better authority," should have perceived a good many errors of omission and commission.

Not even in England do authorities now maintain that Glaisher and Coxwell reached the height of 7 miles, as stated on pages 31 and 160, so that the record of 34,400 feet belongs to Berson and Süring, in Germany, and the balloon "Preussen," holding 300,000 cubic feet of gas, in which they ascended, is much larger than the French "Géant," said on page 33 to be the largest free balloon ever constructed. In the table of long balloon voyages, the distance of 872 miles traveled by Erbslöh and Clayton during the Gordon-Bennett race from St. Louis in 1907 is ignored, although shorter voyages in Europe during the same year are enumerated. There are inaccuracies also in the table of early air-ships, for the speed of the first successful dirigible balloon of Renard and Krebs was 14 miles per hour and not 7½ miles, and Santos-Dumont won the Deutsch prize, by circling the Eiffel Tower, in 1901, and not in 1898. As regards the first mechanical flights it is wrong to say on page 81 that the flights of Farman and Delagrange in 1907–8 "were being eclipsed in America by the Brothers Wright," when the latter had made longer flights several years before. The Malay kite (page 96) is not analogous to the "finbat," since it has no plane projecting at right angles from the middle. Hargrave's kite is correctly described, as is rarely the case, in having no continuous corner sticks which were added by Clayton. The Wright aeroplane does not start on a *declined* rail (page 153). Exceptions can be taken to some of the meteorological conclusions, *e. g.*, that the seasonal and daily changes of temperature are much less at an altitude of 5,000 feet than at the ground, because the contrary has been found by the Blue Hill observations. The statement that an Englishman, Archibald, first used kites to lift automatic registering instruments, on page 158, apparently contradicts one on page 94 that in 1894, for the first time, automatic recording apparatus was sent up on kites from Blue Hill. The last is correct, if instruments recording graphically and continuously, such as are now generally used to obtain observations in the upper air, are meant. Andrée, on his ill-fated north-polar voyage, had two companions, Fränkel and Strindberg, and not three, as said on page 196. It can not be admitted that a projectile fired vertically would fall back with the velocity with which it left the gun, as is asserted on page 213. If dirigible balloons are unable to "tack," like sailing ships (page 226) this is equally true of flying machines. The species of wood suitable for constructing the latter which are named on page 269, have a foreign habitat and none equal the American spruce. In the index, John Wise, the old-time balloonist, is confounded with Lieutenant Wise, the modern kite-experimenter.

The aeronautical achievements are brought down to August, 1909, after Blériot's flight across the Channel had brought home to Englishmen the possibility of aerial invasion, which furnished the psychological moment for publishing this book.

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Scientific Journals and Articles

The March number (volume 16, number 6) of the *Bulletin of the American Mathematical Society* contains: Report of the annual meeting of the society, by F. N. Cole; Report of the winter meeting of the Chicago Section, by H. E. Slaught; Report of the meeting of the American Association, by G. A. Miller; "Shorter notices": Smith's Rara Arithmetica, by L. L. Jackson; Fine and Thompson's Coordinate Geometry, by E. B. Cowley; Boutroux's Fonctions definées par les Equations différentielles du premier Ordre, by C. L. E. Moore; Worms de Romilly's Premiers Principes des Sciences mathématiques, by J. B. Shaw; Auerbach's Taschenbuch für Mathematiker und Physiker, by J. B. Shaw; Laurent's Statistique mathématique, by H. L. Rietz; Duhem's Théorie physique de Platon à Galilée, by E. B. Wilson; Clark's Slide Rule, by F. Cajori; Annuaire du Bureau des Longitudes pour l'An 1910, by E. W. Brown. "Notes on the Institut de France and the annual meeting of the Académie des Sci-

ences," by R. C. Archibald; "Notes"; "New Publications."

THE April number of the *Bulletin* contains: "Simon Newcomb," by E. W. Brown; "A new proof of Weierstrass's theorem concerning the factorization of a power series," by G. A. Bliss; "On some theorems in the Lie theory," by L. D. Ames; "On the discontinuous ζ-groups defined by rational normal curves in a space of n dimensions," by J. W. Young; "A new analytical expression for the number π, and some historical considerations," by G. Vacca; Review of Hermite's Works, Volume II., by James Pierpont; "Shorter notices": Serret-Scheffers, Differential- und Integralrechnung, third edition, Volume III., by A. R. Crathorne; Richter's Kreis und Kugel in senkrechter Projection, by D. D. Leib; Granville's Plane and Spherical Trigonometry, by Jacob Westlund; Lecornu's Dynamique appliquée and Boulanger's Hydraulique générale, by J. B. Shaw; Schafheitlin's Besselsche Funktionen, by A. R. Crathorne. Correction; "Notes"; and "New Publications."

REFLECTIONS ON JOLY'S METHOD OF DETERMINING THE OCEAN'S AGE

As is well known to all geologists, the very important method of estimating the age of the ocean devised by Mr. J. Joly consists substantially in dividing the total sodium content of the sea water by the yearly contribution from the land, this annual tribute being ascertained by analyzing river waters and gauging the streams. It is assumed on uniformitarian principles that what variation there has been in the annual salt tribute is undiscoverable.[1] In a long-forgotten memoir Edmund Halley[2] made a very similar suggestion and anticipated Lyell in propounding a strictly uniformitarian doctrine of the accumulation of salt.

Oceanic sodium is at least chiefly derived from lime-soda feldspars, which as essential constituents are practically confined to Archean and later igneous rocks. The original surface of the earth must have consisted of such rocks to the exclusion of all others, while at the present day the greater part of the land area is covered with sedimentaries. Now the rate of decomposition of rocks is chiefly dependent on exposure. Even in areas of ancient feldspathic massives decomposition does not seem to penetrate to great depths. Thus in the southern Appalachians great areas of gneiss and allied rocks are now covered by a blanket of saprolite (rotten rock in place) which is in many localities 50 feet in thickness, but at all the points where I have observed it less than 100 feet thick. Immediately below the saprolite blanket there is incipient decomposition and the feldspars are milky, but not many yards lower down the feldspars are characteristically translucent and the rock bluish in tint. A layer of decomposition products 100 feet thick seems to arrest decay. Corresponding statements are true of Tertiary volcanics excepting where the decomposition is solfataric. On the other hand Mesozoic and Paleozoic massive rocks deeply buried under sediments are not seldom found to be very free from decomposition. In short, buried massives decompose at a rate which is scarcely sensible.

It is quite conceivable that in the far distant future all the massive rocks might be thoroughly decomposed down to sea level or a trifle below. The continents would then be exclusively detrital. Under such conditions there could be no further important additions to the sodium content of the ocean, for there would then be no leaching, while mere diffusion to any considerable distance is too inordinately slow to produce any noteworthy result even in millions of years.

Thus in the distant past there must have been a time when a far greater mass of massive rock was decomposed each year than now decays in the same period; and a limit to this process can also be foreseen. The total area of exposed massives has surely diminished and will continue to diminish. Climate and temperature may perhaps have been in the past much what they are to-day; the rate of chem-

[1] *Trans. R. S. Dublin*, Vol. 7, 1899, p. 23, and Brit. Assoc. Rep., 1900, p. 369.

[2] SCIENCE, Vol. XXXI., March 25, 1910, p. 459, and *Phil. Trans.*, Vol. 29, 1715, p. 296.