

# **REDISCOVERY OF THE ELEMENTS — GEOGRAPHICAL LOCATIONS OF IMPORTANT HISTORICAL DISCOVERY SITES**

The following table includes sites pertinent to the discovery of the elements, and is arranged in ascending atomic number. The following information is given in six columns:

- “Type of site” — Examples: Lab, mine, museum, university, home, etc.
- “Event” — Examples: Collection of mining specimen, laboratory detection of element, preparation of pure element, etc.
- “Discoverer and date” — The name of the investigator and the year the event occurred.
- “Site location” — Complete description and address of site.
- “Lats/longs” — Latitude and longitude of site, given to 0.01 minute arc (<19 meters), recorded on site by authors (a handful of exceptions includes such sites as Eniwetok Atoll; the placers of Chocó, Colombia; Guntur, India; etc.). Where possible (i.e., a landmark could be identified) all readings were ultimately checked by Garmin maps and/or Google Earth (even though some readings were originally made before Google Earth was released in 2005). Although both the precision and accuracy of GPS (Global Positioning Position system; WGS84, the latest World Geodetic System) are better than 0.01 minute arc, nevertheless higher precision is not given because (a) higher resolution is not needed to find a site and (b) commonly the exact location is ill defined (e.g., the broad entrance to a building; a large mining site; etc.). The format of readings is hddd-mm.mm (with no degree symbols); for example, N59-25.60 E18-21.18 (the location of the Ytterby Mine) represents North 59 degrees 25.60 minutes, East 18 degrees 21.18 minutes. The location chosen to record the GPS coordinates was generally the entrance to a building, mine, quarry, etc. The reason that the degree symbol is not used is because it does not reliably reproduce in different computer platforms and word processing programs, and hence can cause confusion.
- “Ex?” — (Abbreviation for “exist?”) The present status of the site, that is, if a building does it still exist; if

**a mine, is it leveled, or perhaps can still be entered. A complete key for this entry follows:**

**“Ex” Key:**

<b>For buildings (including laboratories and homes):</b>	“b++” means not only does the building still exist, but the laboratory is still functional. “b+” means the building still exists, but is now being used for a different purpose (e.g., administration). “b” means remnants can be found of the building, principally the foundation “b-” means the building no longer exists; the site has become a park, parking lot, another building, etc.
<b>For mines,</b>	“m+” means not only does the mine still exist, but can be visited. “m” means the mine exists, but is blocked/sealed or filled with water. “m-” means only traces of the original mine can be found (filled in and covered with earth)
<b>For quarries,</b>	“q+” means the quarry still exists. “q-” means the quarry has been filled in but remnants of minerals can be found.
<b>For all others:</b>	“+” is used for museums and miscellaneous, can be visited.

**SPECIAL COMMENTS:**

**(When not directly associated with actual discovery sites) statues, monuments, and plaques are placed in a separate table and are organized alphabetically according to person.**

**“\*” beside an element name means it was recognized as an element by Lavoisier.**

**Notes for specific sites:**

[1] [Edinburgh, Scotland] The Botanic Gardens off Leith Walk have been built upon extensively; now of the original gardens, only a small crescent-shaped area remains (Hopetoun Crescent), about 50x150 meters.

[2] It is certain that Scheele discovered oxygen before Priestley, but it is not clear if the actual discovery took place in Uppsala (usually recognized), or actually in Stockholm a year before while Scheele was at his previous post.

[3] [Priestley’s birthplace, Fieldhead, Birstall, York] The barn and part of the original house still exists.

[4] The general mining district of Banská Bystrica — in the center of Slovakia, located 135 km north of Budapest, Hungary — is historically famous for its rich mineral deposits. The type mineral specimen for titanium in the Berlin Museum for Natural History is "Roter Schörl" = "Red Schorl," ostensibly taken from "Lubietová (Rhonitz) bei Banská Bystrica." Lubietová is 15 km east of Banská Bystrica. Historically there has been a confusion of names, and it has recently been shown that the type specimen of "Red Schorl" was actually taken from Revúca (Revúca district), 70 km east of Banská Bystrica.

[5] [Stockholm, Sweden] In 1692 new premises were given within the Griepenhelm's house for the (royal) *Laboratorium Chymicum*. The building was donated to the purpose of a hospital in 1752 — the same Seraphimer Hospital mentioned under the category of Oxygen below. The laboratory at Gripenhelms house slowly fell into disrepair, and by the time of Hjärne's death (1724) had essentially been nonproductive, if not nonexistent, since 1707. The *Laboratorium chymicum* was then established in 1727 at the Royal Mint at Mynttorget (at the intersection of Myntgatan and Stallbron), where a hearty forge was available; and where Brandt discovered cobalt in 1735, Cronstedt discovered nickel in 1751, and Hjelm prepared metallic molybdenum in 1781. This mint was demolished in 1784 to be replaced by the Parliament buildings.

[6] We know where Paracelsus was born (Egg, Switzerland), where he was raised and educated (Villach, Austria), and several specific residences during his life. We do not know where he conducted his research on arsenic, but he gained his mining/chemical experience during his teen years in Villach (original house exists: 18 Hauptplatz, N46-36.85 E13-50.80; various mining locations about), and we know that he possessed an "alchemical kitchen" in the monastery of St. Gallen, Switzerland, (original structures gone; present site is Kloster St. Gallen, a UNESCO site, N47-25.41 E09-22.65), in contrast to his usual practice of preparing medicines on an ordinary hearth beside the simmering soup of an inn's daily fare. The best museum dedicated to Paracelsus anywhere is the Paracelsus-Gedankstätte at Bad Pfäfers, Switzerland (N46-58.46 E09-29.26).

[7] [Southwark, London] One wall of St. Thomas Hospital still exists on High St (Post Office); also the Old Operating Hall still exists (now a museum). Across the street Guy's Hospital, a separate entity, still exists.

<b>Type of site</b>	<b>Event</b>	<b>Discoverer and date</b>	<b>Site Location</b>	<b>Lats/longs</b>	<b>Ex ?</b>
<b>General</b>					
Tavern	Royal Society meetings typically were held here 200 years ago; concept of atoms discussed and developed here	Davy, Dalton Wollaston, Thomson, and others	Crown and Anchor Tavern, Arundel St. and Strand, London, England [Birkbeck College founded here in 1823] [Office/apartment complex now on site]	N51-30.76 W00-06.86	b-
Mining School	Famous mining school; Banská Štiavnica (present Slovakian name); Schemnitz (previous German name); or Selmezbánya (previous Hungarian name)	Reichenstein, del Río, (Don Fausto) Elhujar, among others, trained here	Original school, 2 Andreja Kmet'a Ulica, Banská Štiavnica	N48-27.53 E18-53.62	b+
			Belhazy house, (previous chemical laboratory), 1 Sladkovicoca, Banská Štiavnica, Slovakia	N48-27.52 E18-53.48	b+
<b>The Periodic Table</b>					

Museum (his office where he discovered the Periodic Table)	Periodic Table	Mendeleev, 1869	Санкт-петербургский Государственный Университет, Sankt-Peterburgskiy Gosudarstvenniy Universitet (St. Petersburg State University); (Менделеевская Линия, Mendeleevskaya Liniya, (2, Mendeleevskaya Liniya), Санкт-петербург (St. Petersburg); Ленинградская область (Leningrad Oblast); Россия (Russia)	N59-56.50 E30-17.98	b+
University (where he began formulation of Periodic Table)	Periodic Table	Meyer, Lothar, 1863-65 (organized elements into "natural groups")	Universitäts Platz, Breslau Universität, Breslau, Silesia, Germany; now Plac Uniwersytecki 1, Uniwersytet Wrocławski, Wrocław, Poland	N51-06.83 E17-01.99	b+
University (where he prepared preliminary Table)		1866-67 (prepared Periodic Table but did not publish)	Alte Schickler'sche Gebäude, 3 Schlickerstrasse, Eberswalde, Germany	N52-49.95 E13-49.07	b+
University (where he prepared final Table)		1868-70 (published Periodic Table and plot of atomic volumes (1870))	West wing of original building, Universität Karlsruhe, 12 Kaiserstrasse, Karlsruhe, Germany	N49-00.56 E08-24.72	b+
<b>1. Hydrogen*</b>					
Lab/house	Discovery of elemental hydrogen	Cavendish 1766	13 Great Marlborough Street (with his father)1738-1783, London, England [new buildings on site]	N51-30.87 W00-08.31	b-

	Other houses/labs owned (and where research was conducted)		34 Church Row, Hampstead 1782-1785, London, England	N51-33.33 W00-10.74	b+
			11 Bedford Square 1786-1810, London, England (plaque)	N51-31.19 W00-07.78	b+
			Clapham Common 1785-1810, London, England [now a community park]	N51-27.24 W00-08.78	b -
Museum	Apparatus of Cavendish		Royal Institution, 21 Albemarle Street, London, England	N51-30.58 W00-08.58	+

## 2. Helium

“Lab”	Discovery in sun spectroscopically	Janssen 1868	Guntūr, Andhra, Pradesh, India (total eclipse of the sun, August 18, 1868).	N16-18 E80-26	+
Observatory			Meudon Observatoire, Meudon, Hauts-de-Seine, Ile-de-France, France (suburb of Paris)	N48-48.31 E02-13.87	b++
Observatory	Discovery in sun spectroscopically	Lockyer 1868	Home observatory, 24 Fairfax Road, Hampstead, north London, England	N51-32.59 W00-10.73	b-
Lab	Studies of gases suggesting new spectral line was a new element named "helium" by Lockyer	Lockyer 1868 (assisted by Frankland)	Royal College of Chemistry (now a suit shop), 299 Oxford Street, London, England	N51-30.89 W00-08.69	b-
Lab	Discovery of terrestrial helium	Ramsay 1895	Old Science Bldg (now Slade Art Bldg), Gower Court, University College (London)	N51-31.50 W00-08.05	b+
Home/lab	Spectroscopic verification of terrestrial helium	Crookes 1895	7 Kensington Park Gardens, London, England (plaque)	N51-30.69 W00-12.16	b+

Lab	Discovery of terrestrial helium	Cleve 1895	1860 chemistry building (now Philologicum), 3 Thunbergsvägen, on Carolinaparken, Uppsala, Sweden	N59-51.24 E17-37.69	b+
Quarry	Source of helium – cleveite, a rare earth uraninite mineral		Karlshus Mine (Halvorsrød Mine), northern outskirts of Karlshus, Norway	N59-21.57 E10-51.88	m

### 3. Lithium

Lab	Discovery of earth	Arfwedson 1817	Lab of Berzelius, (German Baker’s House, 9 Nybrogatan and 14 Riddargatan), Stockholm, Sweden [now the site of a boutique]	N59-20.06 E18-04.62	b –
Mine	Source of lithium mineral – petalite, a lithium aluminum silicate		Iron mine at Utö (Island), Stockholms, Sweden	N58-57.98 E18-19.78	m
Museum			Utö Island, beside iron mine	N58-58.02 E18-19.75	+
Lab	Preparation of metallic lithium	Davy 1817	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+

### 4. Beryllium

Lab	Discovery of beryllium (or “glucinium”) earth	Vauquelin 1798	École des mines (2nd site at l’Hôtel Mouchy), 71, rue de l’Université, Paris, France (address before demolition to make way for a new street)	N48-51.60 E02-19.30	b –
-----	--	----------------	--	------------------------	-----

Mine	Source of beryllium minerals — beryl and emeralds		“White” beryl – unknown Emeralds – Peru	Unknown	
School of mines	Suggestion that emeralds and beryl were identical (from crystalline form), prompting Vauquelin’s work	Haiiy pre-1798	École des mines (2nd site at l’Hôtel Mouchy), 71, rue de l’Université, Paris, France (before demolition to make way for a new street)	N48-51.60 E02-19.30	b –
Museum	Includes exhibits on Haiiy				
Lab	Preparation of metallic beryllium	Wöhler 1828	Friedrichs-Werdersche Oberrealschule (trade school), 12 Niederwallstraße, Berlin, Germany [now the site of an apartment complex]	N52-30.74 E13-23.97	b–
Terrestrial source	Original discovery of emeralds and beryl	Emeralds and beryl known to ancients	NA		
Lab	Independent discoverer/confirmer of discovery; refused credit for discovery	Klaproth 1802	Berlin Akademie, present 28 Dorotheenstraße (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]	N52-31.14 E13-23.46	b –

## 5. Boron\*

Lab	Preparation of metallic boron from boric acid (“sedative salt”)	Davy 1808	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+
Lab	Preparation of elemental boron from boric acid (“sedative salt”)	Thenard and Gay-Lussac 1808	École Polytechnique (2nd site), 1, Rue Decartes near Panthéon, Paris, France	N48-50.83 E02-20.90	b+

Terrestrial source	Original discovery of borax	Borax known to ancients as “tinkal”	NA		
<b>6. Carbon*</b>					
Terrestrial source	Original discovery of charcoal	Known to ancients	NA		
Lab	Preparation of carbon dioxide from diamonds	Lavoisier 1772	La Petit Arsenal, rue Bassompierre and Boulevard Bourdon, Paris, France (plaque) [new building on site]	N48-51.05 E02-22.03	b-
Lab	Diamond and graphite are equivalent (give equal amounts of carbon dioxide)	Tennant 1796	4 Garden Court, The Temple, (now 1 Garden Court), London, England	N51-30.73 W00-06.70	b+
<b>7. Nitrogen*</b>					
Lab	Discovery of elemental gas (“phlogisticated air”)	Daniel Rutherford 1772	Joseph Black’s lab, Old College, The Old College Quad, South Bridge, U. of Edinburgh, Edinburgh, Scotland [the site was replaced by "New College" which itself became the "Old College" after King's College was built	N55-56.85 W03-11.17	b-
Botanic Gardens	Site where Rutherford served as professor of U. of Edinburgh		Old Botanic Gardens, “off Leith Walk,” Edinburgh, Scotland	N55-57.67 W03-11.01	+ [1]

Lab	Discovery of elemental gas “Skämd luft”	Scheele 1772	Apoteket Uplands Vapen (apothecary), Stora Torget and Kungängsgatan, Uppsala, Sweden [site first occupied by new pharmacy, now a department store]	N59-51.50 E17-38.37	b-
Museum			Pharmacy “museum” in modern Uplands Vapen Apothecary, Svavagallerian Mall (corner of Bredgränd and Dragarbrunnsgata; extending between Kungsgatan and Dragarbrunnsgatan), Uppsala, Sweden	N59-51.50 E17-38.58	+
Ancient temple	Etymological source for name "ammonium"	Ancient Egyptian temple; visited by Alexander the Great, 332/331 B.C.	Temple of Ammon, Aghurmi, Siwah, Egypt	N29-12.33 E25-32.60	b

## 8. Oxygen\*

Lab	Discovery of elemental gas “Eldsluft” (Swedish) or “Feuerluft” (German) [2]	Scheele ~1770	Probable original discovery site, Serafimerlasarettet (Serafimer Hospital), original site of Gripenhielmska huset (Gripenhielm’s house), 2F Serafimergrand (off Hantverkargatan), now Utbildningsförvaltningen = "Education Administration", Stockholm, Sweden	N59-19.70 E18-03.12	b+
Lab			Possible associated discovery site, Apothecary Förgyhllda Korpen, 16 Stortorget, Stockholm, Sweden	N59-19.50 E18-04.22	b+

Lab		Scheele 1771	"Official" discovery site, Apoteket Uplands Vapen (apothecary), Stora Torget and Kungängsgatan, Uppsala, Sweden [site first occupied by new pharmacy, now a department store]	N59-51.50 E17-38.37	b-
Museum			Pharmacy "museum" in modern Uplands Vapen Apothecary, Svavagallerian Mall (corner of Bredgränd and Dragarbrunnsgata; extending between Kungsgatan and Dragarbrunnsgatan), Uppsala, Sweden	N59-51.50 E17-38.58	+
Lab	Discovery of elemental gas ("dephlogisticated air")	Priestley 1774	Bowood, Calne, England (plaque)	N51-25.70 W02-02.25	b+
House	Birthplace of Priestley		Fieldhead, Birstall, York, England (plaque)	N53-44.58 W01-39.75	b [3]
Church	Church where Priestley preached		Mill Hill Chapel, Lower Bassinghall Street (off City Square), Leeds, England (plaque)	N53-47.80 W01-32.80	b+
Church	Church where Priestley preached		Former "New Meeting House"; site occupied now by St. Michael's Church, Moor Street Queensway, Birmingham, England (plaque)	N52-28.79 W01-53.55	b-
Home	Priestley's house which was burned down by rioters (plaque on building)		"Fair Hill"; now an apartment complex, 10 Priestley Road, Birmingham, England (plaque) [site now occupied by apartment complex]	N52-27.86 W01-52.68	b-
Lab/house	Priestley's home and laboratory in the US		472 Priestley Ave, Northumberland, Pennsylvania, USA (plaque)	N40-53.42 W76-47.40	b+

Lab	Demonstration that water is a compound of hydrogen and oxygen	Lavoisier 1789	La Petit Arsenal; rue Bassompierre and Boulevard Bourdon, Paris, France (plaque) [new building on site]	N48-51.05 E02-22.03	b-
Museum	Lavoisier's apparatus		Musée des arts et métiers; 60, rue Réaumur (corner of Réaumur and Vaucanson); Paris, France	N48-51.94 E02-21.34	+

## 9. Fluorine\*

Lab	Discovery of elemental gas	Moissan 1886	Shed at Faculté de pharmacie, rue Michelet, Paris [new building on site]	N48-50.55 E02-20.18	b-
Museum	Moissan Museum		Faculté de pharmacie; 4, Avenue de l'Observatoire; Paris; France	N48-50.58 E02-20.18	+
Lab	Discovery of hydrogen fluoride; recognition that fluorspar is "calcareous earth saturated with acid"	Scheele 1771	Apoteket Uplands Vapen (apothecary), Stora Torget and Kungängsgatan, Uppsala, Sweden (possibly preliminary work in Stockholm; see Oxygen) [site first occupied by new pharmacy, now a department store]	N59-51.50 E17-38.37	b-
Museum	Associated with modern pharmacy		Pharmacy "museum" in modern Uplands Vapen Apothecary, Svavagallerian Mall (corner of Bredgränd and Dragarbrunnsgata; extending between Kungsgatan and Dragarbrunnsgatan), Uppsala, Sweden	N59-51.50 E17-38.58	+
Mine	Source of fluorite		Garpenberg, Sweden (a large mine complex)	N60-18.55 E16-11.53	m+

Marktplatz; Turm and Ratskeller (where Agricola was Burgermeister)	Description of fluorspar (CaF <sub>2</sub> ) as flux for ores	Agricola 1529	Innere Klosterstraße, Chemnitz, Sachsen, Germany (two plaques and bust of Agricola) - represents activity center of Agricola	N50-49.95 E12-55.11	+
---	--	---------------	--	------------------------	---

## 10. Neon

Lab	Discovery by isolation from air	Ramsay and Travers 1898	Old Science Bldg (now Slade Art Bldg), Gower Court, University College (London), England	N51-31.50 W00-08.05	b+
Apparatus	Hamstead device used for cooling air		Science Museum, Exhibition Road, South Kensington, London, England	N51-29.86 W00-10.44	+

## 11. Sodium

Lab	Preparation of metallic sodium	Davy 1807	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+
Agricultural/ forestry farm	Distinction between vegetable and mineral alkali (potash and soda)	Duhamel 1736	Original chateau and silo; Rue Duhamel du Monceau, Denainvilliers, France	N48-9.02 E02-14.47	b+
Lab	Distinction between “cubic” and “prismatic” saltpetre [sodium and potassium, respectively]	Marggraf 1758	Berlin Akademie, present 28 Dorotheenstraße (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]	N52-31.14 E13-23.46	b-

## 12. Magnesium\*

Lab	Preparation of metallic magnesium	Davy 1808	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+
Terrestrial source	Recognition of salts (magnesium sulfate) at Epsom Wells	1695 (wells discovered in 1618)	Well Rd., Epsom, England (memorial)	N51-19.63 W 00-17.41	+
Library/ museum	Museum holding historical information regarding Epsom		Bourne Hall, Spring St., Ewell, England	N51-21.01 W00-15.12	+
Lab	Distinction between magnesia and calcia	Black 1755	Joseph Black's lab, Old College, The Old College Quad, South Bridge, U. of Edinburgh, Edinburgh, Scotland [the site was replaced by "New College" which itself became the "Old College" after King's College was built	N55-56.85 W03-11.17	b-
Museum	Display on Joseph Black		Royal Museum of Scotland, Chambers St., Edinburgh, Scotland	N55-56.81 W03-11.44	+

## 13. Aluminum\*

Lab	Recognition that alum has an earth different from that in lime	Marggraf 1754	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-
-----	--	---------------	---	------------------------	----

Lab	Preparation of metallic aluminum	Ørsted 1825	U. of Copenhagen, Studiestraede 6, Copenhagen, Denmark [new building on site]	N55-40.75 E12-34.24	b-
Museum	Samples of original cryolite (Na <sub>3</sub> AlF <sub>6</sub> ) from Greenland		Geological Museum, Oster Voldgade 5-7, Copenhagen, Denmark	N55-41.24 E12-34.64	+
Lab	Preparation of metallic aluminum	Wöhler 1827	Friedrichs-Werdersche Oberrealschule (trade school), 12 Niederwallstraße, Berlin, Germany [site now occupied by an apartment complex]	N52-30.74 E13-23.97	b-
Museum	Sample of Wöhler's aluminum		Deutsches Museum, Museuminsel 1, München, Bayern, Germany	N48-07.82 E11-34.97	+
Lab	Improved method of preparing aluminum using sodium (prepared for Napoleon III's banquet dinnerware)	Deville 1854	École Normale Supérieure; 45, rue d'Ulm, Paris, France	N48-50.54 E02-20.66	b+
Home	Original aluminum ingot prepared by Deville		Chateau de la Damette; 47, rue de la Damette, Irigny, France	N45-40.45 E04-49.76	b+
Library/exhibit	Samples of original aluminum prepared by Deville		Display cabinet in Bibliothèque (library); École Normale Supérieure Physique; 24, rue l'homond; Paris, France	N48-50.57 E02-20.82	+
Manufactory	Ingots produced, which introduced the new metal to the public (1855)		Javel Chemical Works, now the site of the Parc André Citroën, Paris, France	N48-50.50 E02-16.44	b-
Lab/Home	Preparation of aluminum from cryolite (became commercial process) — now known as Hall-Héroult process	Hall 1886	Charles Martin Hall, 64 East College St, Oberlin, Ohio USA (plaque)	N41-17.51 W82-12.91	b+
Lab/Tannery/ Home		Héroult 1886	Allée des Tanneurs, Gentilly, France (suburb of Paris) [site now occupied by an apartment complex]	N48-48.91 E02-21.20	b-

Birth place			23, rue du Val d'Orne (Hwy D166), old village of Ste. Benin; Thury-Harcourt; France (plaque)	N48-59.27 W00-29.04	b+
-------------	--	--	--	------------------------	----

## 14. Silicon\*

Lab	Preparation of elemental silicon	Berzelius 1824 (Wöhler)	(1st) Royal Swedish Academy of Science, 30 Stora Nygatan, Stockholm, Sweden	N59-19.44 E18-04.17	b+
Museum	Sample of Berzelius' silicon		George-August-Universität, Inorganic Chemistry, 4 Tammannstraße, Göttingen, Niedersachsen, Germany	N51-33.49 E09-56.90	+
Museum	Berzelius Museum	Berzelius	Museum originally viewed (during year 2000) at the modern Swedish Royal Academy, Lilla Frescativägen 4A, Stockholm, Sweden; the museum is now in storage.	N59-22.02 E18-03.09.	+
			Plans are to move the museum to Observatoriekullen, Observatoriemuseet (Observatory Museum, Observatory Hill), Drottninggatan 120, Stockholm, Sweden	N59-20.50 E18-03.30	
Terrestrial source	Source of silicon minerals	Quartz known to ancients	Berzelius used quartz samples from Sweden, exact location unknown		

## 15. Phosphorus\*

Lab	Discovery of white phosphorus	Hennig Brandt 1669	Michaelisplatz, Hamburg [”Michaelisplatz” no longer exists, but was in vicinity of St. Michaeliskirche; area now occupied by various buildings, shops and a park]	Exact location unknown	b-
			St. Michaeliskirche (St. Michaelis church, built 1648-1673)	N53-32.90 E09-58.67	b+
			Michaelisstrasse, which leads from Michaelisbrücke (Michaelis Bridge), the separation between the “Altstadt” (Old City, before 1500) and the “Neustadt” (New City, after 1500, site of Michaelisplatz)	N53-32.96 E09-59.06	+
Lab	Discovery of red phosphorus	Anton von Schrötter 1845	Polytechnische Institut (now Technisches Universität Wien), Karlsplatz 13, Wien, Austria	N48-11.94 E16-22.20	b+

## 16. Sulfur\*

Terrestrial source	Original discovery of elemental sulfur	Known to ancients	(Example of ancient source: Mt. Vesuvius) Parco Nazionale Del Vesuvio, Italy	N40-50 E14-26	+
			(Example of ancient source: Mt. Etna) Parco Nazionale Dell’Etna, Sicilia, Italy	N37-45 E15-00	+

## 17. Chlorine\*

Lab	Discovery of elemental gas	Scheele 1774	Apoteket Uplands Vapen (apothecary), Stora Torget and Kungängsgatan, Uppsala, Sweden [site first occupied by new pharmacy, now a department store]	N59-51.50 E17-38.37	b-
Museum	Associated with modern pharmacy		Pharmacy “museum” in modern Uplands Vapen Apothecary, Svavagallerian Mall (corner of Bredgränd and Dragarbrungata; extending between Kungsgatan and Dragarbrungatan), Uppsala, Sweden	N59-51.50 E17-38.58	+
Manufactory	Discovery and production of “l’eau de Javel,” a basic solution of chlorine, used for bleach – still used today under the same name!	Berthollet 1785	Manufacture pour les Acides et Sels minéraux, now the site of the Parc André Citroën, Paris, France	N48-50.50 E02-16.44	b-
Lab	Recognition that gaseous “oxymuriatic acid” is in fact elemental chlorine	Davy 1810	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+

## 18. Argon

Home/ adjoining lab	Discovery that atmospheric “nitrogen” had an extra component (present site of balance which was used for critical weighings distinguishing atmospheric and artificial nitrogen)	Lord Raleigh 1894	Lab complex, adjoining main home, Terling Place, Terling, Essex, England	N51-48.13 E00-34.23	b+
Museum	Large glass bulb which Lord Raleigh used to collect argon		Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+

Lab	Discovery by isolation from air	Ramsay and Travers 1894	Old Science Bldg (now Slade Art Bldg), Gower Court, University College (London), England	N51-31.50 W00-08.05	b+
Apparatus	Hamstead device used for cooling air		Science Museum, Exhibition Road, South Kensington, London, England	N51-29.86 W00-10.44	+

## 19. Potassium

Lab	Preparation of metallic potassium	Davy 1807	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+
Agricultural/ forestry farm	Distinction between vegetable and mineral alkali (potash and soda)	Duhamel 1736	Original chateau and silo; Rue Duhamel du Monceau, Denainvilliers, France	N48-9.02 E02-14.47	b+
Lab	Distinction between “cubic” and “prismatic” saltpetre [sodium and potassium, respectively]	Marggraf 1758	Berlin Akademie, present 28 Dorotheenstraße (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]	N52-31.14 E13-23.46	b-

## 20. Calcium\*

Lab	Preparation of metallic calcium	Davy 1808	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+
Terrestrial source	Discovery of calcium	Lime known to ancients	NA		

## 21. Scandium

Lab	Discovery of scandium earth	Nilson 1879	1860 chemistry building (now Philologicum), 3 Thunbergsvägen, on Carolinaparken, Uppsala, Sweden	N59-51.24 E17-37.69	b+
Mine	Source of scandium mineral – euxenite (and possibly gadolinite from Ytterby, Sweden)		The euxenite used was most probably from the Arendal area of Norway	~N58-27 E8 46	
Mine	Source of first stoichiometric scandium mineral — thortveitite, scandium silicate		Evje and Iveland area, Norway	~N58-34 E07-49	m

## 22. Titanium

Parents’ home/lab	Discovery of titanium earth	Gregor 1791	Trewarthenick, Cornwall, England (parents’ home) [another home now resides on the site]	N50-15.63 W04-56.62	b-
Terrestrial source	Source of titanium mineral – ilmenite, FeTiO <sub>3</sub> (mennachanite), in creek		Tregonwell Mill, Cornwall, England (plaque erected April, 2003)	N50-04.83 W05-07.64	+
Church	“Manaccan Church”		Church, Manaccan, Cornwall, England (plaque and specimens inside)	N50-05.01 W05-07.63	b+
Home church	St. Crida’s Church (titanium bowl is used in baptisms)		Creed, Cornwall, England	N50-17.31 W04-54.00	b+
Parsonage with home lab	Subsequent chemical researches with titanium		Creed, Cornwall, England	N50-17.32 W04-53.87	b+

Lab	Preparation of metal	Nilson 1887	1860 chemistry building (now Philologicum), 3 Thunbergsvägen, on Carolinaparken, Uppsala, Sweden	N59-51.24 E17-37.69	b+
Lab	Independent discoverer/confirmer of discovery; refused credit for discovery	Klaproth 1792	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-
Source of mineral	"Red schorl of Hungary"		According to the label on the specimen in the Berlin Museum of Natural History, the type mineral [rutile, titanium oxide] from which Klaproth discovered titanium was from "Lubietová (Rhonitz) bei Banská Bystrica, Slowakei [Slovakia]" Recent research has shown this is incorrect; the actual site was Revúca (Revúca district), Slovakia.	Revúca: N48-40.98 E20-07.00	[4]

## 23. Vanadium

Lab	Discovery of vanadium earth	del Río 1801	Real Seminario de Minería (Royal School of Mineralogy, known as "La Primera Casa de Ciencias," the first mining institute), 90 Republica de Guatemala, Mexico City, Mexico	N19-26.06 W99-07.70	b+
-----	-----------------------------	--------------	--	------------------------	----

Lab/present library	Used by del Río in subsequent studies/library with historical mineralogical holdings		Palacio de Minería, 5 Tacuba, Mexico City (mining institute, used by del Río starting 1812)	N19-26.15 W99-08.38	b+
Mine	Source of vanadium mineral – vanadinite, lead vanadate chloride		Purísima del Cardonal Mine, near Cardonal, Hildalgo, Mexico	N20-37.16 W99-06.76	m+
Museum	Original sample sent to Europe by Humboldt		Museum für Naturkunde (Museum of Natural History), Invalidenstraße 43, Berlin, Germany	N52-31.79 E13-22.78	+
School of Mines	“Rediscovery” of vanadium	Sefström 1831	School of Mines, north corner of Trotzgatan and Bergsskolegränd (9 Bergsskolegränd), Falun, Kopparbergs, Sweden [now a shopping center]	N60-36.35 E15-38.11	b-
Mine	Source of vanadium mineral – magnetite with vanadium impurity		Taberg, Småland, Jönköpings, Sweden	N57-40.65 E14-04.95	m
Lab	Preparation of metallic vanadium	Roscoe 1869	Owens College, 19 Quay St., Manchester, England [now Cobden House Chambers]	N53-28.72 W02-15.12	b+
Museum	Samples from Roscoe		Museum of Science and Industry, Liverpool Rd. (and Lower Byrom St.), Manchester, England	N53-28.63 W02-15.25	+

## 24. Chromium

Lab	Discovery of chromium earth (1797) and preparation of metallic chromium (1798)	Vauquelin 1797-1798	École des mines (2nd site at l’Hôtel Mouchy), 71, rue de l’Université, Paris, France (address before demolition to make way for a new street)	N48-51.60 E02-19.30	b-
-----	--	---------------------	---	------------------------	----

Mine	Source of chromium mineral – crocoite, lead chromate		Цветной, Tsvetnoi Mine; Успенская Горка, Uspenskaya Gorka (Assumption Hill); Березовский (Beresovskiy), near Екатеринбург (Ekaterinburg); Свердловская Область (Sverdlosk Oblast); Россия (Russia).	N56-55.65 E60-48.62	m-
Museum	Samples of crocoite from mine		Уральский Геологический Музей, Uralskiy Geologicheskiiy Musei (Urals Geological Museum); Кокрякова Ул. (Khokhryakova Str.) and Кужбушева Ул. (Kujbysheva Str.); Екатеринбург (Ekaterinburg); Свердловская Область (Sverdlosk Oblast); Россия (Russia)	N56-49.59 E60-35.76	+
Lab	Independent discoverer/confirmer of discovery; refused credit for discovery	Klaproth 1798	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-

## 25. Manganese\*

Scheele's lab	Co-discovery of manganese	Scheele 1774	Apoteket Uplands Vapen (apothecary), Stora Torget and Kungängsgatan, Uppsala, Sweden [site first occupied by new pharmacy, now a department store]	N59-51.50 E17-38.37	b-
---------------	---------------------------	--------------	--	------------------------	----

Gahn's lab	Discovery of metallic manganese	Gahn 1774	School of Mines, north corner of Trotzgatan and Bergsskolegränd (9 Bergsskolegränd), Falun, Kopparbergs, Sweden [now a shopping center]	N60-36.35 E15-38.11	b-
Terrestrial source	Original discovery of pyrolusite	Used for centuries in glass manufacture	NA		

## 26. Iron\*

Terrestrial source	Original discovery of iron	Known to ancients	NA		
--------------------	----------------------------	-------------------	----	--	--

## 27. Cobalt\*

Lab	Discovery of metallic cobalt	Georg Brandt 1735	<i>Laboratorium Chymicum</i> , Mynttorget, intersection of Myntgatan and Stallbron, Stockholm, Sweden [5] [site now occupied by Sverige Riksdag, Parliament buildings]	N59-19.59 E18-04.05	b-[5]
Brandt Manor	Source of cobalt mineral — cobaltite, cobalt arsenide sulfide		Riddarhyttan, Västmanlands, Sweden	N59-49.66 E15-33.12	b
Mine			Pellugruvan (or one of the neighboring mines), Riddarhyttan, Västmanlands, Sweden	N59-49.64 E15-33.00	m
Terrestrial source	Original discovery of cobalt blueing agent for ceramics and glass	Known for centuries	NA		

## 28. Nickel\*

Lab	Discovery of metallic nickel	Cronstedt 1751	<i>Laboratorium Chymicum</i> , Mynttorget, intersection of Myntgatan and Stallbron, Stockholm, Sweden [5] [site now occupied by Sverige Riksdag, Parliament buildings]	N59-19.59 E18-04.05	b- [5]
Mine	Source of nickel ore – probably a nickel arsenide sulfide		Kobaltsgruva (this mine was a main producer of ore for färgkobalt, blue coloring for ceramics trade), Gruvbyvägen, Loos (modern spelling = Los), Gävleborgs, Sweden	N61-44.52 E15-09.40	m+
Mine	Source of nickeline (NiS) used by Cronstedt to obtain adequate quantities for characterization		Kuhschacht, Wernerplatz, Freiberg, Germany (monument) — original Huthaus (mining headquarters) still exists at site	N50-54.81 E13-20.82	m- b+
Terrestrial source	Original discovery of Kupfernickel ore used to color glass green		Known for centuries in Germany		

## 29. Copper\*

Terrestrial source	Original discovery of copper	Known to ancients	NA		
--------------------	------------------------------	-------------------	----	--	--

## 30. Zinc\*

Terrestrial source	Original discovery of zinc compounds	Known to ancients and used for medicines	NA		
Terrestrial source	Original discovery of metallic zinc (tutty)	Known in China, MidEast (Marco Polo), and Cyprus	Reported by Marco Polo in 1272 during his travels in Kuhbenan, Iran	N31-24.58 E56-16.98	
Lab	Prepared zinc from calamine (zinc silicate)	Marggraff 1746	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klapproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-
Mine/museum	Famous zinc works		Erzbergwerk Rammelsberg, Rammelsberger Straße, Goslar, Germany	N51-53.39 E10-25.09	m+

### 31. Gallium

Lab/house	Discovery of gallium earth	Boisbaudran 1875	1, rue de Lusignan; Cognac; France	N45-41.69 W00-19.85	b+
Lab	Preparation of metallic gallium		Wurtz's lab, 15, École de médecine, rue de l'École de médecine, Paris [new buildings on site]	N48-51.05 E02-20.46	b-
Mine	Source of gallium ore — a complex dispersed mixture in sphalerite		200 meters west of D920, 2 km SSW of Pierrefitte-Nestalas, Haute Pyrénées, France	N42-56.82 W00-05.20	m-

## 32. Germanium

Lab	Discovery of germanium and preparation of elemental form	Winkler 1886	Brennhausgasse 5, Technisches Institut Bergakademie, Freiberg, Sachsen, Germany (plaque)	N50-55.23 E13-20.54	b+
Mine	Source of germanium ore – argyrodite, silver germanium sulfide		Himmelsfürst Mine, near Fürstenweg, Himmelsfürst, near St. Michaelis (now incorporated into Brand-Erbisdorf), Sachsen, Germany	N50-51.74 E13-17.77	m-
Museum	Famous collection of minerals		Werner Mineral Museum, Brennhausgasse 14, Freiberg, Sachsen, Germany	N50-55.25 E13-20.60	+
Museum	History museum of university		Nonnengasse 22, Freiberg, Sachsen, Germany	N50-55.10 E13-20.44	+

## 33. Arsenic\*

Terrestrial source	Original source of arsenic compounds (orpiment and sandarac)	Known to ancients as yellow cosmetic	NA		
Lab and terrestrial source	Original preparation of elemental form	Known for centuries; also known in nature. Used by Paracelsus who prepared it in metallic form, but probably known in this form much earlier	NA		
Museum	Exhibits and bust of Paracelsus; home of Paracelsus during the pinnacle of his career		Pharmazie-Historisches Museum, Totengässlein 3, Basel, Switzerland	N47-33.52 E07-35.17	+

Houses/ museums	Residences of Paracelsus		Paracelsus was an itinerant and several known residences are known and are marked with plaques. [6]		
--------------------	--------------------------	--	---	--	--

### 34. Selenium

Lab	Discovery of selenium	Berzelius 1817	Gripsholm Fabrik, Mariefred, Sweden (manufacture is mainly destroyed by fire and rebuilt and is now a Red Cross facility; small original laboratory building still exists and is a storage shed)	Red Cross: N59-15.38 E17-12.82 Shed: N59-15.40 E17-12.75	b+  b+
Mine (and museum)	Source of selenium mineral		Falu koppargruva (Falun copper mine), Falun, Kopparbergs, Sweden	N60-36.01 E15-36.95	m+
Museum	Berzelius Museum		Plans are to move the museum to Observatoriekullen, Observatoriemuseet (Observatory Museum, Observatory Hill), Drottninggatan 120, Stockholm, Sweden [see note above under Silicon regarding the authors' viewing of the museum].	N59-20.50 E18-03.30	+

### 35. Bromine

Lab	Discovery of bromine	Balard 1826	Old École de pharmacie, 14, rue École de Pharmacie, Montpellier, France	N43-36.77 E03-52.69	b+
-----	----------------------	-------------	---	------------------------	----

Salt flats	Source of salts for bromine		Anciens Salines near Sète, France;	N43-22.80 E03-37.58	+
			Scenic overview of the salt flats: Le Site des Pierres Blanches	N43-24.24 E03-40.24	+
Museum	Apparatus and exhibits		New École de pharmacie, 15 avenue Charles Flahault, Montpellier, France	N43-37.39 E03-51.74	+
House	Birthplace of Balard		25 rue de l'Argenterie, Montpellier, France (plaque)	N43-36.52 E03-52.65	b+

### 36. Krypton

Lab	Discovery by isolation from air	Ramsay and Travers 1898	Old Science Bldg (now Slade Art Bldg), Gower Court, University College (London), England	N51-31.50 W00-08.05	b+
Apparatus	Hamstead device used for cooling air		Science Museum, Exhibition Road, South Kensington, London, England	N51-29.86 W00-10.44	+

### 37. Rubidium

Lab	Discovery of rubidium spectroscopically	Bunsen and Kirchhoff 1861	U of Heidelberg (old site), 52 Hauptstraße, Altstadt, Heidelberg, Baden-Württemberg, Germany (plaque)	N49-24.62 E08-41.87	b+
Terrestrial source	Source of solution for spectroscopic analysis		Gradierbau, Die Salinenen, Salinenstraße, Bad Dürkheim, Germany	N49-27.87 E08-10.49	+

University display	Spectroscopic equipment, electrolysis equipment, rubidium samples		Hörsaal Zentrum Chemie, 252 Im Neuenheimer Feld, U of Heidelberg (new campus), Heidelberg, Baden-Württemberg, Germany	N49-25.11 E08-40.38	+
Lab	Preparation of metallic rubidium	Bunsen 1863	Old Chemistry Building, U of Heidelberg (old site), Akademistraße, Altstadt, Heidelberg, Baden-Württemberg, Germany	N49-24.59 E08-41.87	b+
Quarry	Source of mineral for metallic rubidium – lepidolite, a complex lithium potassium silicate		Main site: Hradisko Hill outside "Rozena in Mähren" (German name), today known by the Czech name Rožná (in Moravia), Czech Republic.	N49-28.82 E16-14.50	q+
Quarry			Alternate site: Amerika Mine (2.4 km east of Penig), Saxony, Germany	N50-56.03 E12-44.52	m-

### 38. Strontium

Lab	Discovery of element — characterization of salts	Cruikshank (Arsenal) and Crawford (Hospital) 1790	Royal Military Academy, Woolwich Arsenal, England	N51-29.64 E00-04.12	b+
Hospital	Discovery of element — recognition of “new earth”		St. Thomas Hospital, London, original site (cleared for railroad)	N51-30.31 W00-05.36	b [7]
Mine	Source of strontium mineral – strontianite, strontium sulfate		5 km north of Strontia, Scotland	N56-44.03 W05-32.84	m
Old smelter	Where ore was processed		(Now a post office), Strontia, Scotland	N56-41.47 W05-34.09	b+

Museum	Charles Hope's original strontia	Hope 1792	Joseph Black Building, Kings Buildings, West Mains Rd., U. of Edinburgh, Edinburgh, Scotland	N55-55.44 W03-10.58	+
Lab	Preparation of metallic strontium	Davy 1808	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+
Lab	Independent discoverer/confirmer of discovery; refused credit for discovery	Klaproth 1793	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-

### 39. Yttrium

Lab	Discovery of earth	Gadolin 1794	Kemiska laboratorium (1st floor of academy building), Akademietorget (Academy Square), U of Åbo, Åbo (now Turku), Finland (owing to fire of 1827, the university was completely destroyed, and even the Academy Square no longer exists). The present site is occupied by The Old Academy Building (Vanha Akatemiatalo), Rothoviuksenkatu 2, University of Turku (Turun Yliopisto; Åbo Akademi University).	N60-27.11 E22-16.77	b-
Home/lab	Later home/lab of Gadolin		6A, Kaskenkatu, Åbo (now Turku), Finland (plaque); also, buildings in back on Luostarinkatu (where he worked)	N60-26.80 E22-16.37	b+

Mine	Source of yttrium mineral – gadolinite, a complex rare earth silicate		Ytterby Mine, Ytterby, Resarö (Island), Stockholms, Sweden	N59-25.60 E18-21.18	m
Museum	Exhibits on mine		Vaxholm Fortress Museum, Växon (Island), Stockholms, Sweden	N59-24.19 E18-21.52	+
Lab	Preparation of metallic yttrium	Wöhler 1828	Friedrichs-Werdersche Oberrealschule (trade school) at 12 Niederwallstraße, Berlin, Germany [site now occupied by apartment complex]	N52-30.74 E13-23.97	b-

## 40. Zirconium

Lab	Discovery of earth	Klaproth 1789	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-
Mine	Source of zirconium mineral – zircon, zirconium silicate		"Northern Circars," Andhra Pradesh, India (exact location unknown; original label no longer available)	N16-56 E79-19	-
Museum	Original samples of zircons		Museum für Naturkunde, Invalidenstraße 43, Berlin, Germany	N52-31.79 E13-22.78	+
Lab	Preparation of metallic zirconium	Berzelius 1824	(1st) Royal Swedish Academy of Science, 30 Stora Nygatan, Stockholm, Sweden	N59-19.44 E18-04.17	b+

Museum	Berzelius Museum		Plans are to move the museum to Observatoriekullen, Observatoriemuseet (Observatory Museum, Observatory Hill), Drottninggatan 120, Stockholm, Sweden [see note above under Silicon regarding the authors' viewing of the museum].	N59-20.50 E18-03.30	+
Terrestrial source	Original source of zircons	Known to ancients	NA		

## 41. Niobium

Lab/house	Discovery of niobium earth "columbium"	Hatchett 1801	Middle Pall Mall, Hampstead, London (now Furnival Gardens), England [site now occupied by extensive park and flower gardens]	N51-29.42 W00-13.99	b-
Museum	Original sample of columbite analyzed by Hatchett		Museum of Natural History, Cromwell Rd., London, England	N51-29.74 W00-10.54	+
Quarry	Type site of original type columbite – iron niobate		Swanson Quarry, Haddon Neck, Middletown, Connecticut USA	N41-30.85 W72-31.12	q-
House	Later house, visited by Berzelius		"Mount Clare," Minstead Gardens, Roehampton, England	N51-27.11 W00-15.04	b+
House	Last house		"Bellevue," 91&92 Cheyne Walk, Chelsea, England (plaque)	N51-28.92 W00-10.45	b+

Lab	Differentiation between niobium and tantalum; naming of niobium	Heinrich Rose 1847	Berlin Akademie, present 28 Dorotheenstraße (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]	N52-31.14 E13-23.46	b-
Lab	Metallic niobium	Blomstrand 1864	Magle Stora Kyrkogata 12A (now History Dept.), U. of Lund, Lund, Malmöhus, Sweden	N55-42.17 E13-11.92	b+
Lab	Clearly differentiated niobium from tantalum compounds and described their different chemistry	de Marignac 1865	"Dark damp cellar lab," Société de lecture (Académie de Genève), Grand Rue 11, Genève, Switzerland [lab removed]	N46-12.14 E06-08.70	b+ (main bldg)

## 42. Molybdenum\*

Lab	Discovery of molybdenum earth	Scheele 1778	Apoteket Lejonet, Apotekshuset, 2 Stora Torget, Köping, Västmanlands, Sweden [new municipal building now on site, the "Apotekshuset"] was the "official" pharmacy site of Scheele; but the discovery was actually done at the previous Pohl pharmacy in Köping at Stora Gatan 8-Östra Långgatan 8.	2nd site: N59-30.85 E15-59.56  1st site (discoveries): N59-30.75 E15-59.69	b-  b-
Mine	Source of molybdenum mineral – molybdenum sulfide		Bispberg Gruvan, Bispberg Klack (mountain), Kopparbergs, Sweden	N60-21.67 E15-47.55	m
Museum	Exhibits		Scheele Museum, Östra Långgatan 37, Köping, Västmanlands, Sweden	N59-30.50 E16-00.01	+

Lab	Preparation of metallic molybdenum	Hjelm 1781	<i>Laboratorium Chymicum</i> , Mynttorget, intersection of Myntgatan and Stallbron, Stockholm, Sweden [5] [site now occupied by Sverige Riksdag, Parliament buildings]	N59-19.59 E18-04.05	b- [5]
-----	------------------------------------	------------	--	------------------------	-----------

### 43. Technetium

Lab	Bombardment of molybdenum with deuterons with 37-inch cyclotron	Lawrence, Perrier, and Segrè 1937	Old Radiation Laboratory, U of California-Berkeley, main campus, Berkeley, California USA [building razed for new construction]	N37-52.40 W122-15.37	b-
Lab	Isolation of technetium		Royale Istituto di Fisica Sperimentale, 36 Via Archirafi (corner of Via Archirafi and Via Granfranco Ingrassia), Palermo, Italy	N38-06.61 E13-22.39	b+
Lab	Discovery of masurium?	Noddack, Tacke, and Berg 1925	Chemiegebäude, Physikalisches-Technisches Reichsanstalt (now Bundesanstalt), Abbestraße 2-12, Berlin, Germany	N52-30.98 E13-19.26	b+

### 44. Ruthenium

Lab	Discovery of metallic ruthenium in platinum ores	Klaus 1844	Нижи им. а.м. Бутлерова (Butlerov Chemical Institute); Кремлевская Ул. (Kremlevskaya Str.), Казанский Государственный Университет, Kazanskiy Gosudarstvenniy Universitet (Kazan State University.), Казань (Kazan), Татарстан (Tatarstan), Россия (Russia) (plaque)	N55-47.40 E49-07.31	b+
Museum	Original chemical samples				

Mint	Source of platinum ores		St. Petersburg Mint – Монетный Двор, Monetniy Dvor ("Money Yard") – at Peter and Paul Fortress – Петропавловская Крепость, Petropavlovskaya Krepost; Санкт-Петербург (Saint Petersburg), Ленинградская Область (Leningrad Oblast), Россия (Russia)	N59-57.00 E30-18.87	b+
Lab	Discovery of "vestium," alleged discovery of ruthenium before Klaus but not officially recognized, and later discredited	Sniadecki 1807	Old campus, Vilnius University, 3 Universiteto str., Vilnius, Lithuania (formerly Wilno, Poland-Lithuania); Sniadecki's lab was at 2 Volano Gatve (now Ministry of Education and Science)	N54-40.96 E25-17.26 Lab: N54-40.96 E25-17.49	b+  b+
Lab	Preparation of crude ruthenium but not carefully characterized	Osann 1828	University of Tartu (previously University of Dorpat), Ülikooli 18, Tartu, Estonia	N58-22.87 E26-43.21	b+

## 45. Rhodium

Lab/house	Discovery of metallic rhodium by separation from platinum	Wollaston 1804	14 Buckingham St., London, England [now a parking lot on Greenwell St, a new street]	N51-31.38 W00-08.57	b-
Lab/house	Earlier house (where procedure for preparing malleable platinum was developed)		18 Cecil St., London, England [now Ivy Bridge Lane, a new street]	N51-30.55 W00-07.28	b-
Lab/house	Later house (then purchased by Babbage)		1 Dorset St, London, England (plaque)	N51-31.20 W00-09.28	b+

## 46. Palladium

Lab/house	Discovery of metallic palladium by separation from platinum	Wollaston 1803	14 Buckingham St., London, England [now a parking lot on Greenwell St, a new street]	N51-31.38 W00-08.57	b-
Lab/house	Earlier house (where procedure for preparing malleable platinum was developed)		18 Cecil St (now Ivy Bridge Lane), London, England [now new construction on Ivy Bridge Lane, a new street]	N51-30.51 W00-07.22	b-
Lab/house	Later house (then purchased by Babbage)		1 Dorset St, London, England (plaque)	N51-31.20 W00-09.28	b+
Terrestrial source	Native palladium alloys known from 1500's	Palladium found in gold mined in region	Sabarà, near Belo Horizonte, Minas Gerais, Brazil	S19-53.5 W43-48.0	
Museum	Surviving foundry		Museu do Ouro (and site of original royal foundry), Rua de Intendência, Sabarà, Minas Gerais, Brazil	S19-53.32 W43-48.42	b+

## 47. Silver\*

Terrestrial source	Original discovery of silver	Known to ancients	NA		
--------------------	------------------------------	-------------------	----	--	--

## 48. Cadmium

Lab	Original discovery of metallic cadmium	Stromeyer 1817	Old chemistry building, U of Göttingen (now physics building), 7 Hospitalstraße, Göttingen, Niedersachsen, Germany	N51-31.82 E09-56.19	b+
-----	--	----------------	--	------------------------	----

Manufactury	Production site of zinc compounds contaminated with cadmium that Stromeyer investigated		Johann Ludwig von Unger's Erban & Company, Bismarckstraße, Salzgitter, Niedersachsen, Germany (building razed; site now occupied by Kurpark am Greif, an elderly nursing home)	N52-02.38 E10-22.65	b-
Mine	Major source of cadmium		Erzbergwerk Rammelsberg, Rammelsberger Straße, Goslar, Germany	N51-53.39 E10-25.09	+

## 49. Indium

Lab	Discovery of indium spectroscopically and preparation of metallic indium	Reich and Richter 1863	Hüttenlaboratorium (main laboratory of school/mines), courtyard (present site 22 Nonnengasse) of original academy building (6 Akademiestraße), Technische Universität Bergakademie, Freiberg, Sachsen, Germany	N50-55.10 E13-20.44	b+
Mine	Source of indium mineral		Himmelsfürst Mine, near Fürstenweg, Himmelsfürst, near St. Michaelis (now incorporated into Brand-Erbisdorf), Sachsen, Germany	N50-51.74 E13-17.77	m-
Home	Home of Reich		20 Waisenhaus Straße, Freiberg, Germany (plaque)	N50-54.99 E13-20.37	b+
Museum	Werner Mineral Museum, famous collection of minerals		Brennhausgasse 14, Technische Universität Bergakademie, Freiberg, Sachsen, Germany	N50-55.25 E13-20.60	+
Museum	History museum of university		Nonnengasse 22, Technische Universität Bergakademie, Freiberg, Sachsen, Germany	N50-55.10 E13-20.44	+

## 50. Tin\*

Terrestrial source	Original discovery of tin	Known to ancients	NA		
--------------------	---------------------------	-------------------	----	--	--

## 51. Antimony\*

Terrestrial source	Original discovery of antimony	Sulfide known to ancients	NA		
Marktplatz; Turm and Ratskeller (where Agricola was Burgermeister)	Distinction between antimony and other metals	Agricola 1529	Innere Klosterstraße, Chemnitz, Sachsen, Germany (two plaques and bust of Agricola) - represents activity center of Agricola	N50-49.95 E12-55.11	+

## 52. Tellurium

Home/Lab	Discovery of tellurium	Müller von Reichenstein 1782	Fleischer Gasse 36 (21 older number), Hermannstadt (as known at time of discovery); Str. Mitropoliei 26, Sibiu (as known now), Romania	N45-47.68 E24-08.83	b+
Museum	Samples of historical tellurium samples		Museum of Natural History (Muzeul de Istorie Naturala), Str Cetății 1, Sibiu, Romania	N45-47.70 E24-09.29	+

Mine	Source of tellurium mineral		Nagyagite and sylvanite from Fața Băii, Romania	N46-07.85 E23-08.84	m
Museum	Samples of Romanian and historical mineral samples		Babeș-Bolyai U. Mineralogical Museum, 1 Kogalniceanu Str., Cluj-Napoca, Romania	N46-46.04 E23-35.49	+
University	Medical school, base of Kitaibel's work (now Hungarian World Society)	Kitaibel, 1789	Original Medical school, University of Pest, Semmelweis utca 1 (former Újvilág utca), Budapest, Hungary	N47-29.65 E19-03.53	b-
Laboratory/ home	Independent discovery of tellurium		Home laboratory, Reáltanoda utca, between Szép utca and Ferenciek tere, Budapest, Hungary	N47-29.56 E19-03.45	b-
Mine	Source of wehrlite ore (silver bismuth telluride)		Park marks origin of narrow-gauge track (with now an active amusement train) up into mountains, Nagybörzsöny (DeutschPilsen), Hungary	N47-55.87 E18-50.36	m-
Museum	Old mining equipment and relics, farm equipment		Bányagazda Ház Tájház (Mining manager's old home), Center of town, Nagybörzsöny (DeutschPilsen), Hungary	N47-56.14 E18-49.56	b+
Lab	Independent discoverer/confirmer of discovery; refused credit for discovery	Klaproth 1798	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-

## 53. Iodine

Home/lab/salt petre works	Discovery of iodine	Courtois 1811	9 (present 31), rue St. Ambroise; Paris, France [site now occupied by apartment complex]	N48-51.76 E02-22.70	b-
Previous home	Home/saltpetre works 1802-1807		29 (changed to 39), rue Ste Marguerite (present rue Trousseau); Paris, France [new buildings on site]	N48-51.12 E02-22.74	b-
Academy	Training of Courtois		Dijon Academy, 51 rue Monge, Dijon, Bourgogne, France	N47-19.12 E05-02.02	b+
Saltpetre works	Ancient saltpeter works in Dijon		rue de la Raffinerie, Dijon, Bourgogne, France [houses now on site]	N47-19.01 E05-03.25	+
House	Birthplace of Courtois, across from Dijon Academy		78 rue Monge, Dijon, Bourgogne, France (plaque)	N 47-19.12 E05-02.02	b+
Lab	Determination of elemental nature of iodine	Davy 1813	Royal Institution, 21 Albemarle St, London, England (most of the work done while visiting Paris by using his portable chemistry chest, simultaneous with the work of Gay- Lussac [immediately below]).	N51-30.58 W00-08.58	b+
Lab		Gay-Lussac 1813	École Polytechnique (2nd site), 1, Rue Decartes near Panthéon, Paris, France	N48-50.83 E02-20.90	b+

## 54. Xenon

Lab	Discovery by isolation from air	Ramsay and Travers 1898	Old Science Bldg (now Slade Art Bldg), Gower Court, University College (London), England	N51-31.50 W00-08.05	b+
-----	---------------------------------	----------------------------	--	------------------------	----

Apparatus	Hamstead device used for cooling air		Science Museum, Exhibition Road, South Kensington, London, England	N51-29.86 W00-10.44	+
-----------	--------------------------------------	--	--	------------------------	---

## 55. Cesium

Lab	Discovery of cesium spectroscopically	Bunsen and Kirchhoff 1860	U of Heidelberg (old site), 52 Hauptstraße, Altstadt, Heidelberg, Baden-Württemberg, Germany (plaque)	N49-24.62 E08-41.87	b+
Terrestrial source	Source of solution for spectroscopic analysis		Gradierbau, Die Salinenen, Salinenstraße, Bad Dürkheim, Germany	N49-27.87 E08-10.49	+
University display	Spectroscopic equipment, electrolysis equipment, rubidium samples		Hörsaal Zentrum Chemie, 252 Im Neuenheimer Feld, U of Heidelberg (new campus), Heidelberg, Baden-Württemberg, Germany	N49-25.11 E08-40.38	+
Lab	Preparation of metallic cesium	C. Setterberg 1882	Old Chemistry Building, U of Heidelberg (old site), Akademistraße, Altstadt, Heidelberg, Baden-Württemberg, Germany	N49-24.59 E08-41.87	b+
Mineral source	First source of cesium mineral, pollucite, a complex cesium sodium aluminosilicate		La Speranza quarry, San Piero in Campo, Elba Island, Italy	N42-44.83 E10-12.55	q+

## 56. Barium\*

Terrestrial source	Discovery of “phosphoro di Bologna” (barium sulfate)	Vincenzo Casciarolo early 1600's	Monte Paderno, 6 km SW of Bologna, Italy	N44-26.73 E11-18.81	+
--------------------	--	----------------------------------	--	------------------------	---

Museum	Samples of “phosphoro di Bologna”		"Museum Bombicci," Museo Archeologico Nazionale, Piazza Museo Nazionale, Bologna, Italy	N44-29.89 E11-21.35	+
Lab	Distinction between baryta and lime	Scheele 1774	Apoteket Lejonet, Apotekshuset, 2 Stora Torget, Köping, Västmanlands, Sweden [new municipal building now on site, the "Apotekshuset"] was the "official" pharmacy site of Scheele; but the discovery was actually done at the previous Pohl pharmacy in Köping at Stora Gatan 8-Östra Långgatan 8.	2nd site: N59-30.85 E15-59.56	b <sup>-</sup>
Museum	Exhibits		Scheele Museum, Östra Långgatan 37, Köping, Västmanlands, Sweden	1st site (discoveries): N59-30.75 E15-59.69	b-
Lab	Preparation of metallic barium	Davy 1808	Royal Institution, 21 Albemarle St, London, England	N51-30.58 W00-08.58	b+

## 57. Lanthanum

Lab	Discovery of lanthanum earth	Mosander 1839	(2nd) Royal Swedish Academy of Science, 2 Wallingatan, Stockholm, Sweden	N59-20.26 E18-03.52	b+
Mine	Source of lanthanum mineral – cerite, a complex calcium rare earth silicate	[see cerium]	Bastnäs Mine, Ridderhyttan, Västmanlands, Sweden (part of Ekomuseum Bergslagen)	N59-50.75 E15-35.34	m+
Terrestrial source	source of lanthanum mineral — mosandrite, a complex calcium rare earth titanate-silicate		Mosandrite, Låven (Island), Langesundfjord, Norway	N58-59.73 E09-49.05	+

## 58. Cerium

Lab/house	Discovery of cerium earth	Berzelius and Hisinger 1803	Hisinger's home, (now Akademiska Hus), Herrgårdsvägen 6, Skinnskatteberg, Västmanlands, Sweden	N59-49.71 E15-40.79	b+
Mine	Source of cerium mineral — cerite, a complex calcium rare earth silicate		Bastnäs Mine, Riddarhyttan, Västmanlands, Sweden (source for both Berzelius and Hisinger, and Klaproth) (part of Ekomuseum Bergslagen)	N59-50.75 E15-35.34	m+
Museum	Berzelius Museum	Berzelius	Plans are to move the museum to Observatoriekullen, Observatoriemuseet (Observatory Museum, Observatory Hill), Drottninggatan 120, Stockholm, Sweden [see note above under Silicon regarding the authors' viewing of the museum].	N59-20.50 E18-03.30	+
Lab	Discovery of cerium earth	Klaproth 1803	Berlin Akademie, present 28 Dorotheenstraße (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]	N52-31.14 E13-23.46	b-
Museum	Exhibit on Klaproth		Museum für Naturkunde, Invalidenstraße 43, Berlin, Germany	N52-31.79 E13-22.78	+

## 59. Praseodymium

Lab	Separation of didymium into praseodymium and neodymium	Auer von Welsbach 1885	Old Chemistry Building, 10 Währinger Straße, U of Vienna (presently biology building), Wien, Austria	N48-12.97 E16-21.62	b+
Museum	Exhibits, chemical samples, apparatus		Welsbach Museum, Burgstraße 8, Althofen, Kärnten, Austria	N46-52.52 E14-28.43	+
Home/castle	Welsbach's home and castle		Welsbach Castle, 6 km WSW of Althofen Welsbach Museum, Kärnten, Austria	N46-51.49 E14-23.39	b+
Lab	Discovery of didymium (mixture of Pr and Nd) from lanthana	Mosander 1842	(2nd) Royal Swedish Academy of Science, 2 Wallingatan, Stockholm, Sweden	N59-20.26 E18-03.52	b+

## 60. Neodymium

Lab	Separation of didymium into praseodymium and neodymium	Auer von Welsbach 1885	Old Chemistry Building, 10 Währinger Straße, U of Vienna (presently biology building), Wien, Austria	N48-12.97 E16-21.62	b+
Museum	Exhibits, chemical samples, apparatus		Welsbach Museum, Burgstraße 8, Althofen, Kärnten, Austria	N46-52.52 E14-28.43	+
Home/castle	Welsbach's home and castle		Welsbach Castle, 6 km WSW of Althofen Welsbach Museum, Kärnten, Austria	N46-51.49 E14-23.39	b+
Lab	Discovery of didymium (mixture of Pr and Nd) from lanthana	Mosander 1842	(2nd) Royal Swedish Academy of Science, 2 Wallingatan, Stockholm, Sweden	N59-20.26 E18-03.52	b+

## 61. Promethium

Lab	Discovery of promethium from fission products of uranium	Marinsky, Glendenin, and Coryell 1945	Chemical Analysis Building (then building #706, now building #3550), Central Ave., X-10 Area, Clinton Engineer Works, Oak Ridge, Tennessee, USA; building slated for removal in the near future	N35-55.61 W84-18.99	b+ (b- soon)
Atomic pile	Production of fission products		Graphite reactor, Hillside Dr., X-10 Area, Clinton Engineer Works, Oak Ridge, Tennessee, USA	N35-55.68 W84-19.06	b+

## 62. Samarium

Lab/house	Discovery by separation from didymia	Boisbaudran 1879	1, rue de Lusignan, Cognac, France	N45-41.69 W00-19.85	b+
-----------	--------------------------------------	------------------	------------------------------------	------------------------	----

## 63. Europium

Lab	Discovery by separation from samarium salts	Demarçay 1901	2, Boulevard Berthier, Paris, France [now occupied by modern hotel]	N48-53.67 E02 18.78	b-
Home			152 Boulevard Haussmann, Paris, France	N48-52.52 E02-18.70	b+

## 64. Gadolinium

Lab/house	Discovery by separation from didymia	de Marignac 1880	"Third floor," rue Jean-Sénevier 16, Genève, Switzerland	N46-11.84 E06-08.88	b+
University	Initial work done at U. of Geneva (new site)	(de Marignac was retired from the U of Geneva at the time of discovery)	"Uni-Bastion," Place de l'Université 3 (rue de Candolle), Genève, Switzerland)	N46-11.93 E06-08.65	b+
	Previous lab was at U. of Geneva (old site)		Société de lecture (old university), Grand Rue 11, Genève, Switzerland	N46-12.14 E06-08.70	b+
Lab/house	Discovery by separation from didymia	Boisbaudran 1886	1, rue de Lusignan, Cognac, France	N45-41.69 W00-19.85	b+

## 65. Terbium

Lab	Discovery by separation from yttria	Mosander 1842	(2nd) Royal Swedish Academy of Science, 2 Wallingatan, Stockholm, Sweden	N59-20.26 E18-03.52	b+
Mine	Source of yttria – gadolinite, a complex rare earth silicate		Ytterby Mine, Ytterby, Resarö (Island), Stockholms, Sweden	N59-25.60 E18-21.18	m

## 66. Dysprosium

Lab/house	Discovery by separation from holmia	Boisbaudran 1886	1, rue de Lusignan, Cognac, France	N45-41.69 W00-19.85	b+
-----------	-------------------------------------	------------------	------------------------------------	------------------------	----

## 67. Holmium

Lab	Discovery by separation from erbia	Cleve 1879	1860 chemistry building (now Philologicum), 3 Thunbergsvägen, on Carolinaparken, Uppsala, Sweden	N59-51.24 E17-37.69	b+
Mine	Source of erbia – gadolinite, a complex rare earth silicate		Ytterby Mine, Ytterby, Resarö (Island), Stockholms, Sweden	N59-25.60 E18-21.18	m

## 68. Erbium

Lab	Discovery by separation from yttria	Mosander 1842	(2nd) Royal Swedish Academy of Science, 2 Wallingatan, Stockholm, Sweden	N59-20.26 E18-03.52	b+
Mine	Source of yttria – gadolinite, a complex rare earth silicate		Ytterby Mine, Ytterby, Resarö (Island), Stockholms, Sweden	N59-25.60 E18-21.18	m

## 69. Thulium

Lab	Discovery by separation from erbia	Cleve 1879	1860 chemistry building (now Philologicum), 3 Thunbergsvägen, on Carolinaparken, Uppsala, Sweden	N59-51.24 E17-37.69	b+
Mine	Source of erbia – gadolinite, a complex rare earth silicate		Ytterby Mine, Ytterby, Resarö (Island), Stockholms, Sweden	N59-25.60 E18-21.18	m

## 70. Ytterbium

Lab/house	Discovery by separation from erbia	de Marignac 1878	"Third floor," rue Jean-Sénebier 16, Genève, Switzerland (final work)	N46-11.85 E06-08.88	b+
University	U. of Geneva (new site)	(de Marignac was retired from the U of Geneva at the time of the discovery announcement)	"Uni-Bastion," Place de l'Université 3 (rue de Candolle), Genève, Switzerland?	N46-11.93 E06-08.65	b+

## 71. Lutetium

Lab	Discovery by separation from ytterbia	Urbain 1907	Chimie, Sorbonne, near rue Cujas side, Paris, France	N48-50.86 E02-20.60	b+
Lab	Discovery by separation from ytterbia	James 1907	Conant Hall, U of New Hampshire, Durham, New Hampshire, USA (plaque), now used for Dept of Psychology	N43-08.15 W70-56.01	b+
Lab	Discovery by separation from ytterbia ("casseopeium")	Auer von Welsbach 1907	Treibacher Industries, Auer-von-Welsbach-straße 1, Treibach, Kärnten, Austria	N46-52.13 E14-27.73	b+
Museum	Exhibits, chemical samples, apparatus		Welsbach Museum, Burgstraße 8, Althofen, Kärnten, Austria	N46-52.52 E14-28.43	+
Home/castle/ Lab	Welsbach's home and castle		Welsbach Castle, 6 km WSW of Althofen Welsbach Museum, Kärnten, Austria	N46-51.49 E14-23.39	b+

## 72. Hafnium

Lab	Discovery of hafnium by separation from zirconium	Hevesy and Coster 1923	Niels Bohr Institute, 17 Blegdamsveg, Copenhagen, Denmark	N55-41.80 E12-34.30	b+
-----	---	------------------------	---	------------------------	----

Museum	Original hafnium sample		Bymuseum (City Museum), Vesterbrogade 59, Copenhagen, Denmark	N55-40.33 E12-33.20	+
Museum	Samples of alvite (radioactive zircon containing hafnium)		Geological Museum, Oster Voldgade 5-7, Copenhagen, Denmark	N55-41.24 E12-34.64	+
Mine	Source of hafnium mineral — alvite, a radioactive form of zircon		Tangen Mine, Kragerø, Norway	N58-52.29 E09-21.24	m+
University	Site of Moseley's original X-ray work (defined atomic number which presaged discovery of hafnium)	Moseley 1913-1914	Coupland I Building (physics; renamed Rutherford Building in 2006), Coupland St., U. of Manchester, Manchester, England	N53-27.96 W02-14.08	b+
University	Site of Moseley's X-ray work (later work, including rare earth research)		Townsend Hall, Clarendon Physics, Parks Rd., Oxford, England	N51-45.56 W01-15.39	b+
University	Exhibits in Moseley Room		Moseley Room, Lindemann Hall, Clarendon Physics, Parks Rd., Oxford, England	N51-45.59 W01-15.41	b+
Museum	Exhibit of Moseley's apparatus		Ashmolean Science Museum, Broad St., Oxford, England	N51-45.26 W01-15.33	+
Lab	Preparation of metallic hafnium	van Arkel and de Boer 1925	Philips Research Laboratories (Natuurkundig Laboratorium [Physics laboratory], N.V. Philips Gloeilampenfabrieken), Kastanjelaan, Eindhoven, Netherlands	N51-26.75 E05-27.25	b+

## 73. Tantalum

Lab	Discovery of element	Ekeberg 1802	Academiens Laboratorium Chemicum, 24 Västra Ågatan, U. of Uppsala, Uppsala, Sweden	N59-51.33 E17-38.43	b+
Mine	Source of tantalum mineral – yttrotantalite (yttrium tantalate)		Ytterby Mine, Ytterby, Resarö (Island), Stockholms, Sweden	N59-25.60 E18-21.18	m
Mine	Source of tantalum mineral – tantalite (iron, manganese tantalate)		Skogsböle, Kemiö (Kimito Island), Finland	N60-08.59 E22-35.98	m-
Lab	Differentiation between niobium and tantalum	Heinrich Rose 1847	Berlin Akademie, present 28 Dorotheenstraße (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]	N52-31.14 E13-23.46	b-
Lab/ Manufactory	Preparation of pure metallic tantalum for light bulb filaments	Bolton 1902	Siemens A.G. (then Siemens-Halske Company), Helmholtzstrasse 2-9, Berlin, Germany	N52-31.28 E13-19.42	b+
Lab	Clearly differentiated niobium from tantalum compounds and described their different chemistry	Marignac 1865	"Dark damp cellar lab," Societé de lecture (Académie de Genève), Grand Rue 11, Genève, Switzerland [lab removed]	N46-12.14 E06-08.70	b+ (main bldg)

## 74. Tungsten\*

Lab	Discovery of element	Scheele 1781	Apoteket Lejonet, Apotekshuset, 2 Stora Torget, Köping, Västmanlands, Sweden [new municipal building now on site, the "Apotekshuset"] was the "official" pharmacy site of Scheele; but the discovery was actually done at the previous Pohl pharmacy in Köping at Stora Gatan 8-Östra Långgatan 8.	2nd site: N59-30.85 E15-59.56  1st site (discoveries): N59-30.75 E15-59.69	b-  b-
Mine	Source of tungsten mineral — scheelite, calcium tungstate		Bispberg Gruvan, Bispberg Klack (mountain), Kopparbergs, Sweden	N60-21.67 E15-47.55	m
Museum	Exhibits		Scheele Museum, Östra Långgatan 37, Köping, Västmanlands, Sweden	N59-30.50 E16-00.01	+
Lab	Preparation of metallic tungsten	Elhuyar brothers 1783	Laboratorium Chemicum, Bergarako Errege Seminarioa (Bergara Royal Seminary), Martin Agirre Deunaren Enparantza (St. Martin Agirre Plaza 1, corner of Bidekurutzeta Kalea and Herrilagunak Kalea), Bergara, Gipuzkoa [Basque region], Spain	N43-07.06 W02-24.80	b+

## 75. Rhenium

Lab	Discovery of rhenium from X-rays in platinum ores and gadolinite	Noddack, Tacke, and Berg 1925	Chemigebäude, Physikalisches-Technisches Reichsanstalt (now Bundesanstalt), Abbestraße 2-12, Berlin, Germany	N52-30.98 E13-19.26	b+
Mine	Source of rhenium mineral for isolation – molybdenite in gneiss		Knaben Mine, Knaben, Vest-Agder, Norway	N58-39.55 E07-04.41	m

University	Site of Moseley's original X-ray work (defined atomic number which presaged discovery of hafnium)	Moseley 1913-1914	Coupland I Building (physics; renamed Rutherford Building in 2006), Coupland St., U. of Manchester, Manchester, England	N53-27.96 W02-14.08	b+
University	Site of Moseley's X-ray work (later work, including rare earth research)		Townsend Hall, Clarendon Physics, Parks Rd., Oxford, England	N51-45.56 W01-15.39	b+
University	Exhibits in Moseley Room		Moseley Room, Lindemann Hall, Clarendon Physics, Parks Rd., Oxford, England	N51-45.59 W01-15.41	+
Museum	Exhibit of Moseley's apparatus		Ashmolean Science Museum, Broad St., Oxford, England	N51-45.26 W01-15.33	+

## 76. Osmium

Lab/house	Discovery of osmium by separation from platinum	Tennant 1803	4 Garden Court, The Temple, (now 1 Garden Court), London, England	N51-30.73 W00-06.70	b+
Terrestrial source	European discovery of osmiridium	1819	Кушва(Kushva), Свердловская Область (Sverdlosk Oblast), Россия (Russia)	N58-17 E59-45	+

## 77. Iridium

Lab/house	Discovery of iridium by separation from platinum	Tennant 1803	4 Garden Court, The Temple, (now 1 Garden Court), London, England	N51-30.73 W00-06.70	b+
Terrestrial source	European discovery of osmiridium	1819	Кушва(Kushva), Свердловская Область (Sverdlosk Oblast), Россия (Russia)	N58-17 E59-45	+

Lab	Recognition of a new substance called <i>ptene</i> from its colored salts, later recognized as iridium; workers confounded osmium and iridium	Vauquelin and Collet-Descotils 1803-4	École des mines (2nd site at l'Hôtel Mouchy), 71, rue de l'Université, Paris, France (address before demolition to make way for a new street)	N48-51.60 E02-19.30	b-
-----	---	--	---	------------------------	----

## 78. Platinum\*

Terrestrial source	Original discovery of platinum	de Ulloa 1735 first reported; Wood 1741 performed first lab tests; Brownrigg 1750 first published	Chocó, Colombia (alluvial soils of rivers); original site reported as "Rio di Pinto, " location lost to history, but known to be part of the San Juan River Basin. Representative site chosen was Condoto, today known as "the Platinum Capital of Colombia" on the Condoto River, a tributary of the San Juan.	Condoto, on Rio Condoto N05-06 W76-39	+
	European discovery	1819; first commissioned mine 1824	Area west of Нижний Тагил (Nizhniy Tagil), Свердловская Область (Sverdlosk Oblast), Россия (Russia). First commissioned platinum mine on Река Баранча (Река [River] Barancha, northwest of Nizhniy Tagil.	N58-01 E59-52	+

## 79. Gold\*

Terrestrial source	Original discovery of gold	Known to ancients	NA		
--------------------	----------------------------	-------------------	----	--	--

## 80. Mercury\*

Terrestrial source	Original discovery of mercury	Known to ancients	NA		
--------------------	-------------------------------	-------------------	----	--	--

## 81. Thallium

Lab	Discovery of thallium spectroscopically (preliminary work)	Crookes 1861	Brook Green (parents' farm), Hammersmith, London, England [now occupied by residential houses]	N51-29.72 W00-13.03	b-
Lab	Discovery of thallium spectroscopically		20 Mornington Rd. (now Mornington St), London, England [now occupied by apartment complex]	N51-32.08 W00-08.58	b-
Other home/lab	Later home/lab		7 Kensington Park Gardens, London, England (plaque)	N51-30.69 W00-12.16	b+
Journal office	Chemical News office, also famous Cheshire Cheese pub		Wine Office Court, London, England (also famous Cheshire Cheese Pub)	N51-30.86 W00-06.43	b+
Mine	Source of thallium mineral – thallium-rich selenides		Eskabernite Mine, Tilkerode, Germany (plaque)	N51-38.01 E11-19.13	m
Manufactory	Collection of sludge		Smelter (now ruins), property of Oker-Harzmetall GmbH, 6 Hüttenstraße, Oker, Germany	N51-54.05 E10-29.09	b
Museum	Samples of thallium and thallium components		Science Museum, Exhibition Road, South Kensington, London, England	N51-29.86 W00-10.44	+

Lab	Preparation of metallic thallium	Lamy 1862	Faculté des Sciences de Lille, now rebuilt Carnot College, 43 Carnot Blvd., Lilles, Nord-Pas-de-Calais, France	N50-38.38 E03-03.99	b-
Manufactory	Site where Belgian pyrites were processed to produce sulfuric acid, with accompanying sludge containing thallium		Kuhlman Chimique (rebuilt), now Produits chimiques de Loos, 22 rue Georg Clemenceau, Loos (suburb of Lille), Nord-Pas-de-Calais, France	N50-37.28 E03-00.45	b-
Mine	Source of thallium ores (pyrites) from Belgium		Mine de le Rocheux, Oneux, (village near Theux), Belgian (now a nature reserve)	N50-32.43 E05-49.84	m-
Library/exhibit	Samples of thallium samples prepared by Lamy		Display cabinet in Bibliotheque (library); École Normale Superieure Physique; 24, rue l'Homond; Paris, France	N48-50.57 E02-20.82	+

## 82. Lead\*

Terrestrial source	Original discovery of lead	Known to ancients	NA		
--------------------	----------------------------	-------------------	----	--	--

## 83. Bismuth\*

Terrestrial source	Original discovery of bismuth	Known to Medieval Europe	NA		
--------------------	-------------------------------	--------------------------	----	--	--

Marktplatz; Turm and Ratskeller (where Agricola was Burgermeister)	Distinction among bismuth, antimony and other metals	Agricola 1529	Innere Klosterstraße, Chemnitz, Sachsen, Germany (two plaques and bust)	N50-49.95 E12-55.11	+
---	---	---------------	--	------------------------	---

## 84. Polonium

Lab	First detection and naming of element	Curies 1898	"Physical measurement room," École Supérieure (now ESPCI), 42 Rue Lhomond (old address), Paris, France	N48-50.49 E02-20.90	b-
Lab	Discovery of polonium by separation from pitchblende	Curies 1900	"The Shed," across the courtyard from the Physical Measurement Room, École Supérieure, now ESPCI; present address 10, vue Vauquelin, Paris, France (plaque) [site now occupied by a motorcycle parking lot]	N48-50.50 E02-20.83	b-
Museum	Curie instrumentation and exhibits		Curie Institute; 11, rue Pierre et Marie Curie, Paris, France	N48-50.66 E02-20.67	+
Manufactory	Source of polonium mineral – spent pitchblende (crude uraninite — uranium oxide — from which uranium had been extracted and which had been discarded in refuse pile)		Urangelbfabrik (Uranium Yellow Manufactory), across street from Radium Palác (Radium Palace), nám. Julia Fucika; St. Joachimsthal (now Jáchymov), Bohemia (now Czech Republic) [present site is now a park marked by the Památník Objevení Radia (Monument of Discovery of Radium)]	N50-21.58 E12-56.11	b-

Mine	Original Source of uranium ore		Důl Svornost (“Unity Mine”), NW outskirts, Jáchymov, Czech Republic [presently closed, but furnishes thermal, radioactive water which is pumped to Radium Palace]	N50-22.35 E12-54.70	m
Museum/ Information center	History of mines and city, exhibits		Old mint./museum (Mincovna/Muzeum), corner of Mincovni and Berzrčův vrch; and City Hall (Rathaus), Central Information (Informační Centrum), náměstie Republiky 1, St. Joachimsthal (now Jáchymov), Czech Republic (Bohemia) [both next door to each other]	Old Mint: N50-22.29 E12-54.78  Rathaus: N50-22.29 E12-54.82	b+  b+

## 85. Astatine

Lab	Analysis of bismuth sample which had been bombarded with alpha particles	Corson, Mackenzie, and Segrè 1940	3rd floor, LeConte Hall, U of California-Berkeley (old building, not new wing), main campus, Berkeley, California, USA	N37-52.34 W122-15.41	b++
Cyclotron	Bombardment of bismuth with alpha particles with 60-inch cyclotron		Crocker Hall, U of California-Berkeley, main campus, Berkeley, California, USA [building razed for new construction], location just north of Latimer Hall	N37-52.41 W122-15.36	b-

## 86. Radon

Lab	Detection of “niton”  First description and characterization of element	Rutherford 1900  Rutherford 1902	Macdonald Physics Building (the old Physics Building), where Rutherford performed his work, then Macdonald-Stewart Library, now called the Shulich Library (Engineering and Science), 809, rue Sherbrooke Ouest [West Sherbrooke Street], McGill U, Montréal, Canada	N45 30.30 W73 34.49.	b+
Museum	Rutherford’s apparatus		Ernest Rutherford Bldg. (physics), 3600 rue University, McGill U, Montréal, Canada	N45-30.41 W73-34.72	b+
Lab	First detection of emanation from radium	Dorn 1900	Old physics Bldg, Friedemann-Bach-Platz, Martin-Luther Universität Halle-Wittenberg, Halle, Sachsen-Anhalt, Germany	N51-29.20 E11-57.88	b+

## 87. Francium

Lab	Detection of francium in uranium ores	Perey 1939	Curie Institute (Mme Curie's later laboratory); 11, rue Pierre et Marie Curie, Paris, France	N48-50.66 E02-20.67	b+
-----	---------------------------------------	------------	--	------------------------	----

## 88. Radium

Lab	First detection and naming of element	Curies 1898	"Physical measurement room," École Supérieure (now ESPCI), 42 Rue Lhomond (old address), Paris, France	N48-50.49 E02-20.90	b-
-----	---------------------------------------	-------------	--	------------------------	----

Lab	Discovery of radium by separation from pitchblende	Curies 1900	“The Shed,” across the courtyard from the Physical Measurement Room, École Supérieure, now ESPCI; present address 10, rue Vauquelin, Paris, France (plaque) [site now occupied by a motorcycle parking lot]	N48-50.50 E02-20.83	b-
Museum	Curie instrumentation and exhibits		Curie Institute; 11, rue Pierre et Marie Curie, Paris, France	N48-50.66 E02-20.67	b+
Manufactory	Source of radium mineral – spent pitchblende (crude uraninite — uranium oxide — from which uranium had been extracted and which had been discarded in refuse pile)		Urangelbfabrik (Uranium Yellow Manufactory), across street from Radium Palác (Radium Palace), nám. Julia Fucika; St. Joachimsthal (now Jáchymov), Bohemia (now Czech Republic) [present site is now a park marked by the Památník Objevení Radia (Monument of Discovery of Radium)]	N50-21.58 E12-56.11	b-
Mine	Original Source of uranium ore		Důl Svornost (“Unity Mine”), NW outskirts, Jáchymov, Czech Republic [presently closed, but furnishes thermal, radioactive water which is pumped to Radium Palace]	N50-22.35 E12-54.70	m
Museum/ Information center	History of mines and city, exhibits		Old mint./museum (Mincovna/Muzeum), corner of Mincovni and Berzrčův vrch; and City Hall (Rathaus), Central Information (Informační Centrum), náměstie Republiky 1, St. Joachimsthal (now Jáchymov), Czech Republic (Bohemia) [both next door to each other]	Old Mint: N50-22.29 E12-54.78  Rathaus: N50-22.29 E12-54.82	b+  b+

## 89. Actinium

Lab	Discovery of actinium in uranium ores	Debiere 1899	Sorbonne, near rue Cujas side, Paris, France (collaborated with Curies)	N48-50.86 E02-20.60	b+
Lab	Initial separation of crude uranium ores		"The Shed" (collaboration with the Curies), across the courtyard from the Physical Measurement Room, École Supérieure, now ESPCI; present address 10, rue Vauquelin, Paris, France (plaque) [site now occupied by a motorcycle parking lot]	N48-50.50 E02-20.83	b-
Manufactory	Source of radium mineral – spent pitchblende (crude uraninite — uranium oxide — from which uranium had been extracted and which had been discarded in refuse pile)		Urangelbfabrik (Uranium Yellow Manufactory), across street from Radium Palác (Radium Palace), nám. Julia Fucika; St. Joachimsthal (now Jáchymov), Bohemia (now Czech Republic) [present site is now a park marked by the Památník Objevení Radia (Monument of Discovery of Radium)]	N50-21.58 E12-56.11	b-
Mine	Original Source of uranium ore		Důl Svornost (“Unity Mine”), NW outskirts, Jáchymov, Czech Republic [presently closed, but furnishes thermal, radioactive water which is pumped to Radium Palace]	N50-22.35 E12-54.70	m
Museum/Information center	History of mines and city, exhibits		Old mint./museum (Mincovna/Muzeum), corner of Mincovni and Berzrčův vrch; and City Hall (Rathaus), Central Information (Informační Centrum), náměstie Republiky 1, St. Joachimsthal (now Jáchymov), Czech Republic (Bohemia) [both next door to each other]	Old Mint: N50-22.29 E12-54.78  Rathaus: N50-22.29 E12-54.82	b+   b+

Lab	Discovery of actinium in uranium ores	Giesel 1902 [Buchler was involved in radium production from spent pitchblende from Jáchymov until 1905]	Buchler Chininfrabrik (Buchler Quinine Works), Frankfurter Straße 294, Braunschweig, Germany [now a vacant lot]	N52-15.43 E10-30.77	b-
Company	[Present Buchler GmbH and Amersham Buchler GmbH & Co., where quinine and radioactive businesses, respectively, continue]		Harxbütteler Straße 3 Braunschweig, Germany  [Original Buchler monument from Frankfurter Straße has been moved and now resides here]	N52-19.89 E10-30.41  Monument: N52-19.90 E10-30.46	b+
Mine	Source for Giesel same as for Debiere: see immediately above				

## 90. Thorium

Lab	Discovery of thorium	Berzelius 1828	(1st) Royal Swedish Academy of Science, 30 Stora Nygatan, Stockholm	N59-19.44 E18-04.17	b+
Museum	Berzelius Museum		Plans are to move the museum to Observatoriekullen, Observatoriemuseet (Observatory Museum, Observatory Hill), Drottninggatan 120, Stockholm, Sweden [see note above under Silicon regarding the authors' viewing of the museum].	N59-20.50 E18-03.30	+
Terrestrials source	Source of thorium mineral	Hans Morten Thrane Esmarck	Løvøya (Island), near Brevik, Norway	N59-03.45 E09-44.08	+

Museum; university	Collections and university, Esmarck's father (contact with Berzelius)		Norsk Berverksmuseum, Hyttegt. 3 Kongsberg, Norway;	N59-39.97 E09-38.97	+
			Kongelige Norske Bergseminarium (Old Academy), Kirketorvet, Kongsberg, Norway	N59-39.95 E09-38.72	b+

## 91. Protactinium

Lab	Discovery in uranium ores of Pa-231 isotope ( $3.25 \times 10^4$ yr)	Hahn and Meitner 1917	Freie Universität, Thielalle 63, Berlin, Germany	N52-26.85 E13-17.11	b++
Lab	Discovery in uranium ores of "brevium" — Pa-234m (1.17 min) uranium X <sub>2</sub>	Kasimir Fajans and O. H. Göhring 1913	Chemisches Institut, now Kollegiengebäude der Ehrenhof, Englerstrasse 11, Universität Karlsruhe, Karlsruhe, Germany.	N49-00.61 E08-24.72	b+
Lab	Discovery of "ekatantalum" (final isolation; predicted by Soddy from radioactive series)	Soddy and Cranston 1917	Marischal College, Broad St., U. of Aberdeen (old campus), Aberdeen, Scotland	N57-08.93 W02-05.81	b+
Lab	Preliminary work by Cranston (before WWI)		U. of Strathclyde, 40 George St., Glasgow, Scotland	N55-51.67 W04-14.78	b+
Lab	Preliminary work on radioactive elements by Soddy		Basement, Gilbert Scott Building (now Geography Department), U. of Glasgow, Glasgow, Scotland	N 55-52.24 W04-17.25	b+

## 92. Uranium

Lab	Discovery of uranium	Klaproth 1789	"Apotheke zum Bären" (father's apothecary), corner of Spandauer Strasse and Probstgasse (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]	N52-31.04 E13-24.46	b-
Mine	Source of uranium minerals – "secondary" minerals such as torbernite, a complex copper uranyl phosphate; and gummite, a mixture of yellow uranium oxides		Georg Wagsfort Fundgrube, Wittigsthalstraße, Johanngeorgenstadt, Germany	N50-25.98 E12-43.77	m
Museum	Original samples of uranium minerals		Museum für Naturkunde, Invalidenstraße 43, Berlin, Germany	N52-31.79 E13-22.78	+
Lab	Preparation of metallic uranium	Peligot 1841	École Centrale des Arts et Manufactures, 5, [now Musée Picasso], Rue de Place de Thorigny, Paris, France. (Peligot was a professor at the Conservatoire National des Arts et Métiers; 292, rue Saint Martin, Paris, France, but apparently did his laboratory work at École Centrale.)	N48-51.58 E02-21.76  Conservat.: (N48-52.02 E02-21.29)	b+  (b+)
<b>Transuranium Elements</b>					
Berkeley Lab	Chemical separation of plutonium	Wahl (Seaborg et al.), 1941	307 Gilman Hall, U. of California-Berkeley, main campus, Berkeley, California, USA (plaque)	N37-52.35 W122-15.37	b++

Berkeley Lab	Used in initial element-93 synthesis (neptunium)	McMillan and Abelson, 1939-40	Old Radiation Laboratory (held 37-inch cyclotron), main campus, U. of California-Berkeley, Berkeley, California, USA [building razed for new construction]	N37-52.40 W122-15.37	b-
Berkeley Lab	Used to synthesize 93-101	Many investigators. . .	Crocker Hall (held 60-inch cyclotron and chemical laboratory), U. of California-Berkeley, main campus, Berkeley, California, USA [building razed for new construction]	N37-52.41 W122-15.36	b-
HILAC (Heavy Ion Linear Accelerator)	Used to synthesize 102-106,110 (modified HILAC used for 104 and above)	Many investigators. . .	McMillan Road, Ernest Orlando Lawrence Berkeley National Laboratory, U. of California-Berkeley, Berkeley, California, USA	N37-52.75 W122-14.95	b++
Hydrogen bomb explosion	99 and 100 first detected in products of hydrogen bomb explosion	1952	Elugelab (Flora), Eniwetok Atoll, Marshall Islands, Pacific Ocean (Elugelab Island destroyed in explosion)	N11-40.22 E162-12.62	-
GSI Lab	Synthesis of the "superheavy elements" (transactinides, or above 103 ) --	Many investigators. . .	Gesellschaft für Schwerionenforschung (Institute for Heavy Ion Research), Planckstrasse 1, Darmstadt, Hessen, Germany	N49-55.87 E08-40.66	b++
JINR Lab	The synthesis and characterization of the "superheavies" has proved to be more difficult. In some cases verification was required by other laboratories, and sometimes a joint discovery may be credited by different groups --	Many investigators. . .	Joint Institute for Nuclear Reactions Объединённый Институт Ядерных Исследований), 6 Joliot-Curie Str.(Ул. Жолио-Кюри 6), Dubna (Дубна), Moscow Oblast (Московская Область), Russia	N56-44.83 E37-11.63	b++
			Flerov Laboratory for Nuclear Reactions (Лаборатория Ядерных Реакций)	N56-44.47 E37-11.65	b++
RIKEN	There have been groups involved in this work, from the U.S., Russia, Germany, and Japan.	Many investigators. . .	Rikagatu Kenkyusho (Physico-Chemical Research Institute, 2-1 Hirosawa, Wako, Saitama Prefecture, Japan	N35-46.82 E139-35.75	b++

**Note:** Disputes regarding the *priority* of discovery of the heavier transuranium elements have frequently existed. In many cases, particularly with the heavier transuraniums, verification was necessary and performed by other laboratories (all listed above).

**Note:** In the "Elements" pages, only the first observation of each of the superheavy elements is described -- even if joint credit may be recognized today for some of the elements. A full discussion of all of the observations and verifications is beyond the volume allowed by this present work.