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HOW THE NAMES OF CHEMICAL ELEMENTS REPRESENT KNOWLEDGE

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Introduction

The names of chemical elements constitute a certain microcosm – a closed but rich sign system, particularly interesting as it has taken a lot of time for it to arrive at its current form. Its oldest lexical units had been known long before the very notion of chemical element was introduced in 1661 in *The Sceptical Chymist* by Robert Boyle (words like *złoto* [*gold*], *węgiel* [*carbon*], or *siarka* [*sulfur*] have been present in the Polish language from time immemorial), and the newest ones have only just come into existence, like the lexemes designating transuranic elements, which were not discovered and named until the 20^{th} century (see Eichstaedt 1973, Heiserman 1997, Bergandy 1997, Mizerski 2004, *Powszechna Encyklopedia PWN*).

The studies discussed in this paper aim to extract and classify the knowledge represented in this lexical domain, to establish its characteristics in terms of its place within both national language and scientific jargon, as well as to provide an interpretation of certain peculiarities in the contemporary nomenclature of chemical elements, which does not quite conform to the general rules according to which other chemical substances are named.

This reconstruction of knowledge is based on historical and etymological evidence about particular units, meanwhile its classification rests upon two basic criteria: the type of object to which the names allude (apart from the obvious denotation) and the way in which the object is apprehended by the epistemic subject.

1. Delimiting the area of research

The analysis focuses on Polish names of chemical elements in their contemporary form. I leave out the semantics, the origin, and the usage of the elements' symbols, Latin equivalents and former Polish names that are no longer in use, as well as the names of isotopes (like *prot*, *deuter* or *tryt* [*protium*, *deuterium*, *tritium*]) and allotropes (like *polisiarka*, *oktasiarka*, *grafit*, *diament*, *lonsdaleit*, *fulleren*, *arsen szary* or *arsen żółty* [*polysulfur*, *octasulfur*, *graphite*, *diamond*, *lonsdaleite*, *fullerene*, *metallic grey arsenic*, *yellow arsenic*]). The names of groups and blocks in the periodic table, both single-word and compound (like *litowce*, *berylowce*, *halogeny*, *lantanowce*, *aktynowce*, *pierwiastki bloku d*, *pierwiastki przejściowe*, *gazy szlachetne*, *metale ziem rzadkich*, *grupa IIIA* etc. [*alkali metals*, *alkaline earth metals*, *halogens*, *lanthanide*, *actinide*, *d-block*, *noble gases*, *rare earth elements*, *group IIIA* etc.]), are outside my field of interest, so are terms such as *pierwiastek kryptomorficzny* or *endokryptny* [an element that does not form its own mineral in Earth's crust] or *ekapierwiastek* [*eka-element*], in other words, superordinates of the analyzed lexical units (obviously, neither are non-hypernymic names of individual eka-elements like *ekaglin*, *ekabor*, *ekakrzem* [*eka-aluminium*, *eka-bohrium*, *eka-silicon*] taken into consideration).

My main source is the periodic table of elements taken from *Chemistry Tables* by Witold Mizerski, which also serves as the criterion for delimiting the semantic field (see Mizerski 2004: 17).

2. General characteristics of the names of chemical elements

In terms of its linguistic status, the analyzed group of expressions is a subsystem of scientific terminology, so it is generally considered (with few exceptions such as *złoto* [*gold*], *węgiel* [*carbon*], *siarka* [*sulfur*], or magnez [*magnesium*]) a specialized vocabulary, used almost exclusively in texts on chemistry or on related sciences (cf. the statistics and the criteria for classifying the lexical repertory assumed in Kurcz, Lewicki, Sambor, Szafran, and Woronczak 1990).

Also in terms of their structure, the analyzed strings belong to an exceptional type of expressions in the general Polish language – they are common names, which sometimes may, just like proper names, be derived from the names of particular objects: places or people (*darmstadt* [*darmstadtium*], *berkel* [*berkelium*], *kiur* [*curium*] or *nobel* [*nobelium*]).

When it comes to their grammatical properties, all lexical units of the analyzed class are nouns, which means that they may be inflected for case (but not for number – they do not have a plural form, because they refer to an

uncountable substance). They can have all three genders: feminine (*platyna* [*platinum*], *rtęć* [*mercury*]), masculine (*wodór* [*hydrogen*], *sód* [*sodium*]), and neuter (*złoto* [*gold*], *srebro* [*silver*]). In terms of their origins, they can be divided into three main groups: borrowings, morphological derivatives, and semantic derivatives (cf. Biniewicz 1992, where the mechanisms for the formation of those names are discussed in detail).

3. Origins of the names of chemical elements

Generally speaking, the origins of the names of chemical elements have been well covered. Justifications for the names can be found in numerous studies concerning chemical nomenclature or the history of chemistry, in encyclopedias, glossaries, or even tables (e.g. Bergandy 1997, Eichstaedt 1973, Heiserman 1997, Kalembkiewicz, Lubczak, and Lubczak 1996, *Powszechna Encyklopedia PWN*, Sołoniewicz 1986, Śliwa and Zelichowicz 1994, Mizerski 2004).

As to the typically linguistically-oriented literature on the subject, there are two groups of works: etymological dictionaries and studies on chemical terminology. There are quite a few etymological dictionaries, but they tend to take into account only the rather narrow class of the oldest names adapted directly from the national language to the scientific vocabulary and they leave out the history of the names formed artificially. The second group of works is represented rather poorly. So far, I have come across only one, the abovementioned study by Biniewicz (1992), that would analyze the etymology of the expressions from the domain that is of my concern. The author takes an opposite approach than the lexicographers: he investigates only the origin of the names of the elements in the chemical nomenclature and excludes the origin of the oldest names in the national language. In other linguistic papers dealing with chemical terminology the naming of chemical elements is addressed in very general terms (see Biniewicz 2002).

For the sake of my analysis, I have decided to take into consideration the origin of the names of the elements in scientific terminology as well as in general language if a particular lexical unit was directly borrowed from it. This makes the description of this domain more complete, as it encompasses a certain 'prehistory' of some of the nominations. Nonetheless, what serves as the very basis for my reconstruction of the knowledge represented in the entire domain of my interest, is exclusively those acts of naming that were performed within the branch of science when a certain substance was recognized as an element.

3.1. History of the names of the elements in chemical terminology

When writing about the origin of the names of chemical elements in terminology, the authors of the aforementioned studies occasionally provide different interpretations. They also differ in the level of detail of the information they supply, as well as in the very number of analyzed expressions. Therefore, the following justifications are based on several different sources. If there are no discrepancies, I rely upon the study by Biniewicz, since it is a linguistic analysis. The only exceptions are the names of the elements which the author did not include – out of necessity, all information about these elements must come from other works. Particular strings are being analyzed in the order of the atomic number of the referent, which reflects the structure of the periodic table of elements and which is also in accordance with the convention adopted by Biniewicz.

Apart from the origin of the analyzed lexical units and their semantic justification, I will be also including the broader historical context connected with the acts of nomination – the element's year of discovery, its discoverer, and the original Polish name with its author, if, of course, the Polish version is a semantic calque. All the information comes from the following works: Biniewicz 1992 (which will appear later in the text as 'Bin'), Mizerski 2004 (Miz), Eichstaedt 1973 (Eich), Heiserman 1997 (Heis), *Powszechna Encyklopedia PWN* (PWN). When quoting the expressions originating in Greek, I am consciously omitting the diacritical marks, due to the different orthographic conventions adopted by the authors.

Wodór (Eng. hydrogen, Lat. hydrogenium, H, at. no. 1)

Date of discovery: 1766, **discovered by:** H. Cavendish (who demonstrated that water is produced through the combustion of this gas), **original Polish name:** *hydrogene* (introduced by A. Lavoisier who proved that hydrogen is an element).

Reasoning behind the name: element which produces water while burning; the contemporary Polish name is a shortened version of the word "wodoród", which is a calque of "hydrogen" (Bin).

Hel (helium, He, at. no. 2)

Date of discovery: 1868, **discovered by:** P.J. Janssen and, working independently, J.N. Lockyer (Heis) or J. Locker and P. Frankland (Bin), **original Polish name:** *helium* (named probably by its discoverers).

Reasoning behind the name: element which was detected by its spectra in the Sun's atmosphere (the name comes from the Greek *helios*, meaning "the Sun").

Lit (lithium, Li, at. no. 3)

Date of discovery: 1817, **discovered by:** A. Arfvedson, **original**

Polish name: *lithium* (named by J. Berzelius).

Reasoning behind the name: element which was discovered in a mineral (the name comes from the Greek *lithos*, meaning "stone") (Bin).

Beryl (beryllium, Be, at. no. 4)

Date of discovery: 1798 (in the oxide form), 1828 (in the elemental form), **discovered by:** L.N. Vauquelin (who isolated the oxide), F. Wöhler and, independently, A. Bussy (who isolated the element), **original Polish name:** *beryllium* (named probably by one of its discoverers).

Reasoning behind the name: element which was discovered in the beryl gem (Bin).

Bor (Eng. boron/bore, Lat. borium, Be, at. no. 5)

Date of discovery: 1808, **discovered by:** J.L. Gay-Lussac and L.J. Thénard as well as, independently, H. Davy (Heis), **original Polish name:** *borium* (named probably by one of its discoverers).

Reasoning behind the name: element which was isolated from the substance called borax (Bin).

Węgiel (Eng. carbon, Lat. carbonium, C, at. no. 6)

Date of discovery: unknown (as charcoal, it was already known in antiquity), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was associated with charcoal [Pol. *węgiel*], as it is its main constituent – the name was created on the basis of the word *węgiel*, already existing in Polish, but was given a new meaning (Bin).

Azot (Eng. nitrogen, Lat. nitrogenium, N, at. no. 7)

Date of discovery: 1772, **discovered by:** D. Rutherford and (independently) K.W. Schele, H. Cavendish, and J. Priestley (PWN) or A. Lavoisier (Bin), **original Polish name:** *azote* (named by A. Lavoisier) (Bin).

Reasoning behind the name: element which makes up air and which does not support life (the name originates from the Greek word *azotikos* – "which does not support life") (Bin).

Tlen (Eng. oxygen, Lat. oxygenium, O, at. no. 8)

Date of discovery: 1772 and 1774, identified as an element: 1775–1777, **discovered by:** K.W. Scheele, and then (independently) J. Priestley, later A. Lavoisier identified oxygen as an actual element (Heis), **original Polish name:** none.

Reasoning behind the name: element which is involved in the combustion process (the name originates from the Polish word *tlić* [*smoulder*] given by J. Oczapowski (Bin).

Fluor (Eng. fluorine, Lat. fluorum, F, at. no. 9)

Date of discovery: 1886, **discovered by:** H.F.F. Moissan, **original Polish name:** *fluorine* (probably named by its discoverer).

Reasoning behind the name: element which was discovered in minerals used as flux (Bin) or whose salts are easily fusible (Miz) (the name originates from the Latin word *fluere* – "flow") (Bin).

Neon (neon, Ne, at. no. 10)

Date of discovery: 1898, **discovered by:** W. Ramsay and M.W. Travers, **original Polish name:** *neon* (probably named by its discoverer).

Reasoning behind the name: the newly discovered element (the name originates from the Greek word *neos* – "new") (Bin).

Sód (Eng. sodium, Lat. natrium, Na, at. no. 11)

Date of discovery: 1807, **discovered by:** H.B. Davy, **original Polish name:** *sodium* (named by H.B. Davy) (Bin) or *sodanum* (Miz).

Reasoning behind the name: element which was discovered in caustic soda (Bin) or which is used in a medicine for headaches (from the Latin word *sodanum* meaning "medicine for headache", which comes from Arabic) (Miz).

Magnez (magnesium, Mg, at. no. 12)

Date of discovery: 1808 and 1829, **discovered by:** H. B. Davy, and later (independently) A. Bussy and J. von Liebig, **original Polish name:** *magnesium* (named by A. Lavoisier).

Reasoning behind the name: element which was discovered in the mineral called *magnesia alba* (Bin) or whose salts have properties similar to a laxative from the town of Magnesia (Manisa) (Miz).

Glin (aluminium, Al, at. no. 13)

Date of discovery: 1787 (existence predicted), 1807 (naming), 1825 (final isolation), **discovered by:** A. Lavoisier (anticipated existence of aluminium) H.Ch. Oersted (isolated), **original Polish name:** *aluminium* (named by H. Davy) (Heis).

Reasoning behind the name: element discovered in the aluminium oxide which was isolated from the substance called *potassium alum* (the name originates from the Latin word *alumen* – "alum") (Bin), or: element which is the main constituent of clay (Miz).

Krzem (Eng. silicon, Lat. silicium, Si, at. no. 14)

Date of discovery: 1823, **discovered by:** J.J. Berzelius, **original Polish name:** *silicium* (named by J.J. Berzelius).

Reasoning behind the name: element which was discovered in silica (the name originates from the Latin word *silica*, which comes from Latin

silex – "flint") (Bin).

Fosfor (phosphorus, P, at. no. 15)

Date of discovery: 1669, **discovered by:** H. Brandt, **original Polish name:** *phosphorus* (probably named by its discoverer).

Reasoning behind the name: element which shines in the dark (the name originates from the Greek word *phosphoros* – "light-bearer" (Bin).

Siarka (sulfur, S, at. no. 16)

Date of discovery: unknown (as a sedimentary rock it has been known since ancient times) classification as an element in 1777, **discovered by:** anonymous, classified as an element by A. Lavoisier, **original Polish name:** none (Heis).

Reasoning behind the name: element which was identified with the sedimentary rock which it makes up – for naming purposes Jędrzej Śniadecki picked an already existing name and attributed to it a new meaning (Bin).

Chlor (Eng. chlorine, Lat. chlorum, Cl, at. no. 17)

Date of discovery: 1774 (isolation), 1810 (identified as an element), **discovered by:** K.W. Scheele; H. Davy (Heis) identified it as an element, **original Polish name:** *chlorine* (named by H. Davy).

Reasoning behind the name: element which has fumes that are yellow and green (the name originates from the Greek word *chloros*, meaning "yellow and green" (Bin).

Argon (argon, Ar, at. no. 18)

Date of discovery: 1785 (existence predicted), 1894 (isolation), **discovered by:** H. Cavendish (suggested its existence), W. Ramsay, J.W. Rayleigh (isolated), **original Polish name:** *argon* (probably named by one of the discoverers).

Reasoning behind the name: element which is chemically inert, i.e. does not react with other substances (the name comes from the Greek word *argos* – "inactive, lazy") (Bin).

Potas (Eng. potassium, Lat. kalium, K, at. no. 19)

Date of discovery: 1807, **discovered by:** H.B. Davy, **original Polish name:** *potassium* (named by H.B. Davy).

Reasoning behind the name: element which was discovered in alkaline substances, called *potash* in English (Bin) or which was a constituent of potash – a lye obtained from wood (Miz).

Wapń (calcium, Ca, at. no. 20)

Date of discovery: 1808, **discovered by:** H.B. Davy, **original Polish name:** *calcium* (probably named by its discoverer).

Reasoning behind the name: element which is a component of lime (the name originates from the Latin word *calx* – lime (Bin).

Skand (scandium, Sc, at. no. 21)

Date of discovery: 1871 (existence predicted), 1879 (existence confirmed), **discovered by:** D. Mendeleev (predicted its existence), L.F. Nilson (confirmed its existence), **original Polish name:** *scandium* (probably named by L.F. Nilson).

Reasoning behind the name: the element was named to honour Scandinavia where it was discovered (Bin).

Tytan (titanium, Ti, at. no. 22)

Date of discovery: 1791 (PWN), 1792 (Bin) or 1795 (Heis) and 1910 (isolation and purification) (Heis), **discovered by:** W. Gregor (PWN, Heis) or, independently, M. Klaproth (Bin, Heis), **original Polish name:** *titanium* (probably named by one of the discoverers).

Reasoning behind the name: element which was named after the Greek mythological figures Titans (Bin).

Wanad (vanadium V, at. no. 23)

Date of discovery: 1801, 1830 or 1867 (isolation and purification), **discovered by:** A. Manuel del Rio and, independently, N. G. Sefström, later H. E. Roscoe (isolated) (Heis), **original Polish name:** *vanadium* (named by N.G. Sefström).

Reasoning behind the name: element which was named after the Old Scandinavian goddess Vanadis (Bin).

Chrom (chromium, Cr, at. no. 24)

Date of discovery: 1797 (PWN) or 1798 (Bin), **discovered by:** L. N. Vauquelin, **original Polish name:** *chromium* (probably named by its discoverer).

Reasoning behind the name: element which creates multicoloured salts (the name originates from the Greek word *chroma* – "color" (Bin).

Mangan (Eng. manganese, Lat. manganum, Mn, at. no. 25)

Date of discovery: 1774, **discovered by:** K. W. Scheele (recognized as an element), J. G. Gahn (isolation) (Heis), **original Polish name:** *manganesium* (named by A. Lavoisier).

Reasoning behind the name: element which was discovered in the mineral called *alabandicus manganese* or *manganesium* (Bin) or whose oxide MnO_2 is similar to the substance called magnetite which can be found in the vicinity of Magnesia (Manisa) .

Żelazo (Eng. iron, Lat. ferrum, Fe, at. no. 26)

Date of discovery: unknown (iron has been known as a metal since antiquity), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes Jędrzej Śniadecki took an already existing Polish word and attributed to it a new meaning (Bin).

Kobalt (Eng. cobalt, Lat. cobaltum, Co, at. no. 27)

Date of discovery: 1735 (Bin) or 1739 (Heis), **discovered by:** G. Brandt, **original Polish name:** *cobaltum* (probably named by its discoverer).

Reasoning behind the name: element which was discovered in the mineral called *kobold* or *kobelt* (German *Kobold* – "evil spirit", "treasure-guarding sprite", "hobgoblin") (Bin, Miz).

Nikiel (Eng. nickel, Lat. niccolum, Ni, at. no. 28)

Date of discovery: 1751, **discovered by:** A.F. Cronstedt, **original Polish name:** *niccolum* (possibly the Polish name was also affected by the German name discussed below), (probably named by its discoverer).

Reasoning behind the name: element which was discovered in the ore called *Kupfernickel* (German – "false copper, devil's copper") (Bin).

Miedź (Eng. copper, Lat. cuprum, Cu, at. no. 29)

Date of discovery: unknown (copper has been known as a metal since antiquity), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes Jędrzej Śniadecki took an already existing Polish word and attributed to it a new meaning (Bin).

Cynk (Eng. zinc, Lat. zincum, Zn, at. no. 30)

Date of discovery: unknown (zinc has been known as a metal since antiquity), **discovered by:** anonymous, **original Polish name:** *zincum* (named by: unknown).

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes the German name of the ore *Zinck* or *Zincken* was used and in the Middle Ages the element became known as *zincum* (Bin).

Gal (Eng. gallium, Ga, at. no. 31)

Date of discovery: 1875**, discovered by:** P.E. Lecoq de Boisbaudran, earlier D. Mendeleev predicted gallium's existence, **original Polish name:** *gallium* (probably named by its discoverer).

Reasoning behind the name: element was named to honour the discoverer's homeland – France (the word comes from the Latin name for France – *Gallia*) (Bin).

German (germanium, Ge, at. no. 32)

Date of discovery: 1871 (existence predicted) (Heis), 1886 (discovery) (PWN, Heis) 1866 (Bin), **discovered by:** D. Mendeleev (predicted its existence), C.A. Winkler (discovery), **original Polish name:** *germanium* (named by C.A. Winkler).

Reasoning behind the name: element was named to honour the discoverer's homeland – Germany (the word comes from the Latin name for Germany – *Germania*) (Bin).

Arsen (Eng. arsenic, Lat. arsenicum, As, at. no. 33)

Date of discovery: unknown (arsenic compounds were already known in antiquity) (PWN) or 1250 (Heis), (first description of arsenic appeared in the 13^{th} century), **discovered by:** anonymous (if we consider that discovery took place in antiquity) or Albertus Magnus (if the discovery date is 1250) (Heis), **original Polish name:** *arsenicum* (named by A. Lavoisier).

Reasoning behind the name: element which is connected to the ore called *arsenicon* in Greek (Bin) or to golden tint (Miz); the word *arsen* originates from the Persian word meaning "aureate" (Miz); if it really was the case, the names probably referred to an arsenic compound, to minerals containing this element or to an arsenic allotrope called *yellow arsenic* (which seems less likely as it is not the primary form of this element).

Selen (selenium, Se, at. no. 34)

Date of discovery: 1817 (Bin) or 1818 (Heis), **discovered by:** J.J. Berzelius, **original Polish name:** *selenium* (named by J.J. Berzelius).

Reasoning behind the name: element which was named in order to commemorate a celestial body – the Moon (the word originates from the Greek word *selene* – "moon" (Bin) or to honour the Greek goddess of the Moon called *Selene)* (Miz).

Brom (Eng. bromine, Lat. bromum, Br, at. no. 35)

Date of discovery: 1826, **discovered by:** A.J. Balard, **original Polish name:** *bromum* (probably named by its discoverer).

Reasoning behind the name: element which gives off a bad smell (the name originates from the Greek word *bromos* – "stench" or *bromon* – "stinking") (Bin).

Krypton (krypton, Kr, at. no. 36)

Date of discovery: 1898, **discovered by:** W. Ramsay, M.W. Travers, **original Polish name:** *krypton* (named by: W. Ramsay, M.W. Travers).

Reasoning behind the name: element which was hidden, difficult to isolate (the name originates from the Greek word *kryptos* – "hidden") (Bin).

Rubid (rubidium, Rb, at. no. 37)

Date of discovery: 1861, **discovered by:** R.W. Bunsen, G.R. Kirchhoff, **original Polish name:** *rubidium* (probably named by its discoverer).

Reasoning behind the name: element which burns with a red flame (the name originates from the Latin word *rubidus* – "dark red") (Bin).

Stront (strontium, Sr, at. no. 38)

Date of discovery: 1790 (its existence ascertained), 1808 (isolation), **discovered by:** A. Crawford (confirmed its existence), H.B. Davy (isolated) (Heis), **original Polish name:** *strontium* (named by H.B. Davy).

Reasoning behind the name: element which was discovered in the Scottish village Stronthian (Bin).

Itr (yttrium, Y, at. no. 39)

Date of discovery: 1794 (Bin) or 1789 (discovery) and 1828 (isolation) (Heis), **discovered by:** J. Gadolin (discovery), F. Wöhler (isolation), **original Polish name:** *yttrium* (probably named by one of the discoverers).

Reasoning behind the name: element which was discovered in the Swedish village Yterrby (Bin).

Cyrkon (zirconium, Zr, at. no. 40)

Date of discovery: 1789 (identification) or 1824 (separation), **discovered by:** M.H. Klaproth (identification) or J.J. Berzelius (separation) (Heis), **original Polish name:** *zirconium* (probably named by one of the discoverers).

Reasoning behind the name: element which was discovered in the mineral zircon (Bin) which is the color of gold (Miz) (the name originates from the Persian word meaning "golden") (Miz).

Niob (niobium, Nb, at. no. 41)

Date of discovery: 1801**, discovered by:** Ch. Hatchett, **original Polish name:** *niobium* (probably named by its discoverer).

Reasoning behind the name: element discovered in a mineral which contained another, previously discovered element – tantalum (both names derive from names of two relatives from Greek mythology – Tantalus and his daughter Niobe) (Bin).

Molibden (Eng. molybdenum, Lat. molybdaenum, Mo, at. no. 42)

Date of discovery: 1778, **discovered by:** K.W. Scheele, **original Polish name:** *molybdaenum* (probably named by its discoverer).

Reasoning behind the name: element which was discovered in a substance called *terra molibdaenae* (the name originates from the Latin word *molibdaena* which itself comes from the Greek word *molybdos* – "lead", "lead compound" (Bin)) or which exhibits properties similar to lead (Miz).

Technet (technetium, Tc, at. no. 43)

Date of discovery: 1937, **discovered by:** E.G. Segré, C. Perrier, **original Polish name:** *technetium* (probably named by its discoverer).

Reasoning behind the name: element which was the first element in the history of chemistry to be created by artificial synthesis (Bin).

Ruten (ruthenium, Ru, at. no. 44)

Date of discovery: 1828 (predicted existence) (Heis), 1844 (isolation) (PWN, Heis) or 1845 (Bin), **discovered by:** C. Claus, **original Polish name:** *ruthenium* (named by C. Claus).

Reasoning behind the name: the element was named to honour the ancient country Rus (the name originates from the medieval Latin name *Ruthenia*) (Bin).

Rod (rhodium, Rh, at. no. 45)

Date of discovery: 1803, **discovered by:** W.H. Wollaston, **original Polish name:** *rhodium* (probably named by its discoverer).

Reasoning behind the name: element whose salts are rose-colored in a dilute solution (the name comes from the Greek word *rhodon* – "rose colour") (Bin).

Pallad (palladium, Pd, at. no. 46)

Date of discovery: 1803 **discovered by:** W. H. Wollaston, **original Polish name:** *palladium* (probably named by its discoverer).

Reasoning behind the name: element which was named in honour of the planet Pallas discovered in 1802 (Bin) or after the Greek goddess Athena also called Pallas (Miz).

Srebro (Eng. silver, Lat. argentum, Ag, at. no. 47)

Date of discovery: unknown (as a metal has been known since ancient times), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes Jędrzej Śniadecki took an already existing Polish word and attributed to it a new meaning (Bin).

Kadm (cadmium, Cd, at. no. 48)

Date of discovery: 1817, **discovered by:** F. Strohmeyer and, independently, K.S.L. Hermann, J.C.H. Roloff (Heis), **original Polish name:** *cadmium* (probably named by one of the discoverers).

Reasoning behind the name: element discovered in calamine ore which in the Roman times was called by its Greek name *kadmeia* or *cadmia* (Bin).

Ind (indium, In, at. no. 49)

Date of discovery: 1863, **discovered by:** F. Reich, T. Richter, **original Polish name:** *indium* (probably named by its discoverers).

Reasoning behind the name: element which has a bright indigo spectral line (Bin) or burns with an indigo flame (Miz).

Cyna (Eng. tin, Lat. stannum, Sn, at. no. 50)

Date of discovery: unknown (tin as a metal was already known in antiquity or even in prehistoric times), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes Jędrzej Śniadecki took an already existing Polish word and attributed to it a new meaning (Bin).

Antymon (Eng. antimony, Lat. stibium, Sb, at. no. 51)

Date of discovery: unknown (antimony as a mineral component was already known in antiquity and was classified in the first half of 17^{th} century), **discovered by:** anonymous, **original Polish name:** *antimonium* (named by: unknown).

Reasoning behind the name: element which was a constituent of the mineral with two Latin names *stibium* and *antimonium* – for naming purposes Jędrzej Śniadecki used the latter name and turned it into a Polish form *antymon* (Bin); alternatively: element which never appears alone in nature (in that case the name would derive from the Greek – *anti* and *monos* – not alone) (Heis).

Tellur (tellurium, Te, at. no. 52)

Date of discovery: 1782 (PWN) or 1798 (Bin), **discovered by:** F.J. Müller von Reichenstein, who in 1782 ascertained the existence of tellurium or M. Klaproth, who was the first to isolate it in 1798, **original Polish name:** *tellurium* (named by M. Klaproth).

Reasoning behind the name: element was named to honour the planet Earth (the word originates from Latin *Tellus* – "Earth" (Bin).

Jod (Eng. iodine, Lat. iodum, I, at. no. 53)

Date of discovery: 1811, **discovered by:** B. Courtois, **original Polish name:** *iodum* (named by J. Gay-Lussac).

Reasoning behind the name: element with purple fumes (the word comes from the Greek adjective *iodes* – "violet, purple") (Bin).

Ksenon (xenon, Xe, at. no. 54)

Date of discovery: 1898, **discovered by:** W. Ramsay, M.W. Travers, **origin of the Polish name:** *xenon* (named by: W. Ramsay, M.W. Travers).

Reasoning behind the name: element which was discovered in liquid krypton as an additional, strange substance (the word originates from the

Greek word *ksenos* or *ksenon* – "stranger") (Bin).

Cez (caesium, Cs, at. no. 55)

Date of discovery: 1860, **discovered by:** R. W. Bunsen, G.R. Kirchhoff, **origin of the Polish name:** *caesium* (named by: R.W. Bunsen, G.R. Kirchhoff).

Reasoning behind the name: element which burns with a blue flame (the name originates from the Latin word *caesium* or *caesius* – "sky blue" (Bin)) or which has two blue spectral lines (Heis).

Bar (barium, Ba, at. no. 56)

Date of discovery: 1774 (Bin) or 1808 (Heis), **discovered by:** K.W. Scheele (Bin) or H. Davy (Heis), **origin of the Polish name:** *barium* (named by H. Davy).

Reasoning behind the name: element which was isolated from a mineral called *barite* (originating from the Latin word *baritea*, from Greek *barys* – "heavy") (Bin).

Lantan (lanthanum, La, at. no. 57)

Date of discovery: 1839 (PWN) or 1834 (Bin), **discovered by:** K. G. Mosander (PWN), **original Polish name:** *lanthanium* (named by J. Berzelius (Bin)).

Reasoning behind the name: element which was hidden, difficult to isolate (from the Greek word *lanthanein*, meaning "to conceal oneself" or "to lie hidden" (Bin).

Cer (cerium, Ce, at. no. 58)

Date of discovery: 1803 **discovered by:** J.J. Berzelius, W. Hisinger and, independently, M. H. Klaproth (Heis), **original Polish name:** *cerium* (named by M. Klaproth).

Reasoning behind the name: element which was named after the asteroid Ceres discovered in 1801 (Bin) or after Ceres herself, who was the Roman goddess of agriculture.

Prazeodym (praseodymium, Pr, at. no. 59)

Date of discovery: 1885, **discovered by:** C. Auer von Welsbach, **original Polish name:** *praseodymium* (probably named by its discoverer).

Reasoning behind the name: element which has green salts (Latin *prasinus*, Greek *prasinos*, meaning "green") and which was separated from the substance known as didymium (Latin *didymium*, Greek *didymos*, meaning "double", "twin"), which used to be considered an element (Bin).

Neodym (neodymium, Nd, at. no. 60)

Date of discovery: 1885, **discovered by:** C. Auer von Welsbach, **original Polish name:** *neodymium* (probably named by its discoverer).

Reasoning behind the name: a newly discovered element separated from the substance known as didymium, which used to be considered an element; the name comes from the combination of the Greek *neos*, meaning "new" and *didymos* (Latin *didymus)*, meaning "double", "twin" (Bin).

Promet (promethium, Pm, at. no. 61)

Date of discovery: 1912 (its existence was predicted) and 1947 (its existence was confirmed) (Heis) or 1945 (PWN) or 1946 (Bin), **discovered by:** H.G.J. Moseley (predicted its existence) (Heis), a team of American researchers: Ch.E. Coryell, J.A. Marinsky, L.E. Glendenin (confirmed its existence) (Bin, Heis), **original Polish name:** *promethium* (named by its discoverers).

Reasoning behind the name: element which was named after the Greek mythological figure Prometheus (Bin).

Samar (samarium, Sm, at. no. 62)

Date of discovery: 1879 **discovered by:** P.E. Lecoq de Boisbaudran, **origin of the Polish name:** *samarium* (named by its discoverer).

Reasoning behind the name: element which was isolated from the mineral samarskite (Bin) or named in honour of a Russian engineer, Samarski, who brought a sample of this mineral from the Ural Mountains (Miz).

Europ (europium, Eu, at. no. 63)

Date of discovery: 1896 (PWN) or 1901 (Bin), **discovered by:** E. A. Demarçay, **original Polish name:** *europium* (named by E. A. Demarçay).

Reasoning behind the name: element which was named to honour the continent of Europe (Bin).

Gadolin (gadolinium, Gd, at. no. 64)

Date of discovery: 1880 and 1886 (by another discoverer), **discovered by:** J.Ch de Marignac and P.E. Lecoq de Boibaudran, **original Polish name:** *gadolinium* (named by P.E. Lecoq de Boisbaudran) (Heis).

Reasoning behind the name: element which was named in honour of the eminent Finnish chemist J. Gadolin (Bin) or its name comes from gadolinite, the mineral in which the element was found (Heis).

Terb (terbium, Tb, at. no. 65)

Date of discovery: 1843, **discovered by:** K. G. Mosander, **original Polish name:** *terbium* (named by K.G. Mosander).

Reasoning behind the name: element which was isolated from a mineral found in the Swedish village Ytterby (Bin)

Dysproz (dysprosium, Dy, at. no. 66)

Date of discovery: 1886 or 1906 (isolated), **discovered by:** P.E. Lecoq de Boisbaudran or G. Urbain (isolated) (Heis), **original Polish**

name: *dysprosium* (named by P.E. Lecoq de Boisbaudran).

Reasoning behind the name: element which was difficult to isolate into its pure state (the name comes from the Greek *dysprositos* – "difficult", "hard' (Bin).

Holm (holmium, Ho, at. no. 67)

Date of discovery: 1879, **discovered by:** J.L. Soret and, independently, P.T. Cleve, **original Polish name:** *holmium* (probably named by one of the discoverers).

Reasoning behind the name: element which was named after the Latin *Holmia* for the city of Stockholm (Bin).

Erb (erbium, Er, at. no. 68)

Date of discovery: 1843, **discovered by:** K.G. Mosander, **original Polish name:** *erbium* (probably named by its discoverer).

Reasoning behind the name: element which was isolated from a mineral found in the Swedish village Ytterby (Bin).

Tul (thulium, Tm, at. no. 69)

Date of discovery: , discovered by: P.T. Cleve, **original Polish name:** *thulium* (probably named by its discoverer).

Reasoning behind the name: element which was named after the fairytale-like island known as Thule (from Greek), which is the most northerly part of Scandinavia (Bin) or after Scandinavia itself, as it used to be called Thule in ancient times.

Iterb (ytterbium, Yb, at. no. 70)

Date of discovery: 1878, **discovered by:** J.Ch. de Marignac, **original Polish name:** *ytterbium* (probably named by its discoverer).

Reasoning behind the name: element which was discovered in the vicinity of Ytterby, a village in Sweden (Bin).

Lutet (lutetium, Lu, at. no. 71)

Date of discovery: 1907-1908 (Heis), **discovered by:** C. Auer von Welsbach and, independently, G. Urbain, **original Polish name:** *lutetium* (named by G. Urbain).

Reasoning behind the name: element which was named after Paris, the French city (its Latin names is *Lutetia*) (Bin).

Hafn (hafnium, Hf, at. no. 72)

Date of discovery: 1923 (PWN) or 1922 (Bin), **discovered by:** D. Coster and G. de Hevesy, **original Polish name:** *hafnium* (named by: D. Coster and G. de Hevesy).

Reasoning behind the name: element which was named for the city Copenhagen, whose Latin name is *Hafnia* (Bin).

Tantal (tantalum, Ta, at. no. 73)

Date of discovery: 1802, **discovered by:** A.G. Ekeberg, **original Polish name:** *tantalum* (probably named by its discoverer).

Reasoning behind the name: element which was named to honour the Greek mythological figure Tantalos (Bin).

Wolfram (Eng. tungsten, Lat. wolframium, W, at. no. 74)

Date of discovery: 1781 (Bin) or 1783 (Heis), **discovered by:** K.W. Scheele (Bin) or brothers J. and F. d'Elhuyar (Heis), **original Polish name:** *wolfram* (named probably by one of the discoverers).

Reasoning behind the name: element which was isolated from a mineral known as wolframite (that name came from the German *Wolf* – "wolf" and *Rahm* – "foam") (Bin) or from the ores which impeded the extraction of tin (their name came from the German *Wolf*) (Miz) or the name was derived from the old, scornful name for a metal that was considered worthless – *wolfram* (Heis).

Ren (rhenium, Re, at. no. 75)

Date of discovery: 1925, **discovered by:** W. Noddack, J. Noddack-Tacke, O. Berg, **original Polish name:** *rhenium* (named by W. Noddack).

Reasoning behind the name: element which was named in honour of the German river the Rhine (Latin: *Rhenus*) (Bin).

Osm (osmium, Os, at. no. 76)

Date of discovery: 1803 (Heis) or 1804 (Bin), **discovered by:** S. Tennant, **original Polish name:** *osmium* (probably named by its discoverer).

Reasoning behind the name: element which gives off an unpleasant, pungent smell (the name comes from the Greek *osme*, meaning "smell") (Bin).

Iryd (iridium, Ir, at. no. 77)

Date of discovery: 1803 (Heis) or 1804 (Bin), **discovered by:** S. Tennant, **original Polish name:** *iridium* (probably named by its discoverer).

Reasoning behind the name: element which forms oxides with bright colours (the name comes from the Latin *iris*, meaning "rainbow" (Bin) or from *Iris*, the Greek goddess of the rainbow (Bin)).

Platyna (platinum, Pt, at. no. 78)

Date of discovery: 1735 (PWN, Heis) and 1741 (Heis) or 1750 (Bin), **discovered by:** A. de Ulloa (PWN, Heis) and independently, Ch. Wood (Heis) or W. Watson (Bin), **original Polish name:** *platinum* (named by W. Watson).

Reasoning behind the name: element which resembles silver (the name comes from Spanish *platina*, meaning "little silver" (Bin).

Złoto (Eng. gold, Lat. aurum, Au, at. no. 79)

Date of discovery: unknown (as a metal it has been known since ancient times), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes Jędrzej Śniadecki took an already existing Polish word and attributed to it a new meaning (Bin).

Rtęć (Eng. mercury, Lat. hydrargyrum, Hg, at. no. 80)

Date of discovery: unknown (as a metal it has been known since ancient times), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes E. Czyrniański took an already existing Polish word and attributed to it a new meaning (Bin).

Tal (thallium, Tl, at. no. 81)

Date of discovery: 1861, **discovered by:** W. Crookes, **original Polish name:** *thalium* (named by W. Crookes).

Reasoning behind the name: element which was named after the bright green colour of its spectra line (the name comes from *thallos*, Greek for "green twig") (Bin).

Ołów (Eng. lead, Lat. plumbum, Pb, at. no. 82)

Date of discovery: unknown (as a metal it has been known since ancient times), **discovered by:** anonymous, **original Polish name:** none.

Reasoning behind the name: element which was identified with the metal that it makes up – for naming purposes Jędrzej Śniadecki took an already existing Polish word and attributed to it a new meaning (Bin).

Bizmut (Eng. bismuth, Lat. bismuthum, Bi, at. no. 83)

Date of discovery: 1450 (isolated) and 1683–1737 (became considered an element), **discovered by:** B. Valentinus (isolated) and C. Neumann (started considering it an element – until 16^{th} century it was confused with tin and lead) (Heis), **original Polish name:** *bismuthum* (named by: unknown).

Reasoning behind the name: element which was discovered in the Earth's crust (the name comes from the German word *Wismut*, meaning "meadow" (Bin).

Polon (polonium, Po, at. no. 84)

Date of discovery: 1898, **discovered by:** M. Skłodowska-Curie and P. Curie, **original Polish name:** *polonium* (named by: M. Skłodowska-Curie and P. Curie).

Reasoning behind the name: element which was named in honour of the country Poland – the homeland of the element's discoverer (Bin).

Astat (Eng. astatine, Lat. astatium, At, at. no. 85)

Date of discovery: 1940, **discovered by:** D.R. Corson, K.R. McKenzie, E. Segré, **original Polish name:** *astatium* (named by its discoverers).

Reasoning behind the name: element which is prone to undergo nuclear decay (the name is from the Greek *astatos*, meaning "unstable") (Bin).

Radon (radon, Rn, at. no. 86)

Date of discovery: 1900, **discovered by:** F.E. Dorn, **original Polish name:** *radon* (named probably by its discoverer).

Reasoning behind the name: element which is a product of the nuclear decay of radium (Bin).

Frans (francium, Fr, at. no. 87)

Date of discovery: 1939, **discovered by:** M. Perey, **original Polish name:** *francium* (named by M. Perey).

Reasoning behind the name: element which was named after the country France – either because it is its discoverer's homeland (Bin) or because this is where it was discovered (Miz).

Rad (radium, Ra, at. no. 88)

Date of discovery: 1898, **discovered by:** M. Skłodowska-Curie and P. Curie (Bin) or only M. Skłodowska-Curie (PWN), **original Polish name:** *radium* (named by: M. Skłodowska-Curie and P. Curie).

Reasoning behind the name: element which emits radioactivity (the name comes from the Latin *radius*, meaning "ray") (Bin).

Aktyn (actinium, Ac, at. no. 89)

Date of discovery: 1899 (Bin, Heis) and 1902 (Heis), **discovered by:** A.L. Debierne (Bin, Heis) and F. Otto Giesel (Heis), **original Polish name:** *actinium* (named by A. Debierne).

Reasoning behind the name: element which emits radioactivity (the name comes from the Greek *aktis* meaning "ray" (Bin).

Tor (thorium, Th, at. no. 90)

Date of discovery: 1825 (Bin) or 1828 (PWN, Heis), **discovered by:** J.J. Berzelius, **original Polish name:** *thorium* (named by J.J. Berzelius).

Reasoning behind the name: element which was named after Thor, the Scandinavian (or Saxon) god of thunder (Bin).

Protaktyn (protactinium, Pa, at. no. 91)

Date of discovery: 1913 (unstable isotope) and 1917 (the most stable isotope) (Bin) and 1934 (isolation) (Heis), **discovered by:** K. Fajans and O.H. Göhring (the unstable isotope) O. Hahn and L. Meitner and, independently, F. Soddy (the most stable isotope) (Bin), as well as A.V.

Grosse (isolation) (Heis), **original Polish name:** *protactinium* (named by O. Hahn).

Reasoning behind the name: element which comes first before the element actinium in the decay chain, 'predecessor of actinium' (derived from Greek *proto* + *aktis*) (Bin).

Uran (uranium, U, at. no. 92)

Date of discovery: 1789 (discovery) (Bin, Heis) and 1841 (isolated) (Heis), **discovered by:** M. Klaproth (Bin, Heis) and E.M. Péligot (isolation) (Heis), **original Polish name:** *uranium* (named by: M. Klaproth).

Reasoning behind the name: element which was named after the planet Uranus or after the Roman god's name Ouranos (Bin, Miz, Eich).

Neptun (neptunium, Ne, at. no. 93)

Date of discovery: 1940, **discovered by:** E.M. McMillan, Ph.H. Abelson, **original Polish name:** *neptunium* (named by its discoverers).

Reasoning behind the name: element which was named after the planet Neptune or after the Roman god Neptunus (Bin); according to some sources, what inspired the choice of the name was the order of planets in the Solar System, which reflected either the chronological order in which the transuranic elements were discovered or their position in the table of elements: the planet Neptune is beyond Uranus just as neptunium was discovered after uranium and it is the next element in the periodic table (Eich).

Pluton (plutonium, Pu, at. no. 94)

Date of discovery: 1940 (Bin) or 1941 (Heis), **discovered by:** G.Th. Seaborg and co-workers, **original Polish name:** *plutonium* (named by its discoverers).

Reasoning behind the name: element which was named after the planet Pluto or after the Roman god Pluto (Plouton) (Bin); according to some sources, what inspired the choice of the name was the order of planets in the Solar System, which reflected either the chronological order in which the transuranic elements were discovered or their position in the table of elements: the planet Pluto is beyond Neptune just as plutonium was discovered after neptunium and it is the next element in the periodic table (Eich).

Ameryk (americium, Am, at. no. 95)

Date of discovery: 1944, **discovered by:** G.Th. Seaborg, R.A. James, L.O. Morgan, A. Ghiorso, **original Polish name:** *americium* (named by its discoverers).

Reasoning behind the name: element which was named after the con-

tinent of North America, where it was discovered just like other transuranic elements (Bin).

Kiur (curium, Cm, at. no. 96)

Date of discovery: 1944, **discovered by:** G.Th. Seaborg, R.A. James, A. Ghiorso, **original Polish name:** *curium* (named by its discoverers).

Reasoning behind the name: element which was named in honour of M. Skłodowska-Curie and P. Curie (PWN, Miz) or only after M. Skłodowska-Curie (Bin).

Berkel (berkelium, Bk, at. no. 97)

Date of discovery: 1949 (Bin) or 1950 (Heis), **discovered by:** G. Seaborg, S. Thompson, A. Ghiorso, **original Polish name:** *berkelium* (named by its discoverers).

Reasoning behind the name: element which was named after the research institute, in which it was discovered (University of California in Berkeley) or after the town itself (Berkeley). (Bin).

Kaliforn (californium, Cf, at. no. 98)

Date of discovery: 1950, **discovered by:** S.G. Thompson, K. Street, A. Ghiorso, G.Th. Seaborg, **original Polish name:** *californium* (named by its discoverers).

Reasoning behind the name: element which was named after the research institute, in which it was discovered (University of California in Berkeley)

Einstein (einsteinium, Es, at. no. 99)

Date of discovery: 1952 (PWN, Heis) or 1953 (Bin), **discovered by:** a team of American scientists – among others G.Th. Seaborg, A. Ghiorso, S. Thompson, **original Polish name:** *einsteinium* (named by its discoverers).

Reasoning behind the name: element which was named in honour of the eminent physicist Albert Einstein (Bin).

Ferm (fermium, Fm, at. no. 100)

Date of discovery: 1952, **discovered by:** the group of American scientists – among others G.Th. Seaborg. A. Ghiorso, S. Thompson, **original Polish name:** *fermium* (named by its discoverers).

Reasoning behind the name: element which was named after the eminent physicist Enrico Fermi (Bin).

Mendelew (mendelevium, Md, at. no. 101)

Date of discovery: 1955, **discovered by:** scientists from the Lawrence Berkeley National Laboratory – A. Ghiorso, B.G. Harvey, G.R. Choppin, S.G. Thompson, G.Th. Seaborg, **original Polish name:** *mendelevium* (named by its discoverers).

Reasoning behind the name: element which was named after Dimitri Mendeleev, an eminent chemist who created the periodic table of elements (Bin).

Nobel (nobelium, No, at. no. 102)

Date of discovery: 1958, **discovered by:** A. Ghiorso, T. Sikkeland, J.R. Walton, G. Th. Seaborg, **original Polish name:** *nobelium* (named by its discoverers).

Reasoning behind the name: element which was named after Alfred Nobel, Swedish chemist and inventor (Bin).

Lorens (lawrencium, Lr, at. no. 103)

Date of discovery: 1961, **discovered by:** the group of American scientists – A. Ghiorso and co-workers, **original Polish name:** *lawrencium* (named by its discoverers).

Reasoning behind the name: element which was named in honour of the American physicist known for his invention of the cyclotron – Ernest Orlando Lawrence (Bin, PWN).

Rutherford (rutherfordium, Rf, at. no. 104)

Date of discovery: 1962 (Bin) or 1964 (PWN, Heis) and 1969 (Heis), **discovered by:** G. Florow and his co-workers at the Joint Institute for Nuclear Research in Dubna (Bin, PWN, Heis) and later, independently, by American scientists from Berkeley (Heis), **original Polish name:** *rutherfordium* (probably named by its discoverers).

Reasoning behind the name: element which was named after Ernest Rutherford, an eminent British physicist (PWN).

Dubn (dubnium, Db, at. no. 105)

Date of discovery: 1967 and later, independently, 1970 (Heis) or 1974 (PWN), **discovered by:** scientists at the Joint Institute for Nuclear Research in Dubna (Russia), later, independently, by scientists at the Lawrence Berkeley National Laboratory (USA), **original Polish name:** *dubnium* (named by its discoverers).

Reasoning behind the name: element which was named after the laboratory that created the element or after the town itself (PWN).

Seaborg (seaborgium, Sg, at. no. 106)

Date of discovery: 1974, **discovered by:** scientists at the Joint Institute for Nuclear Research in Dubna (PWN, Heis) and, independently, by American scientists from Berkeley (Heis), **original Polish name:** *seaborgium* (named by its discoverers).

Reasoning behind the name: element which was named in honour of the eminent physicist – Glenn Theodore Seaborg (PWN).

Bohr (bohrium, Bh, at. no. 107)

Date of discovery: 1976, **discovered by:** the scientists at the Joint Institute for Nuclear Research in Dubna, **original Polish name:** *bohrium* (named by its discoverers).

Reasoning behind the name: element which was named in honour of the eminent physicist – Niels Bohr (PWN).

Has (hassium, Hs, at. no. 108)

Date of discovery: 1984, **discovered by:** scientists at the Institute for Heavy Ion Research in Darmstadt**, original Polish name:** *hassium* (named by its discoverers) (PWN).

Reasoning behind the name: element which was named after the German state of Hesse.

Meitner (Eng. meitnerium, Lat. meitner, Mt, at. no. 109)

Date of discovery: 1982, **discovered by:** scientists at the Institute for Heavy Ion Research in Darmstadt**, original Polish name:** *meitner* (named by its discoverers).

Reasoning behind the name: element which was named in commemoration of Lise Meitner, an eminent nuclear physicist who worked on radioactivity (but she was not the one to discover meitnerium) (PWN).

Darmstadt (Eng. darmstadtium, Lat. darmstadt, Ds, at. no. 110)

Date of discovery: 1994, **discovered by:** scientists at the Institute for Heavy Ion Research in Darmstadt, **original Polish name:** *darmstadt* (named by: its discoverers).

Reasoning behind the name: element which was created by scientists at the Institute for Heavy Ion Research in Darmstadt (PWN).

Roentgen (roentgenium, Rg, at. no. 111)

Date of discovery: 1994, **discovered by:** scientists from the Institute for Heavy Ion Research in Darmstadt**, original Polish name:** *unununium*

Reasoning behind the name: element which was named in honour of the eminent physicist Wilhelm Conrad Röntgen, who discovered electromagnetic radiation.

Kopernik (copernicium, Cn, at. no. 112)

Date of discovery: 1996, **discovered by:** scientists at the Institute for Heavy Ion Research in Darmstadt, **original Polish name:** *copernicium.*

Reasoning behind the name: element which was named in honour of Nicolaus Copernicus.

Ununtri (ununtrium, Uut, at. no. 113)

Date of discovery: no data available, **discovered by:** no data available, **original Polish name:** *ununtrium*

Reasoning behind the name: element with the atomic number 113 (systematic names of such elements are formed on the basis of the digits of their atomic number, each digit having a corresponding morpheme: 0-nil, 1-un, 2-bi, 3-tri, 4-quad, 5-pent, 6-hex, 7-sept, 8-oct, 9-enn and each word ending with -ium). This type of nomination is used with reference to the elements, which have not yet been officially accepted by IUPAC (Heis, 423) (PWN, Miz, Heis).

Ununkwad (ununquadium, Uuq, at. no. 114)

Date of discovery: 1999, **discovered by:** Russian scientists from a research centre in Dubna and American scientists from a research center in Berkeley, **original Polish name:** *ununquadium.*

Reasoning behind the name: element with the atomic number 114 (PWN, Miz).

Ununpent (ununpentium, Uup, at. no. 115)

Date of discovery no data available, **discovered by:** no data available, **original Polish name:** *ununpentium.*

Reasoning behind the name: element with the atomic number 115 (PWN, Miz).

Ununheks (ununhexium, Uuh, at. no. 116)

Date of discovery: 1999**, discovered by:** American researchers from a laboratory in Berkeley, **original Polish name:** *ununhexium.*

Reasoning behind the name: element with the atomic number 116 (PWN, Miz).

Ununokt (ununoctium, Uuo, at. no. 118)

Date of discovery: no data available, **discovered by:** no data available, **original Polish name:** *ununoctium.*

Reasoning behind the name: element with the atomic number 118 (PWN, Miz).

The element with the atomic number 117 has not yet been discovered.[1] It must be noted, however, that research is still conducted which aims to synthetize new transuranic elements. Scientists do not rule out the possibility of extending the periodic table even up to the atomic number 168. A hypothetical periodic table which includes super-heavy elements was presented and commented upon by David Heiserman (Heiserman 1997: 423–425). It is highly unlikely that elements above the atomic number 168 are created, but

[1]This element was still unknown at the time when the paper was written. Element 117, called ununseptium, was created in 2010 [translator's note].

the absolute upper-limit of research is the atomic number 200, beyond which gigantic force is required to keep the atomic nucleus together (Heiserman 1997: 423).

3.2. History of the oldest names of the elements in the general language

The origins of the oldest names of chemical elements go back to the very roots of the Polish language: to Proto-Slavic and in some cases even to Proto-Indo-European times. The history of these lexemes and their genetic connections with the expressions present in other languages are interesting enough to be discussed separately.

At this point of my analysis I am referring to the following etymological dictionaries: Brückner 1993, Boryś 2005, Długosz-Kurczabowa 2003 (which includes only two of the analyzed names: *złoto* [*gold*] and *żelazo* [*iron*]), and Bańkowski 2000, which accounts only for the names *miedź* [*copper*], *cyna* [*tin*], and *ołów* [*lead*].

The scope of this research is very limited. It covers the names selected according to the general historical information presented in Biniewicz's study (Biniewicz 1992: 21–39) and in Mizerski's tables (Mizerski 2004: 330–331).

The touchstone of my analysis, which helps to establish the scope of the subsystem, is the age of the lexical form, with no regard to how long it has been functioning in the Polish language as a chemical term to designate an element, because the term "element" itself was introduced to science relatively late – in 1661, as I already mentioned in the introduction. And the first reasonable definitions of an element and of chemical compounds were offered even later. The definition of an element was provided by John Dalton in 1808 in his *New System of Chemical Philosophy*. Therefore, if one was to consider the time when the names of chemical elements were formed from such a perspective, it would turn out that all of the names are quite new – their origins would go back to the second half of the 17^{th} century or even to the 19^{th} century.

In any cases which raise doubt, I resort to yet another helpful 'litmus test'. Namely, I take into consideration only those names that were adopted in the chemical nomenclature from the general language in an unchanged form – as readymade lexemes. I do not include here any derived names, in which only some morphological elements preserve their ancient origin – such as *wodór* [*hydrogen*], which is a shortened version of the word *wodoród* formed from the ancient words *woda* [*water*] and *rodzić* [*to give birth*], or *tlen* [*oxygen*] which comes from an equally ancient word *tlić* [*to smoulder*]. By analogy, I exclude the name *polon* [*polonium*], formed on the basis of the

French word *Pologne*, although it could have been borrowed from Polish, as it derives from the name of Poland, which itself comes directly from the name of the Polan tribe. Derivatives like *glin* [*aluminium*] (from the word *glina* [*clay*]), *krzem* [*silicon*] (from *krzemień* [*flint*]) or *wapń* [*calcium*] (from *wapień* [*limestone*], *wapno* [*lime*]) are not included either in this class of lexical units, although the words that formed them have a very fascinating and ancient etymology. I also leave out, which seems obvious, the names that do not have Slavic origins, even if they might have been known in the Polish language from time immemorial. Namely, the word *ren* [*rhenium*], which derives from the identically-sounding name of a German river. Incidentally, this form is very old, it has Celtic origins and it contains in its morphological structure the stem that forms the very word *rzeka* [*river*] (Brückner 1993: 457).

Now, after having selected the linguistic material, a list of the oldest Polish names of the elements can be made. It looks as follows: *węgiel* [*carbon*], *siarka* [*sulfur*], *żelazo* [*iron*], *miedź* [*copper*], *srebro* [*silver*], *cyna* [*tin*], *złoto* [*gold*], *rtęć* [*mercury*], *ołów* [*lead*].

All the substances, which are the referents of the above lexemes were already known in antiquity (in the form of minerals or metals), but naturally they were not considered chemical elements, as the very notion was unknown at the time. Their discoverers cannot be traced. The authors of the Polish nominations are Jędrzej Śniadecki and Emilian Czyrniański. For naming purposes they resorted to already existing Polish words and they attributed to them new, specialized meanings (Biniewicz 1992). Almost each one of those names was the result of the association of the element with the substance (mineral or metal) in which it occurs as its primary constituent, i.e. a substance which retains its chemical properties after its purification.

It is only in the case of carbon (*węgiel*) that things get more complicated, because originally, there were attempts to differentiate the name of the element from the name of the mineral, which resulted in such proposals as *węglik* (Śniadecki) or *węglan*, but those names never caught on.

Here is the historical and etymological background of individual lexical units of the discussed group:

węgiel (carbon) – formerly: *wągl*, *wągiel*, plural: *wągle*; the word has Proto-Slavic (earlier on Proto-Indo-European) roots and it sounds similar in different languages: Old Church Slavonic *ꙗglь*, orv-olr. *ugol',* srp. *ugal',* ces. *uhel,* lit. and prg. *anglis,* lav. *uogle,* san. *angārah* (Brückner 1993: 609, Boryś 2005: 686); reconstructed Proto-Slavic form: **ęglь* meaning "carbonized wood", "charcoal"; masculine; originally, the stem with *-ĭ-*, deriving from

Proto-Indo-European **angli-* (or **angelo-*) had the same meaning (Boryś 2005: 686).

siarka (sulfur) – a word with Proto-Slavic origin with alternations in Old Polish: *siarka / szarka / sarka*; doublet of such lexemes as: *siara* ("a mother's first milk", but also "sour milk"), *siarnik, siarczysty, szary, sierak* ("dusk"), *siermięga* (a type of clothing named after its grey color) as well as *siny* and *siwy* – it contains the morpheme *si-,* which designates a bright color (Brückner 1993: 487, 489, 492, 541); its semantic equivalents in other languages with similar etymology: hsb. *syra*, ces. *síra, sírka*, orv. *sěra* "siarka", "smoła", rus. *séra*, ukr. *sira*, *sirka*, chu. *sěra*, bul. *sjára*, srp. dialect, *sjera* "mother's first milk"; all of these words derive from Proto-Slavic **sera*, which has two meanings: "sulfur" and "colostrums", but it is unknown which of these two meanings is the original one, as no certain etymology is available (Boryś 2005: 543–544); the name of the mineral is probably justified by its primrose yellow colour.

żelazo (iron) – a word with Proto-Slavic origins with alternations in Old Polish: *żalazo / żalezo / zielazo*; it is a doublet of the word *żeliwo* (which is a shortened version of *żelaziwo* "piece of iron", "iron items") and it sounds similar in different languages: chu. *želězo,* ces. *železo*, lit. *gel(e)žis*, lav. *dzèls*, prg. *gelzo*, *gelso*, slk. *železo*, rus. *želézo*, ukr. *zalízo*, *zelizo*, bul. *želázo*, slv. *želézo*, possibly also ell. *khalkós* (Brückner 1993: 664; Długosz-Kurczabowa 2003: 557–558, Borys 2005: 753–754); those strings derive from the Proto-Slavic form **železo* or **želězo*, whose origin can be interpreted in two ways: (1) it derives from the Proto-Indo-European stem **g'hel-*, which used to mean "stone or something hard" (incidentally, if that was the case, the word *głaz* [*boulder*] would also be a derivative of this unit's doublet) (Długosz-Kurczabowa 2003: 557–558) and (2) the origin of the word is unclear; possibly, it is an ancient borrowing from some Asian language, but I did not manage to pin down the exact source (Boryś 2005: 753–754).

miedź (copper) – a word originating in the Proto-Slavic lexeme **mědь* (feminine, "copper", "bronze", "red brass"), which probably derives from the Pre-Slavic form **(s)moid-i-s* ("wrought metal"); in Old Polish it was also used in reference to copper alloys with other elements as additives ("red brass", "bronze"), related with Polish lexemes: *miedziak*, *miedzianka*, *śniady* (formerly: *śmiady*) and with foreign lexemes: eng. *smith* ("blacksmith"), deu. *Schmied* ("blacksmith") i *Geschmeide* ("ore valuables"), ces. *měd*, rus. *med'*, Old Church Slavonic *mědь* (Brückner 1993: 332, 533; Boryś 2005: 323; Bańkowski 2000: 175).

srebro (silver) – a word with Proto-Slavic origins, its Old Polish

forms are: *śrebro / śrzebro / strzebro / jrzebro* and in dialects: *srebło / śrebło / ščebro / śrybno / ślybrno*, cognate of words: ces. *stříbro*, Old Czech *střiebro*, chu. *sĭrebro*, orv-olr. *sierebro*, rus. *serebró*, Little Russian *sribło*, Old Church Slavonic. *sьrebro*, wen. *slebro*, lit. *sidabras*, lav. *sidrabs*, prg. *sirablis*, got. *silubr*, goh. *silabar*, deu. *Silber*; reconstructed Proto-Slavic form: **sьrebro* ("silver"), whose origin is unclear – it is a borrowing from a non-Indo-European language of the Middle East; perhaps the ultimate source is, for example, the Assyrian form *šarpu* "silver" (Brückner 1993: 511, Boryś 2005: 573).

cyna (tin) – in Old Polish: *cena*, adjective: *ceniany* ("stannic"); cognate of the German form *Zinn* and with the lexeme *cynober* ("vermilion", "red color") (Bańkowski 2000: 209, Brückner 1993: 70); according to Bańkowski (2000: 209) the name of the element derives directly from German, not from Old Polish.

złoto (gold) – a word with Proto-Slavic and Proto-Indo-European roots derived from a Proto-Slavic form **zoł-to* (Brückner 1993: 653, 654) or **zoltъ* , which is a continuation of a Proto-Indo-European stem **g'holt-, *gholt-* alternately: *g'helt-* (Długosz-Kurczabowa 2003: 547–548) or **g'holto-* "golden" and **g'hel-* "shine" – the latter used to refer also to bright colours, especially to gold, yellow, and green, which were not distinguished linguistically once; it is possible that the noun *złoto* was derived from an adjective which was neuter (Boryś 2005: 741); cognate lexemes: ces. *zlato*, orv-olr. *zoloto*, rus. *zóloto* "gold" i *zolotój* "golden", Old Church Slavonic *zlatъ* "golden" i *zlato* "gold", lit. *želtas* ("yellow" or "golden"), lav. *zèlts*, goh. *gold* "golden", ave. *zari* ("yellow", "green", "golden"), *zaranja* ("gold"), as well as pol. *zieleń*, *zioło* (Brückner 1993: 653, 654, Boryś 2005: 741).

rtęć (mercury) – a word with three forms in Old Polish: *rtęć*, *trtęć*, *trztęć* and synonyms: *merkury* and *żywe srebro* [*quicksilver*], cognate of rus. i ces. *rtut'*, slk. *ortut'*, orv. *rьtutь*, derived from the North Slavic form with uncertain origin **rьtqtь* "mercury" – most probably, it was an Asian borrowing; some linguists connect this string with the Arabic lexeme *utārid* "mercury" (as it used to appear in medieval alchemical literature beside the name of the planet Mercury) and Turkish *utarıd* "mercury", but this poses phonetical problems, while others with Lithuanian verbs: *rìsti, ritu* "roll", *riẽsti* "deflect", "bend", "turn", "roll up", which are supposed to be based on the Proto-Indo-European morpheme **rt-* derived form **ret-* "flee", "roll" – the name of the element would then be justified by the appearance of spilled mercury, which takes the shape of small, rolling balls (Brückner 1993: 466, Biniewicz 1992: 36, Boryś 2005: 525).

ołów (lead) – a word with Proto-Slavic origin, masculine in Polish, but neuter in other Slavic languages; in all East Slavic languages its secondary meaning is "tint"; cognate of words: ces. *olovo*, rus. *ólovo* "tint", hrv. i srp. *olovo* "lead", dsb. *wuloj*, hsb. *wołoj*; there is also a formal similarity with semantic equivalents of "lead" in Baltic languages: lit. *álvas*, lav. *alvs*, Old Prussian. *alvis* – possibly, these are all Slavic borrowings; their source was the Proto-Slavic form with uncertain origin **olovo* or **olovъ*, masculine, which meant "lead"; there may be some undetermined etymological connection with Indo-European colour adjectives like goh. *ëlo* "yellow", lat. *albus* "white", ell. *alphós* "white"; the analyzed lexeme would then be justified by the characteristic dark grey colour of the referent, but its precise structure cannot be reconstructed (Bańkowski 2000: 408, Brückner 1993: 379, Boryś 2005: 390).

It is worth adding that the oldest names of the elements discussed above have a very rich pool of reference in the Polish language, which is connected with folk tradition and folk imagery.[2]

4. Typology and structure of the knowledge represented in the semantic field of the names of chemical elements

The history of the names of chemical elements and the reasoning behind them, as discussed above, can serve to recreate the knowledge represented in this entire domain.

4.1. Epistemic subjects of the knowledge represented in the names of chemical elements

The epistemic subject of the knowledge represented in the name of a chemical element is the one who named the element and who often, but not in all cases, may be identified with the very discoverer of this element.

4.2. Objects of the knowledge represented in the names of chemical elements

The knowledge represented in the names of chemical elements may concern two different types of objects:

(a) the chemical element itself, analyzed in various contexts, for example in the context of its properties (see *tlen* [*oxygen*] or *iryd* [*iridium*]), of how it was discovered, of which sample it was part (see *lit* [*lithium*]) and of when it was discovered in comparison with other elements (see *neon*),

(b) objects other than the named element, which are designated by proper names[3] – this is a much more rare case when names are given only to

[2]The associations commonly called up by the oldest names of the elements were examined by cognitive linguists and described in Bartmiński 1996 (see e.g. "węgiel").

[3]I use the term "designation" in the broadest sense it appears in the literature on

commemorate and honour a real or a fictitious person or an object (which is considered very important by the author of the name, recognized by a lot of people and worth being universally known and remembered) without any connection with the named element itself (see *kiur* [*curium*], *ren* [*rhenium*], *wanad* [*vanadium*], *nobel* [*nobelium*]).

The first case is the most common.

Apart from the names which represent knowledge about one object (or one type of objects), there are those which represent a much more complex knowledge. It can concern both the element and the person (like the string *samar*, which was said to come from both the name of the mineral that contained the element and the name of Samarski).

4.3.Types of knowledge represented in the names of chemical elements

The knowledge represented in the names of chemical elements is very diverse (incidentally, it encompasses all the main Aristotelian categories, to which correspond the questions: *What? How numerous or how big is it? What is it like? In relation to what? Where?* and *When?*). It concerns the atomic core of an element or a structure of higher order of which the element is part (i.e. a chemical compound, a crystal, etc.), which is examined with respect to the inherent properties that every sample holds, as well as with respect to the non-inherent properties, related only to certain samples.

The inherent properties that are preserved in the analyzed lexical units are:

– element's atomic number; see systematic names such as *ununokt* [*ununoctium*],

– element's ability to undergo nuclear reactions, see *astat* [*astatine*],

– stage in the decay chain, see *radon*, *protaktyn* [*protactinium*],

– ability to emit radiation during nuclear reactions, see *rad* [*radium*], *aktyn* [*actinium*],

– reactivity or its lack, see *argon*,

– type of chemical reaction that the element undergoes, see *tlen* [*oxygen*],

– product formed during chemical reactions of the element, see *wodór* [*hydrogen*],

– identification of the element with a substance which was not previously considered an element or with one that has a given element as its primary constituent, see *złoto* [*gold*], *węgiel* [*carbon*], *siarka* [*sulfur*],

– similarity to another substance, see *platyna* [*platinum*],

the subject, i.e. also in reference to empty names (Pelc 1984: 296).

– biological properties, see *azot* [*nitrogen*],

– ability of phase transitions, see *fluor* [*fluorine*],

– smell, see *osm* [*osmium*],

– ability to emit visible light, see *fosfor* [*phosphorus*],

– colour (of the spectrum, of the flame in which the sample is burnt, or of the very compound that contains the element), see *tal* [*thallium*], *cez* [*caesium*], *iryd* [*iridium*].

Knowledge other than the inherent properties of the elements preserved in their names includes all circumstances related to the discovery itself:

– people who contributed to the discovery of the element, see *samar* [*samarium*],

– time of discovery in comparison with other elements, see *neon*,

– technical difficulties encountered during the discovery procedure, see *dysproz* [*dysprosium*],

– unusual method of discovery (synthetic production), see *technet* [*technetium*],

– co-occurrence of a different element in the analyzed sample, see *niob* [*niobium*], *tantal* [*tantalum*],

– source of a given sample, see *hel* [*helium*], *bizmut* [*bismuth*],

– type of sample in which an element was detected, see *magnez* [*magnesium*], *lit* [*lithium*].

Moreover, as I already mentioned, some lexical units within the discussed area of research reflect knowledge which refers to proper names and their referent. They are the names of the following objects:

– people, both real and imaginary[4], see *kiur* [*curium*], *wanad* [*vanadium*],

[4]It is worth noting that when it comes to the names of elements which derive from the names of real people, there are two interesting naming customs. Firstly, the person who gives the name to the element never does it on the basis of her own name, even if that person actually discovered the element, in which case she would have every right to leave this particular kind of 'signature'. It probably results from an unwritten principle of modesty that is followed by independent researchers. Meanwhile the only names indirectly connected with the discoverers are those which derive from the names of the discoverers' research institutes. Secondly, surname-based names of the elements usually derive from the names of distinguished natural scientists – physicists, chemists, and an astronomer – or, in the case of *samar*, from that of an engineer. So far, there has been no naming act that would commemorate individuals who made their mark in human sciences, arts, medicine, social activism, etc. and who could serve as inspiration for such names as *humboldtium*, *platonium*, *leibnitium*, *wellsium*, *galenium*, *leonardium*, *davintium*, *chopinium*, etc. Indeed, in some historical analyses there are mentions of the name *columbium*, but it was eventually withdrawn from the nomenclature. Such names, as well as the names of the compounds that these elements form, would sound

– astronomical objects, see *cer* [*cerium*], *pluton* [*plutonium*], *neptun* [*neptunium*],

– continents, see *europ* [*europium*], *ameryk* [*americium*],

– countries, see *polon* [*polonium*], *frans* [*francium*], *ruten* [*ruthenium*],

– cities, see *berkel* [*berkelium*], *iterb* [*ytterbium*], *hafn* [*hafnium*],

– landscape elements (e.g. rivers), see *ren* [*rhenium*].

The structure of knowledge represented in the analyzed semantic field is illustrated in Figure 1, but it needs to be emphasized that this diagram refers only to content. This means that the singled out classes are MERELY CLASSES OF KNOWLEDGE ABSTRACTED FROM THE NAMES OF THE ELEMENTS and not classes of the names themselves when analyzed in terms of the knowledge they represent. Analyzed expressions can contain elements which conceptually are of a different kind, therefore the classification would not be disjunctive. A categorization of the names themselves based on the knowledge they represent is impossible.

as good as the existing ones – let us take for example hypothetical Polish names like: *szopenek galu*, *dwutlenek humboldtu*, or *platonek indu*.

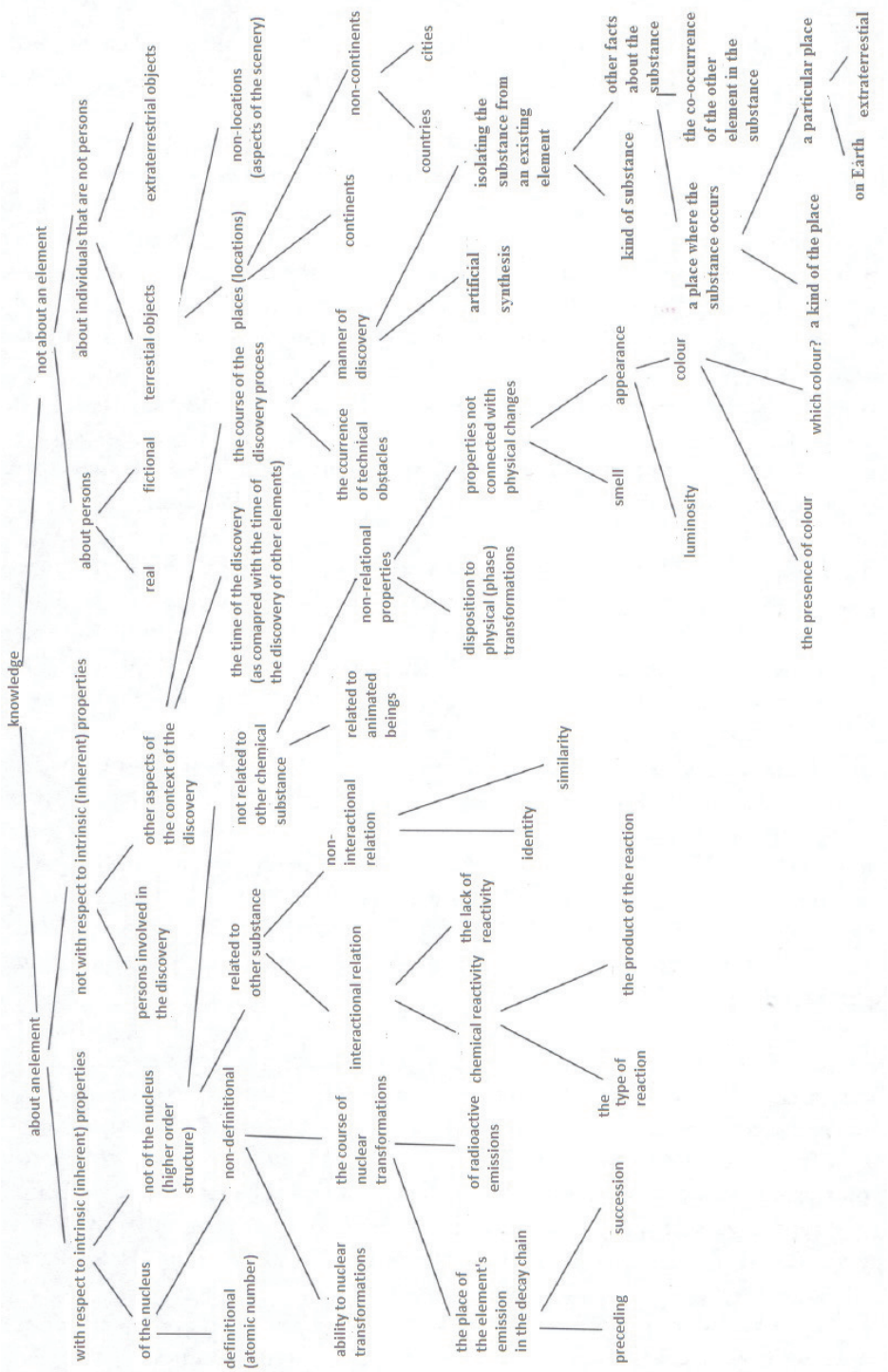

Figure 1. Structure of the knowledge reflected in the names of chemical elements.

5. Sign functions of the names of the elements in contemporary chemistry and the knowledge reflected in them

Sign functions of the names of the elements in contemporary chemistry are not correlated in any way with the knowledge that is represented in their form. This knowledge is absolutely irrelevant when it comes to transmitting information in scientific papers, proof of which being the fact that the knowledge of the etymology of the analyzed expressions is not indispensable for the decoding of such texts.

Moreover, the above-mentioned knowledge may be completely absent from the meaning of the name, even as its subordinate constituent. This may be illustrated by an example of the lexical unit *neodym* [*neodymium*], whose form represents its author's knowledge that the referent was part of a substance called *didym* [*didymium*], which used to be considered an element. The contemporary encyclopedic definition, although quite detailed, left out this fact completely:

neodym, Nd, *neodymium*, chemical element with the atomic number 60; standard atomic weight 144,24; it belongs to the lanthanide series; it is a silvery white metal; melting point 1024°C, boiling point 3027°C, density 7,004 g/cm3; highly reactive; it breaks down water and oxidizes in air (hence the necessity to store it in kerosene or in an inert atmosphere), it reacts with halogens, hydrogen, sulfur, and nitrogen; in its compounds, neodymium is in the +3 oxidation state; in the +2 and +4 states it forms unstable compounds; natural neodymium occurs in minute amounts, mostly in the minerals monazite and bastnasite; it is used in laser technology (neodymium-doped lasers) and in high-strength magnets (e.g. $Nd_2Co_{14}B$, NdFeTi), its glasses are used in astronomy and in the production of welding safety glasses; along with other lanthanides it is sometimes used in catalysis; neodymium hydroxides (NdH_2, NdH_3) are important energy carriers. Neodymium was discovered in 1885 by C. Auer von Welsbach. (*Powszechna encyklopedia PWN*)

What is also irrelevant is the knowledge related to the etymology of the oldest names of chemical elements in the national language and to the associations it evokes within the community, which means that this knowledge is not correlated in any way with the semiotic functions performed by the names of the elements in contemporary scientific texts on chemistry. These functions are connected with denotation only and they can be of two kinds: predicative (establishing the substance's type) or indicative (indicating a particular substance sample).

From a morphological standpoint, one might say that the real meaning

of the names of the elements differs from its structural meaning; as it is for example, by analogy, with the contemporary real meaning of the lexeme *miednica*, which no longer refers to a container made of copper – the difference is such that in this case it is a result of a gradual historical change, while in the case of the names of the elements such a discrepancy between meanings was not only present, but also intended by their authors from the very beginning. In a synchronic approach, these names are original and morphologically indivisible lexical units. They can be considered derivatives (and rather unusual ones) only from a diachronic perspective and only as long as we apply only the formal criteria for such a qualification, i.e. the very fact that the lexeme derives from another string with no concern about the aforementioned 'semantic dualism', which the supposed derivative manifests from the very moment of its formation.

The names of chemical compounds, however, are an entirely different case. Every single one of them is a derivative of a name of either a chemical element or a functional group and its real meaning is identical with its structural meaning. What indirectly confirms this, is the fact that these names represent knowledge that is relevant only from the point of view of scientific description, like the composition of the compound. In other words, the morphemes that derive from the names of chemical elements are merely carriers of information about corresponding referents. The structural meaning of those strings is never transferred to the derivative as part of its real or structural meaning.

Thus, when talking about knowledge represented in the names of chemical elements, one must recognize several separate levels of this representation:

a) knowledge represented in the name which functions in general language, on the level of its etymological meaning,

b) knowledge represented in the name which functions in general language, on the level of its real meaning including denotation and connotation,

c) knowledge represented in the name which functions as a scientific term, on the level of its form, including the epistemic subject, that is, the author of the nomination,

d) knowledge represented in the name which functions as a scientific term, on the level of its real meaning, in *langue*, including the epistemic subject, that is, every user of Polish who has it in his linguistic competence,

e) knowledge represented in the name which functions as a scientific term, on the level of its real meaning, in *parole*, including the epistemic subject, that is, the sender of the message who at that moment is using it as a predicate or a definite description.

6. Names of chemical elements as a language system

To conclude the analysis, it is worth considering the area of research in terms of its structure and its functioning as a language system. As it turns out, the field of the names of the elements is governed by analogical mechanisms as the lexical subsystems of the general language. It can be proved by reference to the model of sign and of language proposed by Ferdinand de Saussure.

According to this theory, a linguistic sign is arbitrary – this means that the relation between the form and the content (*signifiant* and *signifié*) does not stem from any natural link but is a result of an unwritten social agreement. Diachronically, the sign displays two opposite tendencies: on the one hand it changes with time, on the other its constancy is conditioned by tradition. As to the language system, difference is its true essence. Each item is defined by features opposite to the properties of other items and it can exist only because of these oppositions. It can be seen on every level on which the sign functions: on the semantic as well as on the morphological or phonetic level (de Saussure 1959).

The domain of the names of chemical elements functions in quite a similar way. Each lexeme belonging to this domain is arbitrary; one might even say 'super-arbitrary', since not only are there no natural links between how it sounds and what it means, but also, in many cases, there is a complete discrepancy between its structural and its real meaning (names derived from proper names). Every new name is formed by virtue of social agreement – not in the metaphorical sense that it is a custom handed down for generations, but quite literally in the form of specific, codified recommendations of nomenclature committees appointed by the IUPAC. Hence, paradoxically, the names of chemical elements conform to the Sausurrean model to a much greater extent than the signs of the general language. Metaphorically speaking, they are 'hyper-structuralist' linguistic signs.

The discussed expressions have been changing over time, which is amply demonstrated in works such as Biniewicz's historical linguistics dissertation (Biniewicz 1992: 19–40). On the other hand, the names of the elements cannot change, given the fact that it would be impossible to introduce, certainly not overnight, an entirely new nomenclature by the power of a single IUPAC ruling so that it would replace the names established by tradition. It applies particularly to the names that are commonly known and that are used also outside the specialized context of chemical texts, in everyday verbal communication (lexemes like *tlen*, *wodór*, *azot*, *jod*, *platyna*, *złoto*, *srebro*, *magnez*, *ołów*, *fluor*, *krzem*, *chlor*, *wapń*, *selen* [*oxygen*, *hydrogen*, *nitrogen*,

iodine, *platinum*, *gold*, *silver*, *magnesium*, *lead*, *fluorine*, *silicon*, *chlorine*, *calcium*, *selenium*], etc.). This is how the Saussurean unchangeability of the linguistic sign manifests itself (de Saussure 1959).

What deserves special attention and an individual discussion, is the issue of the oppositions within the analyzed system, as they are connected with a particularly interesting aspect of the system's contemporary development. Namely, the practice of replacing systematic names of newly discovered elements with common names as soon as their discovery is officially approved by the IUPAC. Scientists do that even though it is highly disadvantageous in terms of the economy of information: systematic names define the elements in a precise and unequivocal manner (since they reflect the knowledge about the element's atomic number), while common names, derived almost solely from proper names nowadays, neither define the elements, nor do they say anything about their properties. Moreover, such a procedure is an exception from the dominant tendency in contemporary chemical nomenclature to replace common names with systematic ones, since they are more precise and convenient – all this makes this practice even more significant and worthy of analysis.

Probably, one of the reasons for this phenomenon is the attempt to make the new names structurally resemble the old ones that are already established within the system, but there seems to be another, even more important factor involved. It is the tendency of language to differentiate at all levels. It is not hard to notice that the forms of systematic names are obviously unnaturally monotonous and similar – former names of *bohrium*, *hassium*, *meitnerium*, and *darmstadtium* are: *unnilsept* [*unnilseptium*], *unnilokt* [*unniloctium*], *unnilenn* [*unnilennium*], *ununnil* [*unnunnilium*] (Mizerski 2004: 330) and the systematic names still in use are: *ununun*, *ununbi*, *ununtri*, *ununkwad*, *ununheks*, *ununokt* [*unununium*, *ununbium*, *ununtrium*, *ununquadium*, *ununhexium*, *ununoctium*]. Changing these into common names, which derive from lexemes formed in natural language, increases the general number of phonetic oppositions by making the subsystem of the names of the heaviest transuranic elements similar to ordinary semantic fields of the general language, for example selected lexemes from the semantic field of colour terms: *żółć*, *czerwień*, *błękit*, *zieleń*, *oranż* [*yellow*, *red*, *blue*, *green*, *orange*]. Metaphorically, one might say that those who name the elements are letting the natural language 'speak for itself' – this means that they are intuitively aiming to follow the structural pattern of a language system, which is part of their linguistic competence as users of their national languages.

After having taken into account all characteristics of this area of research, it may be concluded that this domain has strong connections with the national language. It allows us to draw a more general conclusion concerning the status of scientific terminology, namely, that it is indeed part of the national language, which is congruent with the opinions of some researchers (e.g. Buttler 1979, Szymczak 1979).

The tendency described above to replace systematic names of the elements with common names attests to one more property of terminological systems. Apart from their general disposition towards regularity (which was discussed e.g. in Łuczyński 1986), these systems can also reveal an opposite tendency to keep a certain amount of irregularity, if it can be justified by deep-rooted tradition or by the necessity to achieve the minimal level of diversification of lexemes (e.g. common names of certain organic compounds like *metan* [*methane*], *etan* [*ethane*], *propan* [*propane*]).

Conclusion

To sum up, the entire domain of the names of chemical elements can be characterized as a lexical system built in its entirety out of original, morphologically indivisible units – at least in a synchronic view. It represents knowledge on several levels.

Knowledge represented by the forms of analyzed strings is not part of their real meaning and is irrelevant from the point of view of chemical description. Moreover, it is diversified when it comes to the type of objects to which it refers – it can concern not only the elements themselves and their properties, but also other objects or individuals. The represented properties themselves are very diverse as well: they may be attributed either to the types of chemical elements or to specimens of the elements.

As a language system, the analyzed domain is characterized by a strong similarity of its structure and of the way it functions to semantic fields of the national language, which may serve as a proof that it is part of this language; especially as some names of the elements happen to be used in everyday verbal communication by people who are not necessarily chemists.

Bibliography

1. Bańkowski, Andrzej (2000) *Etymologiczny słownik języka polskiego* [*Etymological Dictionary of the Polish Language*]. Warszawa: Wydawnictwo Naukowe PWN.

2. Bergandy, Wrócisława (1997) *Od alchemii do chemii kwantowej. Zarys*

historii rozwoju chemii. [*From Alchemy to Quantum Chemistry: An Outlline of the History of Chemistry*]. Poznań: Wydawnictwo Naukowe UAM.

3. Biniewicz, Jerzy (1992) *Rozwój polskiej terminologii chemii nieorganicznej* [*Development of the Polish Terminology in Organic Chemistry*]. Opole: Wyższa Szkoła Pedagogiczna im. Powstańców Śląskich w Opolu.

4. Biniewicz, Jerzy (2002) *Kształtowanie się polskiego języka nauk matematyczno-przyrodniczych* [*Development of the Polish Language of Mathematical-Natural Sciences*] Opole: Wydawnictwo Uniwersytetu Opolskiego.

5. Bogusławski, Andrzej (1998) *Science as Linguistic Activity, Linguistics as Scientific Activity.* Warszawa: Katedra Lingwistyki Formalnej UW.

6. Bojar, Bożena (2005) *Językoznawstwo dla studentów informacji naukowej* [*Linguistics for Science Information Students*]. Warszawa: Wydawnictwo SBP.

7. Boryś, Wiesław (2005) *Słownik etymologiczny języka polskiego* [*Etymological Dictionary of the Polish Language*]. Kraków: Wydawnictwo Literackie.

8. Brückner, Aleksander (1993) *Słownik etymologiczny języka polskiego* [*Etymological Dictionary of the Polish Language*]. Warszawa: Wiedza Powszechna.

9. Buttler, Danuta (1979) "O wzajemnym oddziaływaniu terminologii i słownictwa ogólnego" ["On the Interractions between Terminology and General Vocabulary"]. *Poradnik Językowy* 365 (1979): 58–66.

10. De Saussure, Ferdinand (1959) *Course in General Linguistics.* New York (NY): Philosophical Library.

11. Długosz-Kurczabowa, Krystyna (2003). *Nowy słownik etymologiczny języka polskiego* [*New Etymological Dictionary of the Polish Language*]. Warszawa: Wydawnictwo Naukowe PWN.

12. Eichstaedt, Ignacy (1973) *Księga pierwiastków* [*The Book of Elements*]. Warszawa: Wiedza Powszechna.

13. Heiserman, David L. (1997) *Księga pierwiastków chemicznych.* Warszawa: Prószyński i S-ka. English original: *Exploring Chemical Elements and Their Compounds*. Blue Ridge Summit (PA): Tab Books, 1992.

14. Kalembkiewicz, Jan, Jacek Lubczak, and Renata Lubczak (1996) *Nazwy związków chemicznych* [*Names of Chemical Compounds*]. Rzeszów: Wydawnictwo Oświatowe Fosze.

15. Kurcz, Ida, Andrzej Lewicki, Jadwiga Sambor, Krzysztof Szafran, Jerzy Woronczak (eds.) (1990) *Słownik frekwencyjny polszczyzny współczesnej* [*Frequency Dictionary of Contemporary Polish*]. Kraków: Instytut Języka Polskiego PAN.

16. Łuczyński, Edward (1986) "Charakterystyczne cechy systemu terminologicznego (na przykładzie wczesnej terminologii morskiej)" ["Charateristic Features of a Terminological System: Illustrated by the Early Marine Terminology"]. In *Język. Teoria – Dydaktyka. Materiały VII Konferencji Młodych Językoznawców-Dydaktyków, Trześnia, 2-4 VI 1982 r.*, 129–136. Kielce: Wyższa Szkoła Pedagogiczna im. Jana Kochanowskiego.

17. Mizerski Witold (2004). *Tablice chemiczne* [*Chemistry Tables*]. Warszawa: Wydawnictwo Adamantan.

18. Pelc, Jerzy (1984) *Wstęp do semiotyki.* Warszawa: Wiedza Powszechna.

19. Pióro, Jan W. (1996) *Historio pri sistemigo de kemiaj elementoj.* Piastów: Jan Wacław Pióro.

20. Polański, Kazimierz (ed.) (1995) *Encyklopedia językoznawstwa ogólnego* [*Encyclopedia of General Linguistics*]. Wrocław: Zakład Narodowy im. Ossolińskich.

21. *Powszechna encyklopedia PWN* [*PWN Universal Encyclopedia*] (online version), 1996.

22. Bartmiński Jerzy (1996) *Słownik stereotypów i symboli ludowych* [*Dictionary of Folk Stereotypes and Symbols*]. Lublin: Wydawnictwo Uniwersytetu Marii Curie-Skłodowskiej.

23. Sołoniewicz, Rajmund (1986) *Rozwój podstawowych pojęć chemicznych* [*Development of Basic Chemistry Concepts*]. Warszawa: WNT.

24. Szymczak, Mieczysław (1979). „Rola i miejsce terminologii w języku ogólnonarodowym" ["Role and Place of Terminology in the National Language"]. *Poradnik Językowy* 365: 49–57.

25. Śliwa, Wanda and Natalia Zelichowicz (1994) *Nowe nazewnictwo w chemii związków nieorganicznych i organicznych* [*New Nomenclature in the Chemistry of Organic and Inorganic Compounds*]. Warszawa: Wydawnictwa Szkolne i Pedagogiczne, 1994.