

Synonymic Variation in the Nineteenth-Century Lexicon of Petroleum

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1. Introduction

This paper sets out to examine the results of a corpus-based investigation into the semantic development of some synonyms of the term *petroleum* in nineteenth-century English. This research forms part of a larger project on diachronic changes in terminology, and on the making of specialized lexicons, especially in the fields of ecology and the earth sciences. This paper will discuss three aspects of synonymic variation; namely, first, the semantic “flexibility” of several terms which were frequently used in the nineteenth-century lexicon of petroleum geology (e.g., *naphtha*, *bitumen*, *tar*, *pitch*, *asphalt*); secondly, the simultaneous co-existence and then disappearance of “occasional” or “temporary” synonyms of the term *petroleum* (e.g., *Rangoon petroleum*, *mineral pitch*, *rock oil*, *Trinidad bitumen*, *Seneca oil*, etc.); and thirdly, the inclusion of these synonyms in some dictionaries and encyclopedias of the time.

The prescriptive school of thought in terminology holds that terms should be fixed items and should not be prone to synonymic variation. Terminologists and translators have been trained to embrace terminological standardization, to disparage synonymy in favour of monosemy, and to employ consistency rather than lexical variation:

The concepts that make up specialized fields of knowledge are designated by lexical items known as terms. Term formation is considered to be a conscious and well-thought-out activity because the main purpose of terms is to facilitate specialized communication and knowledge transfer. Given the emphasis on clarity of communication in specialized subject fields, it has long been suggested that terms are relatively fixed items that are not subject to synonymic variation. (Bowker and Hawkins, 2006: 79)

However, despite this widespread assumption that synonymy is something to avoid in specialized languages, since it may hamper effective communication between specialists, a number of studies have revealed that even within the confines of specialized communication, synonymic variation does indeed exist. One specialized field of knowledge in which synonymic variation is known to be prevalent is medicine, but it is also the case in the natural sciences. I’ll try to show that, when they are examined diachronically, synonyms do have a role to play in the shaping of specialized lexicons: “In natural sciences, where it’s all about comparing and classifying, synonymy seems more linked to temporal strata”. (Boulanger, 1983: 324)

2. Methodology of the study

I will adopt a corpus-based approach for the first part of the paper, which makes it possible to study synonyms in actual contexts, rather than in isolation or presented as cross-references in dictionaries, but I will use dictionaries and encyclopedias for the second part of the paper, in order to see whether corpus evidence on synonymic variation corresponds to the information given in the dictionaries and encyclopedias of the time.

The corpus, specially designed for this study, contains specialized texts (mostly book chapters and scientific articles) relating to the fields of mineralogy, chemistry and petroleum geology published in the nineteenth century and the first half of the twentieth century. The wordcount is at present 257,864 words. The corpus was investigated using Mike Scott's lexical analysis software *Wordsmith Tools*,¹ and was divided into three sub-corpora or sub-periods. The delimitation of these sub-periods was mainly governed by extralinguistic criteria. These periods roughly correspond to major events relating to the field of petroleum geology: Period one contains texts published between 1800 and 1860 and corresponds to the period just before the first successful drilling of an oil well by "Colonel" Drake in Pennsylvania in 1859. Period two contains texts published between 1860 and 1900 and corresponds to the oil boom in Pennsylvania and then Texas; period three contains texts published between 1900 and 1960,² corresponding to the development of the internal combustion engine car and therefore to the large-scale industrial exploitation of petroleum.

The decision to base this study on the nineteenth century and the first half of the twentieth century was made for extralinguistic reasons as well. People have used petroleum since ancient times (first as a medicine and later to light their homes) and occurrences of oil throughout the world have been the objects of study by geologists since the seventeenth century: in the first half of the nineteenth century, most geologists, mineralogists and chemists knew that petroleum was basically made of hydrogen and carbon and that it reached the surface of the earth at many places in circumstances which were in some ways peculiar. But at the time, the importance of oil was not fully appreciated; the scientists' comprehension was also circumscribed by limited knowledge of stratigraphy, structure, geologic and chemical processes, and petroleum geology was not a self-sufficient discipline. Until the first half of the twentieth century, scientists had no detailed or extensive knowledge of what petroleum exactly was, where it came from and what could be produced from it. According to *The New American Cyclopaedia*, (1863: 206):

Petroleum or rock oil is a natural product of the soil in some countries, oozing up from below the surface, and flowing out with the water springs. As it occurs in nature, it is of no definite composition, but consists of various oily hydrocarbons, which hold in solution paraffine and more or less solid bitumen[...]. The origin of this fluid is very obscure. It appears to be of organic nature, and does not differ from products distilled from bituminous shales and coal; but it is found in geological formations which were not repositories of great bodies of vegetable or animal substances, and is rarely met with in proximity to beds of coal.

In his book on the history of exploration for petroleum, Owen (1975: 18) notes that:

Petroleum geologists in 1800 already possessed substantial resources of concepts, observations, and equipment, but these hardly constituted an organized scientific system [...]The progress of petroleum geology beyond the speculative stage had to await further advances in scientific capabilities.

For some authors, like Wells in 1862, petroleum was an organic substance which was produced by marine plants and animals rather than by land plants:

The substance, which is doubtless of organic origin, occurs in rocks of all ages [...] and its presence in the lower palæozoic rocks, which contain no traces of land plants, shows that it has not in all cases been derived from terrestrial vegetation, but may have been formed from

¹ Available at <http://www.lexically.net/wordsmith/index.html>. *Wordsmith Tools* consists of three different tools called *Concord*, *Wordlist* and *Keyword*. A list of terms, with occurrences and contexts was extracted for each sub-period of the corpus. Occurrences were obtained using the *Concord* and *Wordlist* tools and context extractions using the *Keyword* tool.

² The main focus of inquiry is on the nineteenth-century terminology of petroleum geology, but documents published in the first half of the twentieth century were also included in the corpus so as to compare the results obtained in the last period of the corpus with the data extracted from the first two periods.

marine plants and animals; the latter is not surprising when we consider that a considerable portion of the tissues of the lower marine animals is destitute of nitrogen, and very similar in chemical composition to the woody fibre of plants. (Wells, 1862: 284)

Whereas for Tate, in 1863, petroleum was the result of the decomposition of plant matter in sand:

These circumstances, added to the fact of the petroleum being found most plentifully at the edge of the sand, led to the conclusion that it is produced by the decomposition of the upper bed of peat, where it is overlaid by sand: all that need to be said is that petroleum is probably the result of a slow fermentation or combustion of the vegetable matter composing the peat, and has been produced in a manner somewhat analogous to the hydro-carbons obtained by the destructive distillation of wood in close vessels. (Tate, 1863: 92)

Here is another example which points to the fact that exact scientific knowledge of what petroleum was was somehow still limited in the second half of the nineteenth century, since it was still believed by some scientists that petroleum was in fact produced by corals:

A correspondent of Chamber's Journal says, confidently, that petroleum is a product, not of coal, but of coral: "Stored away in cells", he remarks, "forming in the aggregate, immense reefs, as it was collected from the impure waters of the early oceans by minute coral polyps, it has been driven by heat and pressure into reservoirs and crevices, where man's ingenuity is discovering it day by day. I have in my possession", he adds, "many specimens of this fossil coral, with the oil plainly visible in the cells. (Timbs, 1861: 251)

These "limitations" imposed by the contemporary state of chemical knowledge had two consequences on the language: first, it led to what may be called the "semantic flexibility" of some terms which were sometimes used with exactly the same meaning as the term *petroleum*, but which were also sometimes used with a different meaning; and second, it also led to the use of a wide range of "occasional" or "temporary" synonyms to express the particular notion of *petroleum*.

3. Semantic flexibility

Several terms, like *bitumen*, *naphtha*, *tar*, *pitch* or *asphalt(um)*, which appear in the first period of the corpus (1800–1860), were either used interchangeably with the term *petroleum* and were then considered as having the same meaning, or were used to name substances that were not petroleum. This "semantic flexibility" appears to have particularly applied to *naphtha* and *bitumen*. *Naphtha* appears 89 times in the overall corpus, and was clearly used as a synonym of *petroleum* in 39 cases, as shown below:

Near London, the naphtha or petroleum is found floating on the surface of the etangs, or stagnant waters of the Thames, and is frequently collected by means of a piece of cloth. (Phillips, 1844: 185)

But in 50 cases, it was used by scientists to designate substances which were not petroleum and in 45 out of these 50 cases, *naphtha* was described as a substance deriving from petroleum:

Petroleum, or rock-oil, is found in various parts of the world [...]. It consists of a combination of carbon and hydrogen, and from it naphtha and paraffin are sometimes derived. (Hildreth, 1836: 4)

The term *bitumen* appears to have also been semantically flexible at the time. It appears 60 times in the corpus and is considered as a synonym of *petroleum* in 31 cases, as in the quotation below:

Petroleum, or Bitumen may very probably arise from the decomposition of coal, effected by subterraneous fires, either volcanic, or produced by the combustion of coal, or the decomposition of pyrites; and these fluid Bitumens, by exposure to the air may gradually pass into a state more or less solid. (Cleaveland, 1816: 394–395)

But, in 17 cases, it was used as a generic term for both *petroleum* and *naphtha* and in 12 other cases, it was described as being one of the components of petroleum:

Petroleum or earthy, slaggy mineral pitch – a dark coloured fluid variety of Asphaltum, containing much bitumen or mineral tar. (Ure, 1860: 220–233)

On several occasions, these terms were even used with different senses, by the same author, in the course of the same book or article. This is the case here with *naphtha*, considered by Wells, in 1862, as being different from *petroleum* on page 283 of his book, but as obviously being the same substance on page 285:

Notes on the history of petroleum or rock oil : the following comprehensive resumé gives the most important facts thus far made known respecting the geological history of the various substances designated respectively as « petroleum », « naphtha », « asphalt » and « pitch ». (Wells, 1862: 283)

The form in which it now occurs depends in great measure upon the presence or absence of atmospheric oxygen, since by oxidation and volatilization what is called naphtha or petroleum, as we have already explained, become slowly changed into asphalt or pitch, which is solid at ordinary temperature. (Wells, 1862: 285)

4. Occasional synonymy

The information extracted from the corpus also shows that a variety of terms³ (16) appearing in sub-period 1 can be considered as synonyms of the term *petroleum*, and were indeed used as such. These 16 terms can be conflated into various semantic groups according to what they describe, each group of synonyms then carrying subtle differences of emphasis.

For example, some of these synonymous terms, like *rock oil* or *earth oil* refer to where petroleum is found in nature:

Sir, - I have examined the sample of the earth oil or petroleum which you left me, and beg to report as follows:-The oil is of a dark, greenish-brown colour, and has somewhat of a pleasant ethereal odour ; it is as near as may be free from water. (Simmonds, 1861: 248)

In November 1859, in the State of Pennsylvania, wells were sunk for the purpose of pumping petroleum or rock oil and have been vigorously continued up to this time. (Farey, 1861 : 467)

Some other synonyms, like *empyreumatic*⁴ *oil*, rather describe the smell of petroleum:

In a specimen of empyreumatic oil (or petroleum) skimmed from the surface of a stagnant pool of water drained from the upper bed of a peat, Professor Bowman found C73 united to H60. (Silliman, 1833: 99)

Other terms, like *dark pitch*, *carbon oil*, *mineral oil*, etc. put the emphasis on what petroleum is made of or what it looks like:

³ I have kept only the synonyms which appear more than 10 times in the corpus and were used by different authors.

⁴ empyreumatic, a. Pertaining to, or having the quality of, EMPYREUMA; tasting or smelling of burnt organic matter. (*OED*, online edition).

After some observations on the antiquity of the use of mineral oil or Petroleum in North America and elsewhere, and on the present condition of the oil and gas-springs in the United States, the author stated that 50,000 gallons of mineral oil are daily raised for home use and for exportation. (Timbs, 1861: 249)

This dark substance is the petroleum or dark pitch, which being specifically heavier than water, remains below, covering the sides and part of the bottom of the spring. (Taylor, 1848: 565)

The last group of synonyms, which is also the largest, is made of toponyms or terms based on place-names and describing the regions, or the countries where petroleum was known to be found: This is the case for *Barbadoes tar*, *Gabian oil*, *Sicilian oil*, *Trinidad bitumen*, *Persian rock oil*, *Genesee oil*, *Seneca oil*, *Seneca rock oil* and *Rangoon petroleum*.

Petroleum, known as Barbadoes petroleum, or Barbadoes tar, the springs of which were visited by the author in 1818, still send forth their oily products, and the springs of other West India Islands and South America have not failed. (Gesner, 1861: 74)

Petroleum is a bituminous substance known under the name of Seneca or Genesee oil and [...] is much used by farmers, and has a ready sale. (Jameson, 1820: 137)

It seems therefore that during the first half of the nineteenth century, the vocabulary of petroleum went through a stage characterized by the simultaneous co-existence of several synonyms of the term *petroleum* as well as by the “semantic flexibility” of terms like *naphtha* or *bitumen*, which were sometimes used as synonyms of petroleum, but which were also used to designate substances which were not petroleum but rather derived from it. However, the development of the internal combustion engine car at the beginning of the twentieth century and the outbreak of the First World War irrevocably changed the role of petroleum in the world and changed how nations regarded this natural resource. As petroleum attracted more attention, scientists gained increased knowledge of underground rock formation and of the chemical processes involved in petroleum geology:

At the first half of the 19th century, the importance of oil was not appreciated and the significance of its structural location was not suspected. Nevertheless, over the ensuing years, tremendous volumes of oil and gas were found. As exploration progressed over the earth, the geologist rapidly expanded his horizons of knowledge. (Owen, 1975: 35)

The data extracted from the corpus indicate that the vocabulary of petroleum went through a second stage during this period, as the terms which proved to be semantically “flexible” in the previous period became fixed in the vocabulary, and as most of the synonymous terms progressively disappeared from the language.

5. From “semantic flexibility” to more semantic “fixity”

It appears that the terms *naphtha*, *bitumen*, *tar* or *pitch* became semantically fixed over the second and the third time period of the corpus, since their use as synonyms of *petroleum* progressively decreased after 1860, as shown in the table below:

	Period 1			Period 2			Period 3		
	TNo*	Sy*	Dm*	TNo	Sy	Dm	TNo	Sy	Dm
<i>Naphtha</i>	89	39	50	76	05	71	83	0	83
<i>Bitumen</i>	60	31	29	45	02	43	39	0	39
<i>Tar</i>	28	12	16	24	03	21	26	0	26
<i>Pitch</i>	17	6	11	14	02	12	10	0	10

* TNo = Total number of occurrences of the term in the period

* Sy = Number of cases where the term was used as a synonym of *petroleum*

* Dm = Number of cases where the term was used with a different meaning

Naphtha, for instance, was not used any longer as a synonym of petroleum after 1900, and since then has been used to refer to a wide variety of volatile hydrocarbon mixtures which are derived from petroleum. *Bitumen* was exclusively used in period three as a generic term which applies to the solid or viscous products which are derived from petroleum by natural or refinery processes:

Petroleum is a complex mixture of hydrocarbons differing in molecular weight and, consequently, in boiling range. Before it can be used as bitumen, petroleum has to be separated, purified, blended, and, sometimes chemically or physically changed. (Guthrie, 1960: ii)

All the 16 terms which were used as synonyms of *petroleum* during the first time period of the corpus, like *earth oil*, *rock oil*, *Rangoon petroleum*, etc., progressively disappeared from the corpus after 1860. This is the reason why they are called “occasional synonyms” or “temporary synonyms”, since they were obviously only used in the vocabulary of petroleum at a time when petroleum geology was still in its early stages. *Earth oil*, for example, appears 187 times in the first period of the corpus, 52 times in the second period and only four times in the last period. *Empyreumatic oil* appears 13 times in the first time period of the corpus, only twice in the second sub-period and not at all in the last sub-period. *Barbadoes tar* appears 39 times in the first sub-period of the corpus, only eight times in the second sub-period, and four times in the last sub-period. The table below shows the number of occurrences for each synonym and for each period. The terms are listed in decreasing order of frequency in the first column of the table. The number of occurrences given in the last column of the table (i.e., the last sub-period of the corpus) corresponds to passages of books or articles dealing with the history of petroleum and giving all the names that were used to designate it in the past. The use of these terms in the final time period is historical only and they are not used in any other contexts.

Number of occurrences for:	P1 (1800–1860)	P2 (1960–1900)	P3 (1900–1960)
<i>Rock oil</i>	201	74	9
<i>Earth oil</i>	187	52	4
<i>Carbon oil</i>	121	48	2
<i>Mineral oil</i>	89	21	0
<i>Dark pitch</i>	76	12	0
<i>Seneca oil</i>	45	06	5
<i>Barbadoes tar</i>	39	08	4
<i>Trinidad bitumen</i>	36	06	2
<i>Rangoon petroleum</i>	29	10	1
<i>Gabian oil</i>	17	06	0
<i>Persian rock oil</i>	15	08	0
<i>Genesee oil</i>	15	10	3
<i>Sicilian oil</i>	14	08	0
<i>Empyreumatic oil</i>	13	02	0
<i>Seneca rock oil</i>	13	04	0

6. The synonymic variation in the dictionaries and encyclopedias of the time

In this part of the article, I will compare the results extracted from the corpus with the definitions of *petroleum* given by some general language dictionaries and encyclopedias of the time. It is a well-known fact that until the publication of the *Oxford English Dictionary* (OED),⁵ English dictionaries were not based on anything like a full examination of real usage and, it is also widely acknowledged that they tended to copy from each other.

Nevertheless, my objective here is to see whether the “occasional” synonyms that I have mentioned before also appeared in dictionaries alongside the term *petroleum* or not, and if the “semantic flexibility” which seems to have characterized terms like *naphtha* or *bitumen* in the first half of the nineteenth century was reflected in the dictionaries of the time. As it was started only recently, this investigation into nineteenth-century dictionaries as well as the results given below must be seen as preliminary. This part of the project is under further investigation, and will eventually include a larger choice of dictionaries and encyclopedias than the ones discussed below, which have been selected only because they could be accessed easily.

Out of the 14 dictionaries and five encyclopedias consulted, seven dictionaries and four encyclopedias present *bitumen* and *petroleum* as synonyms, which is consistent with the corpus-based evidence, but most of the definitions given for these two terms are vague and sometimes even confusing. In the first two quotations, *bitumen* is considered as a synonym of *petroleum*:

Petrol, Petroleum, n (Gr. Petros, elaion): A liquid bitumen; rock oil
 Bitumen, n (L.): A kind of pitch, rock oil
 (*A Dictionary of the English Language*, 1864).

Bitumen, s. A fat, unctuous substance,
 Petroleum, s. A liquid bitumen,
 (*A General Dictionary of the English*, 1805).

But in Johnson’s Dictionary, *bitumen* is given as a generic term for *petroleum* and other substances:

Bitumen, s. A name loosely applied to various inflammable mineral substances, of which asphaltum, naphtha and petroleum, are the principal.
 (*Johnson’s Dictionary of the English Language*, 1817).

The case of *naphtha* is more interesting, because *naphtha* is never clearly defined as a synonym of *petroleum*, but rather as a kind of “bitumen”, which does not really correspond to the corpus-based evidence which rather shows that *naphtha* was either considered as a synonym of *petroleum* or as deriving from it.

Naphtha, naphtha, n. (Gr.): An inflammable bituminous substance.
 (*A Dictionary of the English Language for the Use of Schools and for General Reference*, 1847).

Naphtha, s. A natural limpid bituminous liquid, highly volatile and inflammable.
 (*Johnson’s Dictionary of the English Language*, 1817).

The information on “occasional” synonymy which was extracted from the corpus is also very different from the information given by the dictionaries. Out of the 16 “temporary” synonyms that appear in the corpus, only one, *rock oil*, is given by the huge majority of the dictionaries consulted. Three out of the five encyclopedias I looked up mention *Trinidad Bitumen*, *Seneca oil*, *Genesee oil* and

⁵ The *OED* was first published in fascicles between 1884 and 1928, with a one-volume supplement being added in 1933 and a further four-volume supplement, chiefly containing new words and senses from the nineteenth and twentieth centuries, between 1972 and 1986.

Rangoon Petroleum. The other synonyms are not mentioned at all, even if some of them appear frequently in the first part of the corpus, like *earth oil* (which has 187 occurrences between 1800 and 1860, which makes it the most frequent synonym after *rock oil*), but it is also true for *carbon oil* (121 occurrences) and *mineral oil* (89 occurrences), for example. The two quotations that follow are extracted from the only two encyclopedias consulted, in which some synonyms were given for *petroleum*.

The variety of petroleum is much thicker than naphtha, resembling, in consistence, common tar. It has a strong, disagreeable odour, and a blackish or reddish-brown colour. During combustion, it emits a thick, black smoke, and leaves a little residue in the form of black coal. [...] In the United States, it is found abundantly in Kentucky, Ohio, and New York, where it is known under the name of Seneca or Genesee oil. It is used as a substitute for tar, and as an external application for the remedy of rheumatism and childblains. (*The Popular Encyclopedia*, 1836, vol. 1, part II, BITUMEN)

PETROLEUM. (lat. Petra, a rock, and oleum, oil), rock oil, a natural product of the soil in some countries, oozing up from below the surface, and flowing out with the water springs. [...] When of the greatest fluidity, it resembles naphtha, and has been called by this name, and also oil of naphtha. [...] The Rangoon district on the Irrawaddy is quite as wonderful for its immense production of rock oil or Rangoon petroleum as Bakoo. (*The New American Cyclopaedia*, 1863, vol. XIII, PETROLEUM: 206)

7. Some conclusions

The first conclusion is that corpus evidence shows that “temporary” or “occasional” synonymy, far from being something to avoid in terminology, may well be considered as a phenomenon which crops up naturally at some point in the history of a scientific lexicon and which occurs as part of a formation stage, as it is the case here with petroleum geology. Thus, when it is observed in a diachronic perspective, synonymic variation is indeed part of scientific communication.

This short investigation also shows that the widespread use by scientists of a wide range of synonyms for *petroleum* in the first part of the nineteenth century was only partially translated into the dictionaries and encyclopedias of the time. Even if some of these synonyms were frequently used, they did not appear in the dictionaries, nor was the meaning of *naphtha*, for example, described in the dictionaries as it was in the scientific books and articles of the time.

What remains to be done? A more detailed comparison of the corpus-based evidence with the lexicographical information could be made, by investigating into the terms *asphalt*, *maltha*, or *kerosene*, for example, which also appear in the vocabulary of petroleum geology; the time frame studied could be altered so as to include documents published during the last half of the eighteenth century and see if and when the formation stage characterized by semantic “flexibility” and “occasional” synonymy started before the beginning of the nineteenth century. Other specialized lexicons could also be looked into so as to see if what is described here applies to different fields of knowledge, irrespective of the time period analyzed and of speed with which that field of knowledge progressed.

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