end. The current is then turned on, and the metal becomes brighter and brighter until the weld is completed, after which the current is turned off and the pressure increased to about thirty-five tons. While under this pressure the weld is allowed to cool, after which the car is moved back about six inches and the jaws applied to the other end of the bar, where the process is repeated. The other end is treated in the same manner. In other words, the centre weld is made first, and then the end welds. Artificial means of cooling are used, and as the bars cool they exert a powerful influence in bringing the rail ends close, so as to make a tight joint. The current for the operation of the plant is taken from the regular trolley wire service. It would be expected, from considerations of the action of heat upon metals, that rails welded in this way would buckle when they experienced a considerable rise of temperature, or snap when the temperature was very low, but, as a matter of fact, welded rails neither buckle nor break. By applying immense pressure to the material during welding, the length of a continuous rail made by this process is said to have no limit except that of the line itself.

DR. FRANZ BOAS has made a mathematical study (*American Anthropologist*, N.S., i. p. 448) of the biological significance of the cephalic index on the lines suggested by Mr. Francis Galton, and fully developed by Prof. Karl Pearson. His conclusion is that while the cephalic index is a convenient practical expression of the form of the head, it does not express any important anatomical relation. On the other hand, the relation between capacity and head diameters is found to be of fundamental importance, and among these the relation between the transverse diameter and capacity is most significant. Since in measurements on the living we are unable to measure capacity of the head, it is necessary to find a substitute. It would seem that circumferences are the most available means for judging cranial size. Therefore such circumferences should be included in all anthropometrical schedules designed to investigate racial characters.

FROM the Field Columbian Museum we have received Nos. 3 to 6 of the first volume of its "Geological Series" (Chicago, 1899). No. 3 treats of the ores of the South American Republic of Colombia, the specimens being described by Mr. H. W. Nichols, from a collection made by Señor F. Pereira Gamba. The ores were obtained from the mountainous western portion of Colombia, in which the Andes entering from the south divides into three chains known as the eastern, central and western Cordilleras. Gold was first mined by Europeans in Colombia in 1537, and during the sixteenth and seventeenth centuries the country was the great gold producer of the world; now it is said to rank ninth in importance. Iron ore is worked and smelted at Amaga. The authors observe that the gold and silver ores occur either in the acid lavas, which have been erupted at intervals from the close of the Tertiary period to the present time, or in adjacent Archæan schists. In the early days of mining, the superficial weathered rocks, which are the richest, were worked with signal success; the mines are now sunk below this zone. The ores are found in quartz as fissure-veins in the schists, and also as segregations from the surrounding lavas. In the latter case, they appear to have come to the surface in the lavas, from which they have to some extent been leached by hot solfataric waters and by tropical rains.

MESSRS. NEWTON AND CO. inform us that the whole of the lantern exhibitions at the forthcoming meeting of the British Association at Dover are to be carried out by them.

MESSRS. PHILIP HARRIS AND CO., Birmingham, have just published a diary which should be of service to science teachers. The diary covers the year from September 1, 1899, to August 31, 1900; and, in addition to the usual blank pages, contains seventy-six pages of tables and definitions frequently required in physical and chemical laboratories. The book is thus similar to an engineer's pocket-book, and its publication in the form of a diary will make it a constant companion of many science teachers.

MESSRS. R. FRIEDLÄNDER AND SON, Berlin, have issued in a single volume the numbers of *Naturae Novitates* published by them during 1898. It is well known to collectors of scientific books that Messrs. Friedlander's publication contains a useful classified list of current literature on all branches of science, compiled from catalogues in many languages. It is convenient to have these bibliographical lists in volume form, and a full index at the end increases their value.

THE additions to the Zoological Society's Gardens during the past week include a Sykes's Monkey (*Cercopithecus albigularis*, ♂) from South Africa, presented by Mr. W. P. Peyton; a Common Camel (*Camelus dromedarius*, ♂) from Mogador, presented by Mr. F. G. Aflalo; a Stone Curlew (*Oedicnemus scolopax*), European, presented by Mr. S. M. Sargant; a Common Raccoon (*Procyon lotor*) from Barbados, deposited.

ERRATA.—Lord Kelvin asks us to notify the following errata in the MS. of his letter on the "Blue Ray of Sunrise over Mont, Blanc," published last week (p. 411):—Line 1, for 5 o'clock read 4 o'clock; line 7, after "light" insert "of sunrise."

OUR ASTRONOMICAL COLUMN.

HOLMES' COMET 1899 *d* (1892 III.).—

Ephemeris for 12h. Greenwich Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′ ″	Br	
Sept. 7	2 6 50·14	+41 41 40·0		
8	7 15·57	41 55 35·8		
9	7 39·02	42 9 25·3	0·1814	0·05435
10	8 0·45	42 23 8·0		
11	8 19·84	42 36 43·8		
12	8 37·16	42 50 12·4		
13	8 52·40	43 3 33·5	0·1795	0·05538
14	2 9 5·51	+43 16 46·9		

During the week the comet passes through the north-west of Andromeda, being a few degrees west of γ Andromedæ on the 11th. It is in a good position for observation, but is reported as extremely faint.

In *Popular Astronomy* (vol. vii. pp. 340–342) Prof. C. D. Perrine describes the circumstances of his rediscovery of this comet on June 11 of the present year. The observation was made in the early morning with the 36-inch Lick refractor, the atmospheric conditions being very good. The comet appeared as a round nebulous mass about 30″ in diameter, very faint and with but little central condensation. The orbit is more nearly circular than that of any other known comet, lying wholly between the orbits of Mars and Jupiter, thus suggesting a possible, but as yet unproved, connection with the asteroids also occupying that position.

THE NEW ALGOL VARIABLE IN CYGNUS.—The following are the predicted minima of this newly-discovered variable, which will admit of observation during September:—

	d. h. m.
1899, September ...	12 11 58 G.M.T.
	21 15 27

Mr. J. A. Parkhurst gives (*Popular Astronomy*, August 1899, vol. vii. p. 380) two charts of the stars in the neighbourhood, which will greatly facilitate the detection of the variable. Observations may be satisfactorily made with telescopes of 3 inches aperture. The position is about 1° south preceding the 5th mag. star o^1 Cygni.

HARVARD COLLEGE OBSERVATORY.—Prof. Pickering has recently issued the second part of vol. xxiv. of *Annals of Harvard College Observatory*, containing an exhaustive discus-

sion of the observations made with the meridian photometer during the period 1882–88. The magnitudes, as given in the "Harvard Photometry," are compared with both the "Uranometria Argentina" and the *Bonn Durchmusterung*.

For the greater part there is close agreement, but the magnitudes in the *Bonn Durchmusterung* are found to have a systematic variation according to the right ascension, the stars grouped at about R.A. 7h., in the Milky Way near Monoceros, being more affected than others also in the Milky Way, but at R.A. 18–19h., in Aquila.

Part of the differences between the "Harvard Photometry" values and those of the "Uranometria Argentina" are ascribed to the difference in position of the two stations, as the zenith distances of the stars would be different, and therefore, presumably, the atmospheric absorption; no correction being applied for this, the southern stars at Cordoba would be estimated too bright.

An attempt to revise the scale of the *Durchmusterung* decided that it was practically impossible to reduce it to the photometric scale by any simple rule, and for purposes of comparison the necessary corrections are given to convert one scale into the other from magnitudes 1·0 to 9·2.

Pages 185–233 are devoted to a discussion of the relation between the magnitudes in the *Harvard Photometry* and those determined by Sir William Herschel. Of the six catalogues of Herschel's observations, the third is considered more accurate, and the fifth less so, than the others. In all he published observations of 3000 stars, and the *average* difference from the photometric catalogues of the present day is only ±0·16 magnitude, this including both the possible change during the century which has elapsed and the errors of both determinations. Prof. Pickering is surprised that these observations should not have been repeated at intervals of ten or twenty years, so that deviations of individual stars might be detected. With this idea he gives a special table including all stars in which the difference between Herschel's magnitudes and the photometric ones equals or exceeds half a magnitude.

The remainder of the volume, pp. 234–245, deals with investigations in regard to the relative performance of the large and small meridian photometers which have been employed in the production of the *Harvard Photometry* itself. No difference exceeding the hundredth of a magnitude was detected. Tables are given showing that the values of the *Harvard Photometry* are not sensibly affected by variations of magnitude, right ascension, declination, or proximity to the Milky Way.

TORSION-STRUCTURE IN THE ALPS.[1]

ONE of the most brilliant and suggestive chapters in Suess' monumental work "Das Antlitz der Erde" is that in which he deals with the remarkable whirl-shaped arrangement of the leading lines of the Alpine system (vol. i. chap. 2).

Prof. Suess describes how the "leading line" sweeps round the north in one great curve convex to the north, the Apennines describe a curve convex towards the east, whereas the Dalmatian mountains form opposite it a curve convex to the west; and the curve of the Apennines is continued westward along the Algerian ranges of North Africa, whereas the Dalmatian curve is continued eastward towards Asia Minor. Prof. Suess points out that movements of crust-folding have always taken place towards the convex or outer side of these curves, and have in most cases caused an actual transgression of the curves above the regions in front of them. He further states that it is not fully understood why the mountain-systems should follow curved lines, or why the curves of the Alpine upheaval should in many areas repeat those of former mountain-systems.

Let me, before going further, remind the reader of a lecture given by one of the greatest of stratigraphers, Prof. Lapworth, at a meeting of the Royal Geographical Society five years ago, and reported in these pages ("The Face of the Earth," NATURE, April 26, 1894). This lecture set forth the conception of crust-torsion, demonstrating that "like the present surface of a typical geological formation . . . the surface of the earth-crust at the present day is most simply regarded as the surface of a continuous sheet which has been warped up by the two sets of undulations crossing each other at right angles. But in the case of the earth-surface, the one set of undulations ranges parallel with the equator, and the other ranges from pole to pole."

Prof. Lössen's explanation of the involved stratigraphy of the Harz mountains lays the foundation of our knowledge of torsion phenomena in the field, and, although other explanations have been given of the special difficulties in the Harz mountains, Prof. Lössen's is now generally accepted.

When working out the detailed stratigraphy of a part of the Dolomites, I experienced the same difficulties which Prof. Suess had indicated in connection with the "whirled lines" of the Alpine system generally. My results were laid before the Geological Society in December 1898, and are now published in the August issue of the *Quart. Journ. Geol. Soc.*, along with a stratigraphical map of the district examined. In that paper I have tried to show that the possible solution of some of the difficulties lies in the association of torsional movements in conflicting directions through the crust, with movements of crust-folding taking place across a pre-existing set of crust-folds. The *change in the direction of the resultant earth-thrust* is the cause to which I have ascribed the torsional phenomena observed in the crust-folds.

The following notes will indicate as briefly as possible wherein the characteristic features of Sella and Enneberg in the Dolomites are analogous with characteristic features of the Alpine system, and how far the elucidation I have offered for that area on the lines of torsion may be capable of a wider application.

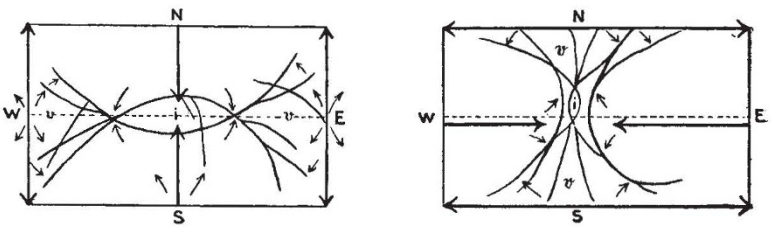

FIG. 1.—Formation of fold-arcs under the influence of torsion-forces. *i*, areas of interference; *v*, areas of virgation.

The stratigraphy of Sella and Enneberg is characterised by twisted strikes, twisted cleavages, twisted arches, twisted troughs, twisted faults, twisted dykes and sills—in fact, the rocks have been twisted and sheared to such a degree that thick deposits have been twined into the form of rock-whorls and large masses of limestone for the greater part changed to dolomite. The various combinations of twisted strikes produce the effect of "whirled" stratigraphical lines round individual centres of the region examined. Sigmoid curves in one direction are correlated with sigmoid curves in another, and arcs which are convex towards north and south are connected by virgating lines with arcs which are convex towards east and west.

Thus we may say that the curves round the north, east, and south of the Sella mountain resemble the "whirl-shaped leading lines" of the Riviera Alps, Apennines and Algerian mountains round the western basin of the Mediterranean Sea; while the curves round the north, west, and south of the Pralongia and Sett Sass area resemble the whirl-shaped lines of the Dalmatian and Pindus mountains and the curvature through the eastern basin of the Mediterranean Sea. The latter curvature resembles that of the mountains around the Roumanian plain, or of the Alps round the plain of Piedmont.

Examples might be multiplied interminably, and on great and small scale, *the reason being that the essential structure of the Alpine system is based upon spirally twisted folds, and not upon linear anticlines and synclines.*

The formation of fold-arcs is illustrated in the accompanying diagrams (Fig. 1), which show that the action of one torsion-couple must be compensated by the reverse action of a correlated torsion-couple, and a fold-arc convex towards one compass direction must be coordinated with a fold-arc convex towards the opposite compass direction. When the convexities approach one another during torsional movements the result is that oppositely-curved fold-arcs intertwine in an area which may be

[1] Condensed from the concluding chapter, "Application to the Alps," in a paper presented at the Roy. Geol. Soc., December 1898.