has been removed, this subject being now dealt with in the general chapter on staining, which has been re-written. The chapters on connective tissues, on blood and glands, and on the nervous system have been thoroughly revised and considerably amplified. Explanations relating to the principles of technical processes have been included in general chapters, and do not in this edition occur under the special sections.

OUR ASTRONOMICAL COLUMN.

THE PLANET MARS.—In No. 360 of the *Observatory* Mr. Wesley discusses the photographs of the planet Mars which Mr. Lowell recently published. Mr. Wesley has made a very careful study of the six prints, and has been able to distinguish easily, on one or another of them, the features named by Mr. Lowell. He is not, however, prepared to corroborate the opinion expressed by the latter that the photographs confirm the fact that the so-called "canals" are *continuous lines*, for imperfect definition might render a row of dots as an unbroken line. As the Lowell photographs are too small to reproduce satisfactorily, Mr. Wesley has made a composite drawing showing all the features seen on any of the prints, and this is given as a frontispiece.

In the same journal Mr. Denning gives, among other planetary observations, an account of his recent areographical researches with a 12½-inch Calver reflector, using a power of 300. He is very certain of the actual existence of the features termed "canals," many of which he was able to identify quite easily. He regards "canals," however, as an unfortunate designation for the irregular, frequently knotted streams of shading, which are by no means straight or narrow, but have a perfectly natural appearance, and says:—"The idea that they are clearly cut lines, suggestive of artificial origin, may be dismissed as a mere conjecture unsupported by reliable evidence."

Major Molesworth, of Trincomalee, Ceylon, has recently communicated to the Royal Astronomical Society a record of his observations of Mars during the opposition of 1903. These observations were made, under excellent conditions, with a 12¾-inch Calver reflector, generally employing a power of about 450. An abstract of this paper, giving the principal tables and conclusions, appears in No. 8, vol. lxv., of the *Monthly Notices*, accompanied by six beautiful drawings showing the chief characteristic features of the Martian surface during the opposition. As his results testify, Major Molesworth has made a long and laborious study of this planet with great zeal, and he has not the slightest doubt as to the reality of the "so-called canals." These markings do not, however, appear to him as continuous definite lines, but rather like "streaky" lines such as would be drawn on very rough paper with a rounded crayon or stump. He records several instances of gemination, and offers a natural explanation of the phenomenon. On six occasions he observed projections either on the limb or the terminator. In conclusion, he proposes a new classification of Martian features, and discusses the several "contrast" and "illusion" theories which have been opposed to the reality of the "canals." Likening these peculiar markings to those seen on Jupiter, he concludes that if the latter be accepted as real—as they undoubtedly are—then the similar ones on Mars cannot, on any logical basis, be ascribed to illusion.

THE RINGS OF SATURN.—Observing at Aosta (Italy) during the later months of 1904, MM. Amann and Rozet noted a novel feature on Saturn's rings. On October 20 M. Amann saw a sharp, accentuated marking, or shadow, on the rings some distance from the outer edge of the shadow cast by the planet itself, and having a curved form concave towards the planet. Between October 20 and November 15 this new feature was not seen, although numerous observations were made under favourable conditions. After November 15 the shadow was seen repeatedly, and it was then noticed that that part of it which was projected on the inner ring was always broader and more accentuated than the other part. Between December 22 and 27 it was seen that this broader portion was bifurcated, so that the whole shadow had the form of a capital Y; that the apparition was a shadow was shown by its fixed position relative to the planet, notwithstanding the rotation of the latter and its rings (*Bulletin de la Société astronomique de France*, August).

DECLINATIONS OF CERTAIN NORTH POLAR STARS.—In No. 3440 of the *Astronomische Nachrichten* Dr. Auwers pointed out that in certain hours of right ascension, north of declination +82°, there were gaps containing no "fundamental" stars, and asked that these gaps might be filled. In answer to this request Miss Harriet Bigelow, of the Smith College Observatory (University of Michigan), has determined the places of twenty-one stars situated between declinations +84° 34′ and +88° 55′, and now publishes them in vol. vii. of the *Proceedings of the Washington Academy of Sciences* (pp. 189–249). The instrument employed was the Walker meridian circle, having a telescope of 6·3 inches aperture and a focal length of 8 feet.

THE MINOR PLANET OCLLO (475).—Another set of positions of the interesting asteroid Oclio, as determined by Mr. R. H. Frost at Arequipa, are given in Circular No. 103 of the Harvard College Observatory. The object was re-discovered on, and its position determined from, a plate taken on June 6, and was also shown on other plates secured on June 7 and 9. The determined positions show that Oclio seems to be about 4° from its position as computed from the previously published elements. The data now given, together with the positions published in Circulars Nos. 63 and 101, should enable the elements of Oclio's peculiar orbit to be determined with great accuracy, and to insure against the future loss of this planet.

THE ROYAL UNIVERSITY OBSERVATORY OF VIENNA.—We have just received vols. xv. and xviii. of the *Annalen der k.k. Universitäts-Sternwarte in Wien*, edited by the director, Prof. E. Weiss. Vol. xv. contains a catalogue of 2417 stars the places of which have been determined by Herr F. Bidschof with the meridian circle, and are given for the mean equinox of 1885·0. The instrumental equipment and the methods employed in the reduction are discussed at length. A series of observations of Jupiter made between February 20 and May 1, 1898, by Herr J. Rheden is also described in this volume, and the description illustrated by fifty coloured drawings of the planet, which are given on the two accompanying plates.

Vol. xviii., in the first part, is devoted to the results obtained from the observations of minor planets and comets, made by Dr. J. Palisa with the Grubb refractor of 67 cm. (about 27 inches) aperture during the years 1899–1901. The observations of seven comets and four nebulæ are included, and the whole of the results are tabulated at the end in a handy form for reference. This volume is completed by the meteorological results obtained in 1901, 1902, and 1903, the pressure, temperature, &c., being given for 7 a.m., 2 p.m., and 9 p.m. on each day.

THE STATE AND THE CLAYWORKER.[1]

IT is the purpose of each of these works to supply the members of the clay industry, in the State to which it refers, with an account of the geological relationships, the mode and place of occurrence, and the chemical and physical properties of the raw clays both worked and unworked. The manufacturing processes of various types of ware are also described as they are practised in the State, with numerous details of physical tests that have been applied to them.

The subject has been treated upon very similar lines in both reports; the Iowa volume, however, contains more information upon the practical manufacturing side; it devotes a chapter to the selection and upkeep of power plants, and has a fuller account of different forms of kiln; there is even a section dealing with the composition of the fuels used in burning the clays. But this volume

1 "Clays and Clay Industries of Iowa." By S. W. Beyer, G. W. Bissell, I. A. Williams, J. B. Weems, and A. Marston. Iowa Geological Survey, vol. xiv. Pp. xi+664. (Des Moines: Iowa Geol. Survey, 1904.)
"The Clays and Clay Industry of New Jersey." By H. Ries and H. B. Kümmel, assisted by G. N. Knapp. Geological Survey of New Jersey, vol. vi. Final Report. (Trenton, N.J.: Geological Survey of New Jersey, 1904.)

suffers somewhat in comparison with the New Jersey one through faulty editing; there are many more diagrams in the former than in the latter work, but they are sometimes too small for the matter they contain (p. 572); they are rather untidy in appearance, and are frequently inserted sideways in the text when they should be upright. The chemical portion is unnecessarily duplicated, and the important table of analyses (p. 344) is rendered useless for ready reference by the complete omission of silica.

Both books are provided with maps of the geological distribution of the clays, with abundant photographic illustrations of varying degrees of value, with a directory of the clayworkers in the State, and fairly numerous references to the literature of the subject. In each case the section dealing with pottery is weak.

Prof. Ries still maintains that the most generally useful way of expressing the chemical nature of a clay is through the ultimate analysis, though he admits the value of the so-called "rational" analysis in the case of the higher grade clays; with this view we are entirely in accord. Messrs. Beyer and Williams appear to lean somewhat towards the "rational" analysis, and have given the results in this form along with the ultimate analysis—a useful custom. Their method of dividing the ultimate analysis into "sand and clay," "total fluxes," and "moisture, CO_2 and SO_3," is convenient. The influence of titanium on the fusibility of clay is rightly emphasised by Ries; in this country it has been very generally neglected in analyses.

The physical tests applied to clay products were:—compression tests, transverse tests, absorption tests, and freezing and thawing (Iowa only); of these, the second is held in highest esteem; it is certainly far superior to the crushing test in most cases, but we are among those who do not agree with Prof. Marston that for *paving* brick it can take the place of the "rattler" test; the objections he urges against the latter may be applied with equal force to the former, while he admits that the action of the "rattler" approximates more closely to the kind of wear to which paving bricks are subjected in actual use.

From a multitude of councillors we expect wisdom; it is none the less true that if the councillors will not consult one another we are apt to get only confusion. Everyone who publishes some results of physical tests of clays and clay wares seems to think that these should become recognised standards at once. The two authorities here cited are no exception; each one stoutly believes that its own favoured methods should be adopted for general use. There is here a satisfactory unanimity as to the kind of test required, but when we come to details of application, we find considerable divergence of practice in precisely those points which together go to constitute a standard test.

Thus in obtaining the modulus of rupture in the "transverse" test of bricks, New Jersey employs rounded knife-edge contacts alone, while Iowa interposes steel bearing-plates between the brick and the knife-edges; in the crushing and absorption tests New Jersey uses half a brick, Iowa grinds out from the brick a 2-inch cube; again, the former measures linear shrinkage and calculates the cubic shrinkage, the latter reverses the process, using a Seger volumeter for the purpose. For estimating texture (fineness of grain) Iowa employs a modification of Whitney's method, New Jersey uses a centrifugal apparatus. Further, there is an important difference between the methods of collecting materials; Prof. Marston asks for a fairly large consignment to be sent by the manufacturer, and tests twenty or more bricks in the transverse way; on the other hand, members of the New Jersey Geological Survey staff pick out five to seven representative bricks on the spot, and send them to be similarly tested by Prof. Ries. Useful though these tests may be for local reference, it is evident that a standard series of tests will never be arrived at by such isolated endeavours; indeed, we cannot help feeling that in these and similar publications there is much duplication and waste of energy through the lack of a little coordination.

There will be diversity of opinion as to the expediency of the State taking upon itself the task of publishing tests of manufactured wares; it stands in the same relationship to producers as to consumers, yet, while such publications may be supposed to benefit the latter class uniformly, a considerable injustice might conceivably be done to one of the former the ware of which took a lower place in the scale. This danger is exemplified to some extent in the Iowa report, which mentions the names of firms in conjunction with the results, and the effect is too much like an advertisement. New Jersey adopts the plan of publishing the laboratory number of the test; the manufacturer has the result communicated to him privately. For our part we doubt the wisdom of such publication, except upon lines similar to those on which watches and thermometers are tested in this country.

But good maps of the distribution of the clays, the preparation and collection of comparable data of the physical and chemical properties of the *raw* materials, experiments on the results of blending hitherto unworked clays with one another and with known clays, and the coordination of the information and samples in a manner accessible to all, is the legitimate duty of a State department, and of the utmost value to all sections of the community.

The Geological Surveys of Iowa and New Jersey have performed most of these duties in a manner which cannot fail to be appreciated. When we remember that in addition to this Geological Survey work there is in each State a well equipped ceramic laboratory for testing and for instruction in the manufacture of all grades of wares—the department of ceramics in the State College of New Brunswick has an outfit in the brick-making section capable of turning out 20,000 bricks per day—we are constrained to turn our eyes to our own State, where we see the capital pioneer effort of an individual, George Maw, nearly fifty years ago—and what beside? "Comparisons," as Mrs. Malaprop says, are "obvious."

THE CEREBELLUM: ITS RELATION TO SPATIAL ORIENTATION AND LOCOMOTION.[1]

AS the cerebellum is well represented in the lowest vertebrates and undergoes relatively little change in form with the higher development of the rest of the brain, it must be regarded as a fundamental structure of the vertebrate nervous system. This may be one of the reasons that much interest has centred in its study and in the attempt to define its functions in exact physiological terms. Though Willis (Oxford, 1660) noted the intimate connection between the cerebellum and pons Varolii, and recognised that the trapezial fibres of the latter are a cerebellar and not a cerebral system, and though Majendie laid the first foundations of our knowledge of its functions, it has only been of recent years that we have gained, chiefly from the work of Luciani and the workers who followed him, satisfactory insight into its anatomy and physiology.

In the lecture, Sir Victor Horsley analysed the conclusions on its functions which have been obtained by the destruction and stimulation methods of study, and in addition contributed from his clinical and laboratory experience some facts which help to elucidate the *rôle* it plays in our nervous economy.

In the first place all recent work confirms the conclusion formulated years ago by Edinger, that the cerebellum is essentially an organ for the reception of certain sensory impulses. Systems of fibres ascending from the spinal cord convey to it part of the sensory impulses which enter through the dorsal roots from the cutaneous and more deeply placed peripheral nerves. These tracts of fibres end in the cerebellum exclusively in its vermis or middle lobe. To the vermis also come direct root fibres of the vestibular nerves which collect from the semi-circular canals, the organs of the special sense of orientation in space, the sensations of change of position and of the position of the head in space. The lateral lobes of the cerebellum, on the other hand, are in connection through the pontine grey matter with the temporal lobes and with the kinæsthetic cortex of the forebrain. All these systems which conduct to the cerebellum end in its cortex, and

[1] Abstract of Boyle Lecture delivered by Sir Victor Horsley, F.R.S., before the Junior Scientific Club of the University of Oxford, June 5.