**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be identified) all readings were ultimately checked by Garmin maps and/or Google Earth (even though some readings were originally made before Google Earth was released in 2005).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:**

 **For buildings** “b++” means not only does the building still exist, but the laboratory is still functional.

**(including laboratories** “b+” means the building still exists, but is now being used for a different purpose (e.g., administration). **and homes):** “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.

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| **For mines,**  | “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.  |
| **For quarries,** **For all others:**  | “m- ” means only traces of the original mine can be found (filled in and covered with earth) “q+” means the quarry still exists. “q- ” means the quarry has been filled in but remnants of minerals can be found. “+” 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.

1. 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 Byrstrica." 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.
2. [Stockholm, Sweden] In 1692 new premises were given within the Griepenhielm’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 Gripenhielms 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.

1. 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 reseach on arsenic, but he gained his mining/chemical experience during his teen years in Villach (original house exists: 18 Hauptzplatz, 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).
2. [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.

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| **Type** **of site**  | **Event**  | **Discoverer and date**  | **Site Location**  | **Lats/ longs**  | **Ex** **?**  |
|  |  | **General**  |  |  |
| 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 Selmeczbánya (previous Hungarian name)  | Reichenstein, del Río, (Don Fausto) Elhujar, among others, trained here  | Original school, 2 Andreja Kmeťa 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+  |
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|  |  | **The Periodic Table**  |  |  |

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| 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, Mendelevskaya 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")   1866-67 (prepared Periodic Table but did not publish)   1868-70 (published Periodic Table and plot of atomic volumes (1870)  | 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)  | Alte Schickler'sche Gebäude, 3 Schlickerstrasse, Eberswalde, Germany  | N52-49.95 E13-49.07  | b+  |
| University (where he prepared final Table)  | West wing of original building, Universität Karlsruhe, 12 Kaisserstrasse, Karlsruhe, Germany  | N49-00.56 E08-24.72  | b+  |
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|  |  | **1. Hydrogen\***  |  |  |
| 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-  |

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|   | 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  | +  |
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|  |  | **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+  |

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| 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  |
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|  |  | **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+  |
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|  |  | **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-  |

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| 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  | Haüy 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 Haüy  | Musée de Minéralogie, École des mines, 60 Boulevard Saint-Michel, Paris, France  | N48-50.73 E02-20.39  | +  |
| 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-  |
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|  |  | **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+  |

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| Terrestrial source  | Original discovery of borax  | Borax known to ancients as “tinkal”  | NA  |   |   |
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|  |  | **6. Carbon\***  |  |  |
| 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+  |
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|  |  | **7. Nitrogen\***  |  |  |
| 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]  |

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| Lab  | Discovery of elemental gas  | Scheele 1772  | Apoteket Uplands Vapen (apothecary), Stora  | N59-51.50  | b-  |
|     | “Skämd luft”     |      | Torget and Kungängsgatan, Uppsala, Sweden [site first occupied by new pharmacy, now a department store]  | E17-38.37    |  |
| Museum  | Pharmacy “museum” in modern Uplands  | N59-51.50  | +  |
|      |      |      | Vapen Apothecary, Svavagallerian Mall (corner of Bredgränd and Dragarbrunsgata; extending between Kungsgatan and Dragarbrunngatan), Uppsala, Sweden  | E17-38.58     |      |
| Ancient temple  | Etymological source for name  | Ancient Egyptian  | Temple of Ammon, Aghurmi, Siwah, Egypt  | N29-12.33  | b  |
|     | "ammonium"    | temple; visited by Alexander the Great, 332/331 B.C.  |     | E25-32.60    |     |
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|  |  | **8. Oxygen\***  |  |  |
| Lab  | Discovery of elemental gas  | Scheele ~1770  | Probable original discovery site,  | N59-19.70  | b+  |
|   | “Eldsluft” (Swedish) or  |   | Serafimerlasarettet (Serafimer Hospital),  | E18-03.12  |   |
|       | “Feuerluft” (German) [2]       |        | original site of Gripenhielmska huset (Gripenhielm’s house), 2F Serafimergrand (off Hantverkargatan), now Utbildningsförvaltningen = "Education Administration", Stockholm, Sweden  |       |       |
| Lab  | Possible associated discovery site,  | N59-19.50  | b+  |
|   |   |   | Apothecary Förgyhllda Korpen, 16 Stortorget, Stockholm, Sweden  | E18-04.22   |   |

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| 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 Dragarbrunsgata; extending between Kungsgatan and Dragarbrunngatan), Uppsala, Sweden  | N59-51.50 E17-38.58  | +  |
| Lab  | Discovery of elemental gas  | Priestley 1774  | Bowood, Calne, England (plaque)  | N51-25.70  | b+  |
|   | (“dephlogisticated air”)  |      |   | W02-02.25  |   |
| 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  | N53-47.80  | b+  |
|   |   |    | (off City Square), Leeds, England (plaque)  | W01-32.80  |   |
| Church  | Church where Priestley preached  | Former "New Meeting House"; site occupied  | N52-28.79  | b-  |
|   |   |     | now by St. Michael’s Church, Moor Street Queensway, Birmingham, England (plaque)  | W01-53.55   |  |
| Home  | Priestley’s house which was  | "Fair Hill"; now an apartment complex, 10  | N52-27.86  | b-  |
|   | burned down by rioters (plaque on  |   | Priestley Road, Birmingham, England  | W01-52.68  |  |
|   | building)   |     | (plaque) [site now occupied by apartment complex]  |   |  |
| Lab/house  | Priestley’s home and laboratory in  | 472 Priestley Ave, Northumberland,  | N40-53.42  | b+  |
|   | the US  |   | Pennsylvania, USA (plaque)  | W76-47.40  |   |

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| 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  | +  |
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|  |  | **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 Dragarbrunsgata; extending between Kungsgatan and Dragarbrunngatan), 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+  |

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| Marktplatz; Turm and Ratskeller (where Agricola was Burgermeister)  | Description of fluorspar (CaF2) 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  | +  |
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|  |  | **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  | +  |
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|  |  | **11. Sodium**  |  |  |
| Lab  | Preparation of metallic sodium  | Davy 1807  | Royal Institution, 21 Albemarle St, London, England  | N51-30.58 W00-08.58  | b+  |
| Agricutural/ 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-  |
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|  |  | **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  | +  |
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|  |  | **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-  |

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| 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 (Na3AlF6) 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 Superieure; 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 Bibliotheque (library); École Normale Superieure Physique; 24, rue lhomond; 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 know 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-  |

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| 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+  |
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|  |  | **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  |   |   |
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|  |  | **15. Phosphorus\***  |  |  |

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| 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 frrom 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+  |
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|  |  | **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  | +  |
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|  |  | **17. Chlorine\***  |  |  |

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| 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 Dragarbrunsgata; extending between Kungsgatan and Dragarbrunngatan), 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+  |
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|  |  | **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+  |

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| 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  | +  |
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|  |  | **19. Potassium**  |  |  |
| Lab  | Preparation of metallic potassium  | Davy 1807  | Royal Institution, 21 Albemarle St, London, England  | N51-30.58 W00-08.58  | b+  |
| Agricutural/ 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-  |
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|  |  | **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  |   |   |
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|  |  | **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 some 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 E7-49 |   |
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|  |  | **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, FeTiO3 (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+  |

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| Lab  | Preparation of metal  | Nilson 1887  | 1860 chemistry building (now Philologicum),  | N59-51.24  | b+  |
|   |   |   | 3 Thunbergsvägen, on Carolinaparken, Uppsala, Sweden  | E17-37.69   |   |
| Lab  | Independent discoverer/confirmer  | Klaproth 1792  | "Apotheke zum Bären” (father’s apothecary),  | N52-31.04  | b-  |
|   | of discovery; refused credit for  |   | corner of Spandauer Strasse and Probstgasse  | E13-24.46  |  |
|       | discovery      |        | (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]  |       |  |
| Source of  | “Red schorl of Hungary”  | According to the label on the specimen in the  | Revúca:  | [4]  |
| mineral  |   |   | Berlin Museum of Natural History, the type  | N48-40.98  |   |
|        |        |        | mineral [rutile, titanium oxide] from which Klaproth discovered titanium was from "Lubietová (Rhonitz) bei Banská Byrstrica, Slowakei [Slovakia]" Recent research has shown this is incorrect; the actual site was Revúca (Revúca district), Slovakia.  | E20-07.00       |        |
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|  |  | **23. Vanadium**  |  |
| Lab  | Discovery of vanadium earth  | del Río 1801  | Real Seminaro de Minería (Royal School of  | N19-26.06  | b+  |
|      |      |      | Mineralogy, known as "La Primera Casa de Ciencas," the first mining institute), 90 Republica de Guatemala, Mexico City, Mexico  | W99-07.70     |      |

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| 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  | +  |
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|  |  | **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-  |

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| 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 Geologichesckiy Musei (Urals Geological Museum); Кокриякова 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-  |
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|  |  | **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-  |

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| 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  |   |   |
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|  |  | **26. Iron\***  |  |
| Terrestrial source  | Original discovery of iron  | Known to ancients  | NA  |   |   |
|   |  |  |  |
|  |  | **27. Cobalt\***  |  |
| Lab  | Discovery of metallic cobalt  | Georg Brandt 1735  | *Laboratorium Chymicum*, 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  |   |   |

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|  |  | **28. Nickel\***  |  |  |
| Lab  | Discovery of metallic nickel  | Cronstedt 1751  | *Laboratorium Chymicum*, 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  |   |   |
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|  |  | **29. Copper\***  |  |  |
| Terrestrial source  | Original discovery of copper  | Known to ancients  | NA  |   |   |
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|  |  | **30. Zinc\***  |  |  |

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| 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, Klaproth 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+  |
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|  |  | **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 médicine, rue de l’École de médicine, 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-  |
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|  |  | **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  | +  |
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|  |  | **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  | +  |

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| Houses/ museums  | Residences of Paracelsus  |   | Paracelsus was an itinerant and several known residences are known and are marked with plaques. [6]  |   |   |
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|  |  | **34. Selenium**  |  |  |
| Lab  | Discovery of selenium  | Berzelius 1817  | Gripsholm Fabrik, Mariefred, Sweden (manufactury 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  | +  |
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|  |  | **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+  |

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| Salt flats  | Source of salts for bromine  |   | Anciens Salines near Sète, France;   Scenic overview of the salt flats: Le Site des Pierres Blanches  | N43-22.80 E03-37.58  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  | +  |
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|  |  | **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  | +  |

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| 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-  |
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|  |  | **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+  |

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| Museum  | Charles Hope’s original strontia  | Hope 1792  | Joseph Black Building, Kings Buildings,  | N55-55.44  | +  |
|   |   |   | West Mains Rd., U. of Edinburgh, Edinburgh, Scotland  | W03-10.58   |   |
| Lab  | Preparation of metallic strontium  | Davy 1808  | Royal Institution, 21 Albemarle St, London,  | N51-30.58  | b+  |
|   |   |   | England  | W00-08.58  |   |
| Lab  | Independent discoverer/confirmer  | Klaproth 1793  | "Apotheke zum Bären” (father’s apothecary),  | N52-31.04  | b-  |
|   | of discovery; refused credit for  |   | corner of Spandauer Strasse and Probstgasse  | E13-24.46  |  |
|       | discovery      |       | (present Probststrasse), Berlin, Germany; present address corner of Probstgasse and Nikolaikirchplatz (plaque for zum Bären, Klaproth and uranium) [site now occupied by new buildings]  |       |  |
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|  |  | **39. Yttrium**  |  |
| Lab  | Discovery of earth  | Gadolin 1794  | Kemiska laboratorium (1st floor of academy  | N60-27.11  | b-  |
|           |           |            | 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).  | E22-16.77          |  |
| Home/lab  | Later home/lab of Gadolin  | 6A, Kaskenkatu, Åbo (now Turku), Finland  | N60-26.80  | b+  |
|    |    |    | (plaque); also, buildings in back on Luostarinkatu (where he worked)  | E22-16.37   |    |

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| Mine  | Source of yttrium mineral –  |   | Ytterby Mine, Ytterby, Resarö (Island),  | N59-25.60  | m  |
|   | gadolinite, a complex rare earth silicate  |  | Stockholms, Sweden   | E18-21.18   |   |
| Museum  | Exhibits on mine  | Vaxholm Fortress Museum, Växon (Island),  | N59-24.19  | +  |
|   |   |  | Stockholms, Sweden  | E18-21.52  |   |
| Lab  | Preparation of metallic yttrium  | Wöhler 1828  | Friedrichs-Werdersche Oberrealschule (trade  | N52-30.74  | b-  |
|     |     |     | school) at 12 Niederwallstraße, Berlin, Germany [site now occupied by apartment complex]  | E13-23.97    |  |
|   |  |  |  |
|  |  | **40. Zirconium**  |  |
| Lab  | Discovery of earth  | Klaproth 1789  | "Apotheke zum Bären” (father’s apothecary),  | N52-31.04  | b-  |
|        |        |         | 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]  | E13-24.46       |  |
| Mine  | Source of zirconium mineral –  | “Northern Circars,” Andhra Pradesh, India  | N16-56  | -  |
|   | zircon, zirconium silicate   |     | (exact location unknown; original label no longer available)  | E79-19   |   |
| Museum  | Original samples of zircons  | Museum für Naturkunde, Invalidenstraße 43,  | N52-31.79  | +  |
|   |   |   | Berlin, Germany  | E13-22.78  |   |
| Lab  | Preparation of metallic zirconium  | Berzelius 1824  | (1st) Royal Swedish Academy of Science, 30  | N59-19.44  | b+  |
|   |   |   | Stora Nygatan, Stockholm, Sweden  | E18-04.17  |   |

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| 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  |   |   |
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|  |  | **41. Niobium**  |  |  |
| Lab/house  | Discovery of niobium earth  | Hatchett 1801  | Middle Pall Mall, Hampstead, London (now  | N51-29.42  | b-  |
|     | “columbium”    |      | Furnival Gardens), England [site now occupied by extensive park and flower gardens]  | W00-13.99    |  |
| Museum  | Original sample of columbite  | Museum of Natural History, Cromwell Rd.,  | N51-29.74  | +  |
|   | analyzed by Hatchett  |    | London, England  | W00-10.54  |   |
| Quarry  | Type site of original type  | Swanson Quarry, Haddon Neck, Middletown,  | N41-30.85  | q-  |
|   | columbite – iron niobate  |    | Connecticut USA  | W72-31.12  |  |
| House  | Later house, visited by Berzelius  | “Mount Clare,” Minstead Gardens,  | N51-27.11  | b+  |
|   |   |    | Roehampton, England  | W00-15.04  |   |
| House  | Last house  | “Bellevue,” 91&92 Cheyne Walk, Chelsea,  | N51-28.92  | b+  |
|   |   |   | England (plaque)  | W00-10.45  |   |

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| Lab  | Differentiation between niobium  | Heinrich Rose 1847  | Berlin Akademie, present 28 Dorotheenstraße  | N52-31.14  | b-  |
|     | and tantalum; naming of niobium    |     | (originally 7 Letzten Straße, then 10 Dorotheenstraße), Berlin, Germany [destroyed in WWII]  | E13-23.46    |  |
| Lab  | Metallic niobium  | Blomstrand 1864  | Magle Stora Kyrkogata 12A (now History  | N55-42.17  | b+  |
|   |   |   | Dept.), U. of Lund, Lund, Malmöhus, Sweden  | E13-11.92   |   |
| Lab  | Clearly differentiated niobium  | de Marignac 1865  | "Dark damp cellar lab," Societé de lecture  | N46-12.14  | b+  |
|   | from tantalum compounds and  |   | (Académie de Genève), Grand Rue 11,  | E06-08.70  | (main  |
|   | described their different chemistry  |   | Genève, Switzerland [lab removed]  |   | bldg)  |
|   |  |  |
|  | **42. Molybdenum\***  |  |
| Lab  | Discovery of molybdenum earth  | Scheele 1778  | Apoteket Lejonet, Apotekshuset, 2 Stora  | 2nd site:  | b-  |
|       |       |       | 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  | N59-30.85 E15-59.56  1st site (discoveries):  |     b-  |
|   |   |   | in Köping at Stora Gatan 8-Östra Långgatan  | N59-30.75  |  |
|   |   |    | 8.  | E15-59.69  |  |
| Mine  | Source of molybdenum mineral –  | Bispberg Gruvan, Bispberg Klack  | N60-21.67  | m  |
|   | molybdenum sulfide  |    | (mountain), Kopparbergs, Sweden  | E15-47.55  |   |
| Museum  | Exhibits  | Scheele Museum, Östra Långgatan 37,  | N59-30.50  | +  |
|   |   |   | Köping, Västmanlands, Sweden  | E16-00.01  |   |

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| Lab  | Preparation of metallic molybdenum  | Hjelm 1781  | *Laboratorium Chymicum*, 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 Instituto 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  | Chemigebäude, 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  | Нихи 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  |

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| Mint  | Source of platinum ores  |   | St. Petersburg Mint – Монетный Двор, Monetniy Dvor ("Money Yard") – at Peter and Paul Fortress – Петропавловская Крепость, Petropavlovskaya Krepost; Санкт-Петерсбург(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+  |
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|  |  | **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+  |
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|  |  | **46. Palladium**  |  |  |

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| Lab/house  | Discovery of metallic palladium by separation from platinium  | 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  | Sabará, 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+  |
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|  |  | **47. Silver\***  |  |  |
| Terrestrial source  | Original discovery of silver  | Known to ancients  | NA  |   |   |
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|  |  | **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+  |

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| 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  | +  |
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|  | **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), Technisches 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, Technisches Universität Bergakademie, Freiberg, Sachsen, Germany  | N50-55.25 E13-20.60  | +  |
| Museum  | History museum of university  |   | Nonnengasse 22, Technisches Universität Bergakademie, Freiberg, Sachsen, Germany  | N50-55.10 E13-20.44  | +  |
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|  |  | **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  | +  |
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|  |  | **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 Cetăţii 1, Sibiu, Romania  | N45-47.70 E24-09.29  | +  |

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| Mine  | Source of tellurium mineral  |   | Nagyagite and sylvanite from Faţa Băii, Romania  | N46-07.85 E23-08.84  | m  |
| Museum  | Samples of Romanian and historial mineral samples  | Babeş-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-  |
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|  |  | **53. Iodine**  |  |  |

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| 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+  |
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|  |  | **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+  |

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

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| 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  1st site (discoveries): N59-30.75 E15-59.69  | b-     b-  |
| Museum  | Exhibits  | Scheele Museum, Östra Långgatan 37, Köping, Västmanlands, Sweden  | N59-30.50 E16-00.01  | +  |
| Lab  | Preparation of metallic barium  | Davy 1808  | Royal Institution, 21 Albemarle St, London, England  | N51-30.58 W00-08.58  | b+  |
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|  |  | **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, Riddarhyttan, 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  | +  |

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|  |  | **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  | +  |
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|  |  | **59. Praseodymium**  |  |  |

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| 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**  |  |  |

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| 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+  |
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|  |  | **64. Gadolinium**  |  |  |

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| Lab/house  | Discovery by separation from didymia  | de Marignac 1880  (de Marignac was retired from the U of Geneva at the time of discovery)  | "Third floor," rue Jean-Sénebier 16, Genève, Switzerland  | N46-11.84 E06-08.88  | b+  |
| University  | Initial work done at U. of Geneva (new site)  | "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)  | Societé 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+  |
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|  |  | **67. Holmium**  |  |  |

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| 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  |
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|  |  | **70. Ytterbium**  |  |  |

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| Lab/house  | Discovery by separation from erbia  | de Marignac 1878  (de Marignac was retired from the U of Geneva at the time of the discovery announcement)  | "Third floor," rue Jean-Sénebier 16, Genève, Switzerland (final work)  | N46-11.85 E06-08.88  | b+  |
| University  | U. of Geneva (new site)  | "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+  |

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| 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+  |
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|  |  | **73. Tantalum**  |  |  |

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| 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)  |
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|  |  | **74. Tungsten\***  |  |  |

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| 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  |

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| 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  | +  |
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|  |  | **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  | +  |

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| Lab  | Recognition of a new substance called *ptene* 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-  |
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|  |  | **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 repoted 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 (Ryeka [River] Barancha, northwest of Nizhniy Tagil.  | N58-01 E59-52  | +  |
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|  |  | **79. Gold\***  |  |  |
| Terrestrial source  | Original discovery of gold  | Known to ancients  | NA  |   |   |
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|  |  | **80. Mercury\***  |  |  |
| Terrestrial source  | Original discovery of mercury  | Known to ancients  | NA  |   |   |
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|  |  | **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  |
| Manufactury  | 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  | +  |

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| 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 chemiques 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  | +  |
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|  |  | **82. Lead\***  |  |  |
| Terrestrial source  | Original discovery of lead  | Known to ancients  | NA  |   |   |
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|  |  | **83. Bismuth\***  |  |  |
| Terrestrial source  | Original discovery of bismuth  | Known to Medieval Europe  | NA  |   |   |

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| Marktplatz;  | Distinction among bismuth,  | Agricola 1529  | Innere Klosterstraße, Chemnitz, Sachsen,  | N50-49.95  | +  |
| Turm and Ratskeller (where Agricola was Burgermeister)  | antimony and other metals      |       | Germany (two plaques and bust)      | E12-55.11      |       |
|   |  |
| **84. Polonium**  |  |
| Lab  | First detection and naming of  | Curies 1898  | "Physical measurement room," École  | N48-50.49  | b-  |
|   | element   |   | Supérieure (now ESPCI), 42 Rue Lhomond (old address), Paris, France  | E02-20.90   |   |
| Lab  | Discovery of polonium by  | Curies 1900  | “The Shed,” across the courtyard from the  | N48-50.50  | b-  |
|      | separation from pitchblende     |       | Physical Measurement Room, École Supérieure, now ESPCI; present address 10, vue Vauquelin, Paris, France (plaque) [site now occupied by a motorcycle parking lot]  | E02-20.83     |  |
| Museum  | Curie instrumentation and exhibits  | Curie Institute; 11, rue Pierre et Marie Curie,  | N48-50.66  | +  |
|   |   |    | Paris, France  | E02-20.67  |   |
| Manufactory  | Source of polonium mineral –  | Urangelbfabrik (Uranium Yellow  | N50-21.58  | b-  |
|   | spent pitchblende (crude uraninite — uranium oxide — from which  |   | Manufactory), across street from Radium Palác (Radium Palace), nám. Julia Fucika; St.  | E12-56.11  |   |
|   | uranium had been extracted and  |   | Joachimsthal (now Jáchymov), Bohemia  |   |   |
|   | which had been discarded in  |   | (now Czech Republic) [present site is now a  |   |   |
|    | refuse pile)   |    | park marked by the Památnik Objeveni Radia (Monument of Discovery of Radium)]  |    |    |

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| Mine  | Original Source of uranium ore  |   | Dûl Svornost (“Unity Mine”), NW outskirts,  | N50-22.35  | m  |
|     |     |  | Jáchymov, Czech Republic [presently closed, but furnishes thermal, radioactive water which is pumped to Radium Palace]  | E12-54.70    |     |
| Museum/ Information center     | History of mines and city, exhibits       | Old mint,/museum (Mincovna/Muzeum), corner of Mincovni and Berzrčûv vrch; and City Hall (Rathaus), Central Information (Informační Centrum), náměstie Republicky 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-  |
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|  |  | **86. Radon**  |  |  |

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| 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-  |

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| Lab  | Discovery of radium by separation  | Curies 1900  | “The Shed,” across the courtyard from the  | N48-50.50  | b-  |
|      | from pitchblende     |       | Physical Measurement Room, École Supérieure, now ESPCI; present address 10, vue Vauquelin, Paris, France (plaque) [site now occupied by a motorcycle parking lot]  | E02-20.83     |  |
| Museum  | Curie instrumentation and exhibits  | Curie Institute; 11, rue Pierre et Marie Curie,  | N48-50.66  | b+  |
|   |   |    | Paris, France  | E02-20.67  |   |
| Manufactory  | Source of radium mineral – spent  | Urangelbfabrik (Uranium Yellow  | N50-21.58  | b-  |
|   | pitchblende (crude uraninite — uranium oxide — from which  |   | Manufactory), across street from Radium Palác (Radium Palace), nám. Julia Fucika; St.  | E12-56.11  |   |
|   | uranium had been extracted and  |   | Joachimsthal (now Jáchymov), Bohemia  |   |   |
|   | which had been discarded in  |   | (now Czech Republic) [present site is now a  |   |   |
|   | refuse pile)   |     | park marked by the Památnik Objeveni Radia (Monument of Discovery of Radium)]  |   |   |
| Mine  | Original Source of uranium ore  | Dûl Svornost (“Unity Mine”), NW outskirts,  | N50-22.35  | m  |
|     |     |           | Jáchymov, Czech Republic [presently closed, but furnishes thermal, radioactive water which is pumped to Radium Palace]  | E12-54.70    |     |
| Museum/ Information center     | History of mines and city, exhibits       | Old mint,/museum (Mincovna/Muzeum), corner of Mincovni and Berzrčûv vrch; and City Hall (Rathaus), Central Information (Informační Centrum), náměstie Republicky 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+    |
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| **89. Actinium**  |
| Lab  | Discovery of actinium in uranium  | Debierne 1899  | Sorbonne, near rue Cujas side, Paris, France  | N48-50.86  | b+  |
|   | ores  |    | (collaborated with Curies)  | E02-20.60  |   |
| Lab  | Initial separation of crude uranium  | "The Shed" (collaboration with the Curies),  | N48-50.50  | b-  |
|       | ores      |        | 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]  | E02-20.83      |  |
| Manufactory  | Source of radium mineral – spent  | Urangelbfabrik (Uranium Yellow  | N50-21.58  | b-  |
|   | pitchblende (crude uraninite — uranium oxide — from which  |   | Manufactory), across street from Radium Palác (Radium Palace), nám. Julia Fucika; St.  | E12-56.11  |   |
|   | uranium had been extracted and  |   | Joachimsthal (now Jáchymov), Bohemia  |   |   |
|   | which had been discarded in  |   | (now Czech Republic) [present site is now a  |   |   |
|   | refuse pile)   |     | park marked by the Památnik Objeveni Radia (Monument of Discovery of Radium)]  |   |   |
| Mine  | Original Source of uranium ore  | Dûl Svornost (“Unity Mine”), NW outskirts,  | N50-22.35  | m  |
|     |     |           | Jáchymov, Czech Republic [presently closed, but furnishes thermal, radioactive water which is pumped to Radium Palace]  | E12-54.70    |     |
| Museum/Infor mation center      | History of mines and city, exhibits       | Old mint,/museum (Mincovna/Muzeum), corner of Mincovni and Berzrčûv vrch; and City Hall (Rathaus), Central Information (Informační Centrum), náměstie Republicky 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+    |

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| 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 Debierne: 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  | +  |

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| Museum; university  | Collections and university, Esmarck’s father (contact with Berzelius)  |   | Norsk Berverksmuseum, Hyttegt. 3 Kongsberg, Norway;  Kongelige Norske Bergseminarium (Old Academy), Kirketorvet, Kongsberg, Norway  | N59-39.97 E09-38.97  N59-39.95 E09-38.72  | +   b+  |
|   |  |  |  |  |
|  |  | **91. Protactinium**  |  |  |
| Lab  | Discovery in uranium ores of Pa- 231 isotope (3.25x104 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 X2  | 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+  |
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|  |  | **92. Uranium**  |  |  |

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

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| 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 exised. 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.