HISTORIC NOTES OF COSMIC PHYSIOLOGY.*

By Dr. T. Sterry Hunt.

[Abstract.]

The author began by insisting that general physiology, as the philosophy of material nature, is co-extensive with general physiography, in which sense it was employed by the best writers up to the first year of this century. In the abridgements of the Philosophical Transactions of the Royal Society up to 1700, and to 1720, the chief division is into Mathematical and Physiological subjects, the latter including the phenomena of the three kingdoms of nature. There is a physiology not only of animals and plants, but of the inorganic world, and from terrestrial physiology we rise to a conception of the physiology of the Cosmos or material universe; a subject which from the earliest times has attracted the attention of philosophers. One of the most evident of the problems thus presented is that of interstellar space, and its relations to our earth and its gaseous envelope. After noticing the views of the ancient Greeks, the author referred to the discovery by Alhazen of the refraction of light, from the phenomena of which the Arab philosopher attempted to fix the limit of the terrestial atmosphere. He then noticed the similar attempts of later observers, and adverted to the well-known hypothesis of Wollaston, who endeavored to assign thereto an absolute limit on grounds which are inadmissible. He adverted to various views as to the so-called ether of space, which Newton thought, must include exhalations from celestial bodies, and noticed the hypothesis of Grove that the medium for the transmission of radiant energy through space is but a more attenuated form of the matter which constitutes the gaseous envelopes of the earth and other celestial bodies, between which, through this medium, Grove supposed material interchanges might take place. The suggestion of Arago as to the possibility of determining the density of the rare matter of interstellar space was noticed, as well as that of Sir William Thomson, who has even attempted to fix the minimum density of the luminiferous medium, which he, like Grove, conceives may be a rarified extension of the terrestrial atmosphere. Mattieu Williams, adopting the hypothesis of the atmospheric nature of the interstellary matter, has attempted to show how the sun in its course through space may condense this matter with the evolution of heat and thus replenish the solar fires. From this ether also by a stoichiogenic process the various chemical species are perhaps generated.

The author had endeavored to approach the study of interstellary matter from a wholly different side. From a consideration of the chemical and geological changes of which we have evidence in the earth's crust since the beginning of life on the planet, it is clear that enormous volumes of carbonic dioxide have become fixed partly in the form of carbon, with evolution of oxygen, and partly as carbonates—equal in the aggregate to 200 atmospheres or more. This enormous volume, it is held, must have come from outer space to supply the gradual absorption of the gas from the atmosphere, while by a reverse process of diffusion the great amount of liberated oxygen may have been got rid of, and the equilibrium of the atmosphere in this way maintained. The consequences, both meteorological and geological of this process were discussed by the author in 1878, and more fully in 1880 in an essay on The Chemical and Geological Relations of the Atmosphere in the *American Journal of Science*. As a farther contribution to the history of these views, the author proceeded to show that Sir Isaac Newton not only held to the presence in interstellar space of exhalations from the sun, the fixed stars, and the tails of comets, which he supposed to become diffused in and to form part of the ether, but even suggested that this etherial matter is the solar fuel and essential to planetary life. From a consideration of the processes of vegetable growth and decay, Newton arrived at the conclusion that elements from interstellar space, brought by gravity within the terrestrial atmosphere, serve to nourish vegetation, and by its decay are converted into solid substances. In this way are, according to him, generated not only combustible (sulphureous) bodies, but calcareous and other stones, whereby the mass of the planet is augmented. These views put forward in Newton's famous Hypothesis concerning Light and Color in 1675, and in the Queries to the *Optics*, are more definitely enunciated in Propositions 41 and 42 of Book III of the *Principia*.

* Read before the A. A. A. S., Cincinnati, 1881.

ON THE UNIFICATION OF GEOLOGICAL NOMENCLATURE.

By Richard Owen.

With a view to proposing such Geological Terminology as would probably be acceptable to a large majority of the scientific representatives of those nations sending delegates to the International Congress for the Unification of Geological Nomenclature, it seems necessary to offer for discussion some principles, and to lay down some

SUGGESTIVE RULES:

1. To agree that all questions shall be decided by a plurality vote; or, if thought best, by a two-third majority.

2. To assign distinctive names for the headings of geological divisions and subdivisions, instead of calling, for instance the "Silurian," sometimes an "Age," at others a "Period, System, Era, Formation," or as by the French "Etage," which is translated by Surenne as meaning (when applied to Geology) stratum or layer. Further suggestions on this point will be given in the "Conspectus of Headings."

3. To arrange under these heads, when thus decided upon, such formations as are generally considered of nearly coördinate value, in lieu of giving the same apparent importance to a minor subdivision, say of Upper Silurian (such as Salina), or one of the Devonian (e. g. Chemung) that we assign to the whole Tertiary. The subjoined Tabular View offers a modified coördination.

4. To select, as far as practicable, for the geological formations thus arranged, geographical terms, indicating the areas where these formations prevail extensively, or have been studied very thoroughly. This would obviate any controversy on mooted points regarding the lithological or paleontological character of the formation. In order to illustrate the practical application of this rule, let us take for examination the nomenclature proposed by the illustrious Sir R. Marchison, in his great work of 1854, "Siluria," descriptive of the geological formation in the country inhabited by the ancient "Silures." His work of 1839 was entitled "The Silurian System," but his later publication showed a preference for the shorter and more expressive form as a noun. The adjective has, with slight modifications, been adopted in most modern languages; but by selecting the noun "Siluria," we unify for universal recognition. The same may be said for "Devonia." If it is not considered too great an innovation to alter terms already so well received, we might say "Silur-Britannia," "Devon-Caledonia," and proceed then to distribute the honors among different nationalities, as more fully exhibited in the Conspectus. The term Carboniferous is not correct when applied to Mountain Limestone or Millstone Grit, besides Coal Measures cannot be so rendered into other modern languages as to make a suitable subdivision, it is therefore suggested to name the system after the region having the greatest Coal area (the United States), and the Coal Measures after a European country in which coal is well developed. This would give us Appalachia or Carbon-Appalachia for the system, and Belgia for

the productive Era, while the great development of Millstone Grit in Ireland furnishes the term "Hibernia," and the celebrated Adelsberg grotto or cave in Mountain Limestone suggests the term "Austria," as appropriate for that Era. So also Perm-Russia, because the Permian system prevails so extensively from Kasan to the Gulf of Tscheskaïa, near the White Sea; Trias-Germania, because the Germans have given to all geologists the subdivision of that system (Bunter, Muschelkalk and Keuper) also Jura-Gallia, because the system prevails largely, and has been studied minutely in France. This plan of nomenclature would also serve to recall to the geologist, and convey to the student, important facts regarding the distribution of the formation.

5. Somewhat in the same manner, uniformity might be given to the names of nonfossiliferous rocks, by adopting Dr. Dana's orthography, as given in his latest works, where he employs the letter "y" instead of "i" as in Granyte, to distinguish rocks from minerals with names ending in "ite." Even the final "e" may as well be omitted in order to unify for other languages; and we then have, for example, Granyt, Syenyt, etc., or we may even so apply the rule as to have international names for Limestone, Sandstone, Magnesian limestone and the like, calling them Calkyt, Silikyt, Dotomyt, etc. Some German scientists (see Cotta's "Gesteinslehre") use, for instance, the word Quartzit, writing it however with an "i."

6. It is thought further that, in many cases, geological terms might be abbreviated, so as to be readily intelligible in all languages, somewhat on the symbolic system adopted in chemistry. A conspectus of the proposed modifications in geological nomenclature, with a column

SUGGESTIVE CONSPECTUS, TOWARDS UNIFICATION OF GEOLOGICAL NOMENCLATURE.

EON.	PERIOD.	ERA.	EPOCH.	EQUIVALENTS.
Neozoic or Quaternary	XIII. Cimbria	33 Antillia or Gaudeloupia	b Mentonia a Neandertha	Recent — Modern — Neolithic, Paledithic
		32 Madagascaria	b Nile-Gange a Nora-Toxandria (or Auckland-Kawhia)-(New Zealand)	Reindeer
	XII. Patagonia	31 Scythia or Siberia	a Rhenus-Port Hudsonia (Loess)	Champlain — Alluvium
		30 Pampas-Virginia	b Ebor-nora-Kentuckyia (Newburg, N. Y., and Big-bone Lick)	Diluvium
	XI. Scandinavia	29 Suedia	a Darling—Australia b Regio Grœnlandica	Glacial or Drift
		28 Laboradoria	a Arctico-Boria or Borea	
Cenozoic or Tertiary	X. Ter-Pliocene or Italia	27 Sicilia	a Girgenti—Catania b Etruria—Apulia	Pliocene — Sumter (Dana)
		26 Subapenninia	a Carolina—Virginia	Aralo—Caspian of Lyell
	IX. Ter-Miocene or Græcia	25 Emodi—India (Himalaya)	b Sivalik—Pannonia a Cecropia—Sardinia (or Pikermi, or Pentelicus-Sar)	Miocene — Yorktown
		24 Helvetia	b Caucaso—Tongria a Spitzbergen—Alaskia	
	VIII. Ter-Eocene or Afric-Asia	23 Parisia	b Alabama—Georgia a Berlin—Westphalia	Eocene — Alabama
		22 Aegypto—Persia or Suessonia	b Tyrol—Istria a Dalmatia—Syria	Lignitic Epoch
Mesozoic or Secondary	VII. Creta-Hispania	21 Anglo-Senonia	Mæstricht—Venetia Pyrenœi—Carpatesia	Cretaceous — Up. Wh. Chalk Lower do.
		20 Lusitania	Texas—Niobraria Dacia—Cimmeria Magellan—Circassia	Upper Green sand
		19 Neocomia	Wealden — Sussexia-Néocomien of d'Orbigny	Lower do.
	VI. Jura-Gallia	18 Portlandia	Calais—Bononia- (Boulogne sur mer)	Jurassic — Wealden
		17 Bavaria	Solenkofen—Oxfordia	Oolitic Epoch
		16 Vindelicia	Boll—Avonia	Liassic do.
	V. Trias-Germania	15 Bolivia	Cheshire—Somersetia	Triassic — Keuper
		14 Hanoveria	Beaufort—Lunevillia (Dieynodon and Ceratites nodosus)	Muschelkalk
		13 Saxonia	Brunopolis—Polonia Brunswick loc. Eng. lilif. Connecticut—Moravia	Bunter
Paleozoic or Primary	IV. Perm—Russia	12 Kasan-Tscheskaïa	Thuringia Nosgesusia	Permian
	III. Carbonaria or Carbon-Appalachia	11 Carbonia or Belgia	Missouri—Pennsylvania Namur—Coimbria	Carboniferous — Coal Measure
		10 Hibernia	Michigan—Tasmania Monongolia (W. Virginia) Cumbria (Yorkshire Mt.) Adelsberg—Nova Scotia Iowaia — Kaskaskia, St. Louis, etc., etc., etc.	Millstone Grit
		9 —— Austria Subcarb [5] 9° —— Alemania	Waverleyia (Ohio) Volga—Uralia	Subcarb [5] Limestone or Sandstone
	II. Devonia or Devon-Caledonia	8 Livonia or Caledonia	Villmar—Catskillia Nassau—Westphalia or Franconia	Devonian — Catskil Chemung
		7 Rhen—Prussia	Plymouth—Eifelia Hamilton—Chemungia	
		6 Neregonia (Norway)	Cathay—Potoria Dalecartia	Hamilton Corniferou
	I. Siluria or Silur-Britannia	5 Scania	Gottland—Tyrolia Helderberg—Ludlovia	Silurian — Upper — Helderberg
		4 Niagaria	Medina—Clintonia Wenlock—Pentlandia	Niagara
		3 Boiohemia or Trentonia	Augers—Hudsonia Caradoc—Trentonia	
		2 Canadia	Vitré—Murcia Llandeils—Esthonia	Lower — Trenton Canadian
		1 Cambria	Potsdam—Longmyndia Acadia	Cambrian

DIFFERENT HEADINGS, WITH ONE OR TWO EXAMPLES.

MACROCHRONE.	EON.	PERIOD.	ERA.	EPOCH.	MICHROCHRONE.
(Greatly extended time.) *Examples.* Neptunia (all aqueous rocks.)	("A space of time, a life-time.") Paleozoic Eon.	("An interval of indefinite time.") Permia Carbonaria Devonia Siluria	("A succession of years between two fixed points.") Austria (Mt. limest.) Cambria	("A pause.") Iowaia Potsdamia Acadia	(Comparatively short time.) Karkaskia, St. Louis, etc., etc.

EXAMPLES SHOWING THE ADAPTABILITY OF CERTAIN HEADINGS TO MOST OF THE MODERN LANGUAGES.

		System. ("An assemblage of objects ranged in regular sub-ordination, or related by some common law.") Σύδεημχ (το) Le système. Das System, Il sistéma. El sistéma.	*Sub-system.*	*Group.* ("An assemblage of objects in a certain order.") Le Groupe. Die Grüggen. Il grúppo. El grúpo.	*Sub-group* or *Section.* Sectio. La section. Die section. La sezione. La seccion. or *grade* or *member*, with slight modifications can be used in the above languages.

ABBREVIATED FORMS WITH SOME EXAMPLES.

		For *Periods.* Roman numerals, I, II, III, etc., or Capital letters A B C, etc., applied thus: I = Silusia. or A = "	For *Eras.* Arabic numerals 1, 2, 3, etc., applied thus: 2. = Canadia 1. = Cambria	For *Epochs.* Small letters a, b, c, etc., [repeated for the epochs of each era.] 2^b= Vitrè-Murcia 2^a=Llandeils-Esthonia 1^b= Potsdamia 1^a= Acadia	For *Members*, marks used to the right and above the era letter, similar to the power-sign in mathematics. Thus to designate the Burlington member of the Iowa subcarniferous, we would write: III. $9^{a''}$ or C. $9^{\circ}a''$

of the leading present equivalents is submitted below, in which it will be observed that one great object, kept in view, was the recording particularly by the Epoch names, such localities as are noted for having given us remarkable fossils, characteristic of that peculiar formation, whether found in well-known regions of Europe and America, or in such distant countries as Patagonia, N. Zealand, the Cape of Good Hope, Greenland or Spitzburgen, etc.

NOTE TO TABLE 1.

To further facilitate the understanding of some of the suggestions submitted, a tabular view is subjoined, giving different headings, with their definitions from standard dictionaries, as well as a conspectus of the symbols.

NOTE TO TABLE 2.

Probably some difficulties, and, despite of care exercised, some errors in the details may be pointed out; but if the general principles are found acceptable, or suggestive of such discussion as may ultimately lead to unification of our Geological Nomenclature, the object proposed, in the preparation of this paper, will be attained.

A NEW MATERIAL FOR STOP-COCKS AND STOPPERS FOR REAGENT BOTTLES.*

BY H. W. WILEY.

For some time I have been working with a compound invented by Mr. T. J. Mayall, of Reading, Mass., and known as the Mayall metal. One form of this compound was intended as a material for journals, pneumatic tubes, etc. It is made of 5 to 6 parts graphite, 1 part rubber and ½ part sulphur. Instead of sulphur, sulphide of antimony can be used. The material is a perfect self-lubricant and to a high degree resists the action of acids and alkalis.

From its properties I was led to believe that it would be especially useful for chemical apparatus, in the manufacture of stop-cocks, connecting tubes, etc. My expectations were fully realized.

I have used it with success for burettes, cocks for hydro-sulphuric acid, stoppers for hydrote bottles, etc, These never stick, no difference how firmly they are pressed in nor how long they are left. The material is firm and elastic and will hold threads nearly as well as a metal.

I regard it as peculiarly useful for stop-cocks for acids, especially hydro-sulphuric. It is capable of a high polish, and will not tarnish. Slightly modified in composition it is used for covering houses and plating the bottoms of ships. Placed on ships it seems to prevent entirely the adhesion of barnacles, Strange as it may seem, it also makes an excellent insulating material for telegraph wires. I have not yet tried the effect of ozone upon it and only partially of permanganate of potassium.

* Read before the A. A. A. S., Cincinnati, 1881.

PHONETICS OF THE KAYOWE LANGUAGE.*

BY ALBERT S. GATSCHET.

Books printed in Indian languages often render those tongues in a most imperfect manner, on account of the deficient knowledge of Indian phonetics on the part of the authors. The Kayowe language is a fair average specimen of Indian pronunciation, and is very rich in sounds, having no less than forty-four sounds, if we count in the long and the nasalized vowels. In its phonetic series the most conspicuous fact is the prevalence of the nasals and the total absence of dsh, tch, which are so conspicuously frequent in the majority of American languages, of r and of v. The palatal series is represented by one consonant only; the guttural and dental series are well represented, while in the labial series p, b, and m are the only frequent sounds. F is found in some words only, where it alternates with p, pai, or fai, land, earth. Among the sounds not frequently met with are sh, w

* Read before the A. A. A. S., Cincinnati, 1881.