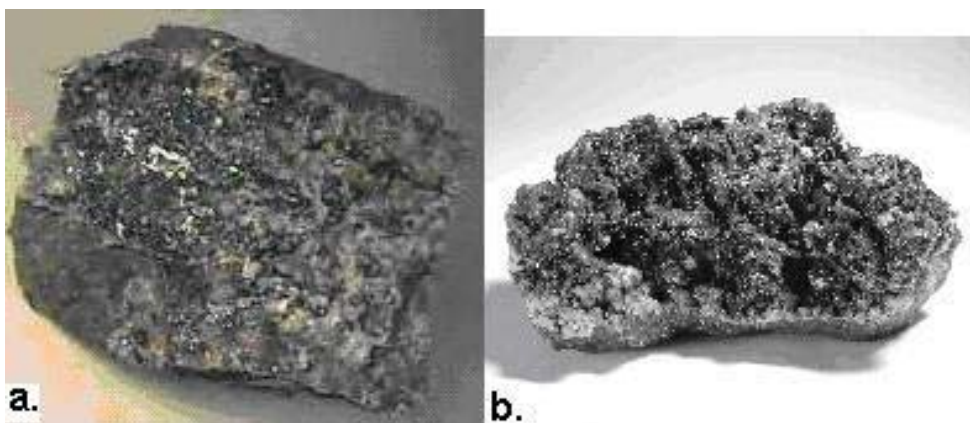


Fig. 3. – a) Sylvanite, AgAuTe_4 ; b) Nagyagite, $\text{AuPb}(\text{Sb, Bi})\text{Te}_{2-3}\text{S}_6$.
Both samples come from Săcărâmb.

Two minerals played an important role in Müller's most famous discovery, that of the new element tellurium, namely sylvanite and nagyágite (Fig. 3). Both were found in the Săcărâmb (Hung. Nagyág) orebody. The exploitation of the gold and silver bearing ores there had started before 1750, on the property of the Born family (I. von Born, 1774; A. Stütz, 1803). The unique complexity of these ores was a challenge for mineralogists and chemists. This is also reflected in the various names used for the two above-mentioned minerals:

- Silvanit (Rom.): Silvanium luteum, Tellurium luteum, Aurum albidum, Aurum graphicum, Aurum bismuthicum (Lat.); Sylvanit, Gelbtellurerz, Weißgolderz, Gelberz, Weisses in grünlichgelbe fallendes Golderz, Kattunerz, Weißtellurerz, Nagyáger Silber, Weißsilvanerz, Schrifterz, Schrifttellur, Goldtellur, Aurotellurit, Müllerit, Problematisches Golderz (Germ.); Argent molybdique, Or graphique, Sylvane graphique (Fr.); Aurotellurite, Goldschmidtite, Graphic tellurium, Sylvanite (Engl.); Goldschmidtita, Sylvanita, Aurotellurita (Span.)
- Nagyágit, săcărâmbit (rom.); Silvanium lamellosum, Tellurium lamellosum (lat.); Blättertellurerz, Blättererz, Blättriges Golderz, Graugold, Graugolderz, Nagyágererz (germ.) (M. Kováts, 1822).

But the name of Müller von Reichenbach remains associated mainly with the discovery of tellurium in these minerals, and in one found in Fața Băii (Facebánya) near Zlatna (Hung. Zalatna, Germ. Klein Schlatten) (F. Szabadvary, 1992). Among the round 30,000 entries for his name in the Internet (Google, accessed July, 2007), more than 95% refer to tellurium or elements discovery. The discovery of tellurium is itself an intricate story (Diemann, E. and al., 2002, 2004), and this could explain many wrong assertions found in literature on this subject. For instance, in a Romanian treatise on inorganic chemistry (D. Negoiu, 1972) we read:

„Tellurium was discovered by V. Ruprecht (1782), (who mistaked it for antimony), by von Reichenstein (who mistaked it for bismuth) and by F.J. Müller (1784) in a mineral from Transylvania (Fața Băii). The fact was confirmed by T. Bergman (1785). The name was given by M.H. Klaproth (1798).”

Besides considering von Reichenstein and F.J. Müller as two different persons, there are still other confusions in this paragraph, as we will show bellow.

A gold ore from the mine Mariahilf in Fața Băii attracted attention by its lower yield in gold than expected. The well known Austrian mineralogist and metallurgist Ignaz von Born (1742–1791)² (Fig. 4) reported in a scientific paper (I. von Born, 1782), *Nachricht vom gediegenen Spiesglaskönig in Siebenbürgen*³ that Anton Ruprecht, professor at the Mining Academy in Schemnitz considered antimony to be present in this mineral, and responsible for the diminution of gold yield, by combining with this element.

² As Born's birthplace Alba Iulia (Karlsburg) is currently assigned, where his noble family had its residence, but in reality he was born at Cavnic – Maramureș (M.Mitu)

³ *Spiesglas* was an old name for the mineral antimonite Sb_2S_3 , and *Spiesglaskönig* designated pure antimony

Fig. 4. – Ignaz von Born.



Müller von Reichenstein answered to this assertion by a paper (Müller von Reichenstein, 1783), with the hypothesis that the unknown element in the mineral was bismuth. After further investigation, published in 4 papers (1783–85) he rejected this assumption also, because the properties of the element did not correspond to those of antimony or bismuth. He named it *metallum problematicum* (and also *aurum problematicum* or *aurum paradoxum*) and expressed the supposition that „it could be a hitherto unknown semi-metal?”.

In order to confirm this hypothesis, he sent (1783) samples of the mineral to the Swedish chemist and mineralogist Torbern Olof Bergman (1735–1784, Fig. 5), professor in Uppsala, considered the veritable chemists’ Pope of his time. But Bergman (O. Horovitz, 1996, p. 116) died the next year, without having investigated the mineral.



Fig. 5. – T.O. Bergman.

It was not until 1797, that Müller von Reichenstein sent mineral samples to the German chemist Martin Heinrich Klaproth (1743–1817, Fig. 6, 7), professor in Berlin, the discoverer of uranium (O. Horovitz, 1996, p. 455). Klaproth confirmed Müllers's reasoning and considered there was enough evidence to affirm the discovery of a new element. He recognised the merits of Müller von Reichenstein as the discoverer of this new element, in a lecture held in January 1798 at the Royal Academy of Sciences in Berlin. Since Müller had not designated the element, Klaproth proposed the name *Tellurium*, from Latin *Tellus* = earth: “Zur Ausfüllung dieser bisherigen Lücke in der chemischen Mineralogie lege ich hier meine mit diesen kostbaren Erzen angestellten Versuche und Erfahrungen dar, deren Hauptresultat in der Auffindung und Bestätigung eines *neuen eigenthümlichen Metalls* besteht, welchem ich den von der alten Mutter *Erde* entlehnten Nahmen *Tellurium* beylege” (M.H. Klaproth, 1803)⁴.



Fig. 6. – H.M. Klaproth.

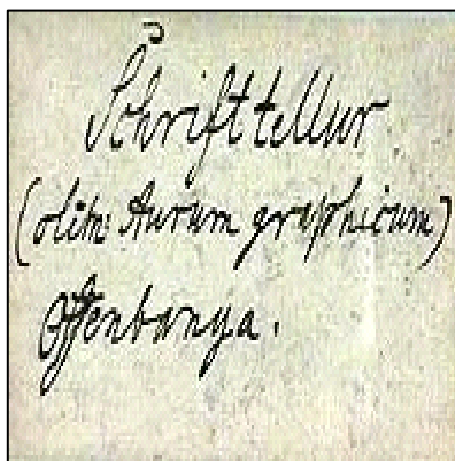


Fig. 7. – Label written by Klaproth for one of Müller's sylvanite samples (Museum of the Humboldt University in Berlin).

The discovery of tellurium was also claimed by the Hungarian botanist and chemist Kitaibel Pál (Paul) (1757–1817). He did find the new element in a gold ore from the Hungarian mining centre Nagyborzsöny (Deutsch-Pilsen) in 1789 (Szatmáry L., 1931). Klaproth had read Kitaibel's unpublished manuscript in 1796, but did not

⁴ In order to complete this previous gap in the chemical mineralogy, I present my tests and experiments made with these precious minerals, whose main result is the discovery and confirmation of a *new specific metal*, to which I give the name *Tellurium* from the old mother *Earth*.

Fig. 8. – Kitaibel Pál (Austrian stamp, 1992).



mention it in connection with the discovery of tellurium. Klaproth explained that he had not made the association with Kitabel's findings and could convince him about Müllers priority. Today, Müller of Reichenstein is quasi unanimously considered the discoverer of tellurium.

The discovery of tellurium was also claimed by the Hungarian botanist and chemist Kitaibel Pál (Paul) (1757–1817). He did find the new element in a gold ore from the Hungarian mining centre Nagyborzsöny (Deutsch-Pilsen) in 1789 (Szatmáry L., 1931). Klaproth had read Kitaibel's unpublished manuscript in 1796, but did not mention it in connection with the discovery of tellurium. Klaproth explained that he had not made the association with Kitabel's findings and could convince him about Müllers priority. Today, Müller of Reichenstein is quasi unanimously considered the discoverer of tellurium.

REFERENCES

- Born, Ignaz von (1774), *Briefe über Mineralogische Gegenstände*, Ed. Johann Jakob Ferber, Frankfurt, Leipzig, p. 11.
- Born, Ignaz von: (1782), *Nachricht vom gediegenen Spiesglaskönig in Siebenbürgen*, *Abhandlungen einer Privatgesellschaft in Böhmen*, 5, p. 382–386.
- Diemann, E., Müller, A. and Barbu, C.H. (2002), *The Exciting Story of the Discovery of Tellurium*, *Chemie in unserer Zeit*, Vol. 36 p. 334–337; (2004), *Acta Universitatis Cibiniensis, Seria F Chemia*, 7 (1), p. 89–95.
- Dordea, Ion (1992), *Aus dem Leben und Wirken des Gubernialrats Franz Joseph Müller von Reichenstein als Leiter des Siebenbürgischen Bergwerksthesauriats in den Jahren 1778–1802*, *Res Montanorum*, 5, p. 32–36.
- Esmark, Jens (1797), *Kurze Beschreibung einer mineralogischen Reise durch Ungarn*, Freiberg, p. 90–94.

- Horovitz, Ossi (1996), *Calendarul chimiștilor*, Ed. Transilvania Press.
- Huber, Peter and Huber, Simone (1992), *Franz Joseph Müller Freiherr von Reichenstein – seine Bedeutung für die Mineralogie und seine Veröffentlichungen*, Res Montanorum, 5, p. 18–22.
- Klaproth, M.H. (1803), *Chemische Untersuchung der Siebenbürgischen Golderze*. In: *Sammlung der deutschen Abhandlungen, welche in der Königlichen Akademie der Wissenschaften zu Berlin vorgelesen worden in den Jahren 1789–1800*, p. 15.
- Kováts, Michaële (1822), *Lexikon Mineralogicum Enneaglottum*, Pest, p. 139
- Mitu, Mihai: *Un fiu al Transilvaniei - geniu european: Ignaz von Born*, Gesellschaft der Germanisten Rumäniens (GGR) – <http://www.ggr.ro/>, accessed July, 2007-09-27.
- Müller Reichenstein, F.J. von (1783), *Schreiben an Herrn Hofrath von Born. Über den vermeintlichen natürlichen Spiesganzkönig*, Physikalische Arbeiten der einträchtigen Freunde in Wien. 1. Quartal, p. 57–59.
- Müller Reichenstein, F.J. von (1783–85), *Versuche mit dem in der Grube Mariahilf in dem Gebirge Fazeby bey Zalathna vorkommenden vermeinten gediegenen Spiesganzkönig*, Physikalische Arbeiten der einträchtigen Freunde in Wien, 1. Quartal, 1783, p. 63–69; *Fortsetzung der Versuche mit dem in der Grube Mariahilf in dem Gebirge Fazeby bey Zalathna vorkommenden vermeinten gediegenen Spiesganzkönig*, Physikalische Arbeiten der einträchtigen Freunde in Wien, 2. Quartal, 1784, p. 49–53.
- Nachricht von den Golderzen aus Nagyag in Siebenbürgen*, 2. Quartal, 1784, p. 85–87; *Fortsetzung der Versuche mit dem in der Grube Mariahilf in dem Gebirge Fazeby bey Zalathna vorkommenden vermeinten gediegenen Spiesganzkönig*, Physikalische Arbeiten der einträchtigen Freunde in Wien, 3. Quartal, 1785, p. 344–352.
- Müller von Reichenstein, F.J. (1785), *Phys. Arb.*, Wien: **3**, 48.
- Mutschlechner, Georg (1992), *Franz Joseph Müller in Tirol (1775–1778)*, Res Montanorum, 5, p. 26–31.
- Negoiu, Dumitru (1972), *Tratat de chimie anorganică*, vol, 2, Ed. Tehnică, București, p. 552–553.
- Perianu, Dan (2007), *Der Bergmeister Franz Joseph Müller von Reichenstein*, Allgemeine Deutsche Zeitung für Rumänien, BZ, 25 Jul., p. IV, 1 Aug., p. IV.
- Peyer, Joseph (1992), *Franz Joseph Müllner – Vorfahren und Kindheit*, Res Montanorum, 5, p. 3–25.
- Stütz, Andreas (1803), *Physikalische-mineralogische Beschreibung des Gold- und Silberbergwerks zu Szekerembe bei Nagyag*, Wien.
- Szabadvary, Ferenc (1992), *Die Entdeckung des Tellurs*, Res Montanorum, 5, p. 13–14.
- Szatmáry László (1931), *Kitaibel Pál, a magyar chemicus*, A Magyar Gyógyszerésztudományi Társaság Értesítője, p. 343–375.
- Tringli, Istvan (1992), *Franz Joseph Müller als bekannter und unbekannter Wissenschaftler*, Res Montanorum, 5, p. 15–17.
- Vozar, Jozef (1992), *Franz Joseph Müller in der Slowakei*, Res Montanorum, 5, p. 37–40.
- Das Schemnitzer Bergwesen und die Gründung der Bergakademie*, Res Montanorum, 5, p. 45–49.