Simply that when in the course of events an investigator is given great opportunities, it should be assumed that he is a heaven-born Lucifer, and will act accordingly. Should he prove unequal to the trust reposed, and his ways be ways of darkness—not of light—another must be entered in his place, but a truce to half-way measures. Research with a string to it suffers too many drawbacks.

Yet, even with freedom and right intellectual surroundings, we as investigators can hardly lay too much emphasis on the frame of mind in which we approach the problems that confront us. By our common methods, and even by our metaphors, we too often seem to advance upon the undiscovered country as though the chief desire were to reclaim it anyhow and any way, so that it were done rapidly and before others could arrive. This is a notion borrowed from the creed of economics, but it does not fit research. The endowment of research can foster more than this. Just as the frontier is not only the locality of active advance, but also the place where strong frontiersmen grow, so the chief gain coming from those stationed on the boundaries of science is not the mere reclamation of the wilderness, but far more, the improvement of the scientific breed, for as we advance the problems become rapidly more difficult, and it is only the abler men who can push on the work. For us then it becomes a privilege, if not a duty, to so work together that in this country the endowment of research shall be adjusted to preserve the intellectual stimulus and the scientific freedom which the universities afford, while it removes some of the drawbacks 'thereunto appertaining,' and so administered that in stimulating scientific activity, it shall do this not only and not mainly for the sake of immediate returns, but also, and even more, for the sake of the effect which the experience must have on those who do the work—aiming to develop the better man to meet the greater problem.

Henry H. Donaldson.

American Association for the Advancement of Science.
Section E—Geology and Geography.[1]

The section was called to order by Professor Eugene A. Smith, retiring vice-president, who introduced and resigned the chair to his successor, Professor William North Rice. On motion Professor L. C. Glenn, of Vanderbilt University, was elected secretary *pro tem.* in the absence of the regular secretary of the section, E. O. Hovey. President C. R. Van Hise was elected a member of the council, Professor E. H. Barbour a member of the general committee and Professor L. C. Glenn press secretary. Fifty-nine members of the association were recommended for promotion to fellowship, forty of them on the basis of their membership in societies of high technical standing.

The address of the retiring Vice-president, Professor Eugene A. Smith, was on the subject 'On some Post-Eocene and Other Formations of the Gulf Region of the United States,' and will be printed in full in Science. Eleven other papers were upon the program, six of which were read in full by their authors. The other five were read in abstract or in full by the secretary *pro tem.* in the absence of their authors. Abstracts of all the papers read follow:

On the Use of the Words Synclinorium and Anticlinorium: William North Rice.

A technical term once introduced should be retained in the original sense. If in the progress of thought the concept which a word expresses ceases to be useful, the word may become obsolete, but should not be used to express a totally different idea.

[1] New Orleans meeting.

Secondly, a technical term should be etymologically appropriate.

The words *synclinorium* and *anticlinorium* were introduced by James D. Dana.[2] According to the form of the contraction theory of mountain-making developed by Dana, most monogenetic mountain ranges were believed to have been made by the crushing of the strata in a geosyncline. Such a range he proposed to call a *synclinorium*. The final part of the word is from ὄρος, mountain, and the word is altogether appropriate etymologically. Dana, however, recognized that a somewhat permanent line of elevation might be formed as a geanticline, a considerable area of the crust being elevated into a gentle arch without any considerable disturbance of the strata. Such a range he proposed to call an *anticlinorium*. As an example of an anticlinorium he cited the 'Cincinnati Uplift' formed in mid-Paleozoic time, nearly contemporaneously with the Taconic synclinorium.

The words synclinorium and anticlinorium are accordingly not stratigraphic, but orographic terms. They denote two types of mountain elevations.

I believe the anticlinorium type is more important than Dana himself supposed. The Appalachian range, for instance, was formed as a synclinorium in post-Carboniferous time, subsequently peneplained, and reelevated as an anticlinorium in Tertiary time. This remark is made in passing, as it is not my purpose at present to discuss the theory of mountain-making.

It is much to be regretted that several recent writers have used the words in entirely different senses. Van Hise unhappily set the example in his masterly—his really epoch-making—studies of rock deformation.[3] He uses the words in a purely stratigraphic sense, making an anticlinorium simply a compound anticline, and a synclinorium a compound syncline. He distinguishes synclinorium and anticlinorium from geosyncline and geanticline, using the latter pair of words substantially in the sense in which Dana used them. The etymology of the words synclinorium and anticlinorium is as inappropriate in the new sense as it was appropriate in the original sense.

Sir Archibald Geikie[4] and Scott[5] follow in the footsteps of Van Hise, distinguishing synclinorium and anticlinorium from geosyncline and geanticline, but using the former pair of words in the sense simply of compound folds. Geikie explicitly attributes to Dana the usage which he follows, but has apparently taken his definitions from Van Hise without referring to Dana's paper.

Chamberlin and Salisbury[6] have introduced a further confusion by treating synclinorium and anticlinorium as synonyms respectively of geosyncline and anticline.

It is, perhaps, too late to restore the words to their original sense, after they have been used in other senses by writers of so high authority. Yet such restoration seems very desirable.

The Overlap of the St. Stephens Limestone on the Lower Tertiary Formations in Crenshaw and Pike Counties, Ala.: EUGENE A. SMITH.

The paper described, with the aid of a map, a case of overlap of the Vicksburg limestone on the Nanafalia division of the lower Tertiary, where the former occurs in detached patches in the territory of the latter. The whole series of the intervening Tertiary formations outcrops between these

[2] *American Journal of Science*, Series 3, Vol. 5, pp. 431, 432.

[3] *Journal of Geology*, Vol. 4, p. 319.

[4] 'Text-book of Geology,' latest edition, pp. 678, 679.

[5] 'Introduction to Geology,' pp. 236–238.

[6] 'Geology,' Vol. 1, pp. 480, 481.

isolated patches and the regular outcrops of the Vicksburg.

On the Jackson Anticlinal in Clarke County, Ala.: Eugene A. Smith.

A well-defined anticlinal fold in Clarke County, Ala., shows some rather peculiar features of erosion and other phenomena which were described with the aid of an illustrative map.

Erosion at Ducktown, Tennessee: L. C. Glenn.

Ducktown is situated on an old peneplain now uplifted into a plateau and thoroughly dissected so that the actual surface consists of slopes many of which are steep. It is a region of deep surficial rock decay, of heavy annual rainfall and of thick forest-covering under natural conditions.

The roasting and smelting of copper ores in the recent past has entirely destroyed the vegetation and left the surface perfectly bare. Surface erosion is rapidly removing the soil covering. The slopes are already deeply scarred with gullies only a few years old which are still rapidly growing.

The waste from the steep slopes has buried the former surface along the streamlets between them and is rapidly building up waste planes, so that neither slope nor narrow flood-plain is of any value for agriculture or grazing. Reforestation will be a very slow and difficult process.

Floods on these small streams rise higher and more rapidly than formerly and subside more quickly. During dry seasons some springs that were formerly perennial go dry and others almost cease flowing.

The case has peculiar importance as an illustration of not only the possibilities but the certain results of deforestation by man in other parts of the southern Appalachians, and of the need of adoption by the general government of a policy of forest preservation in these mountains.

The Hydrology and Geology of the Gulf Embayment Area of West Tennessee, West Kentucky and Southern Illinois: L. C. Glenn.

Unconsolidated deposits of Cretaceous or later age consist from below upward of Coffee, Rotten Limestone, Ripley, Porter's Creek, La Grange, Lafayette, Loess, Loam and Alluvium formations, the last four being surficial, but giving character in much of the area to waters from springs and shallow wells. Structurally the rocks dip gently from the edge toward the center of the embayment area.

The Coffee, Ripley and La Grange are water bearing and form one or more available sources of potable deep water over practically the entire region. The La Grange covers the greatest area and is most important. Deep waters are gotten at depths varying according to local conditions from 150 to 700 or 800 feet, the majority ranging from 200 to 400 feet. The water flows out at the surface in many cases and rises nearly to the surface in many others. The quality of the deep water is generally good. If any mineral matter is present it is apt to be a small amount of iron carbonate. Calcium and magnesium carbonate and sulphate may be present in some cases, usually in small quantities.

Increasing attention is given by the inhabitants of the region to these deep waters, and wells are sunk not only for corporate and industrial supply but for many private families. The beneficial effect of the deep water on the health of the users is marked.

The Skull of Syndyoceras: Erwin H. Barbour.

A new fossil mammal, allied to *Protoceras* of the Oligocene and to the modern antelope, was discovered by the Morrill Geological Expedition of the University of Nebraska during the past season in the

Loup Fork Tertiary of Sioux County, Neb. The skull of this genus, which has been named *Syndyoceras,* is characterized by two prominent frontal horns which curve inward and by two maxillary horns which rise from a common trunk and curve outward. The anterior horns divide the anterior nares into two parts, the posterior of which resembles a blow hole. The lower canines have become incisiform by migration, and likewise the first premolar has become distinctly caniniform.

The following abstracts were read by the secretary *pro tem.* in the absence of the authors of the papers:

The Keweenawan at Lake of the Woods in Minnesota: N. H. WINCHELL.

A visit in August, 1904, to the south shore of the Lake of the Woods, disclosed large areas of gabbro, apparently identical with that of the Keweenawan seen at Duluth and at other points in northern Minnesota.

An examination of specimens collected by J. E. Todd for the Minnesota Geological Survey, now in the museum of the University of Minnesota, warrants the assumption not only that this rock, under some shades of variation, occurs widely on the south shore of this lake, but also that it is associated with heavy basaltic rocks quite similar to the black basalts of the Lower Keweenawan, as well as with red granite.

This discovery, while correcting the prevalent idea of the 'Laurentian' age of the rocks of the south shore of Lake of the Woods, indicates that the strike of the Keweenawan from Duluth passes northwestwardly, and probably includes the outcrop of copper-bearing amygdaloid lately announced by the Canadian Geological Survey, occurring in the prairie at the north end of Lake Manitoba, where the strike of the formation is northwest and southeast.

Some Sink-hole Lakes of North Central Florida: E. H. SELLARDS.

The porous and very soluble limestone underlying the Florida peninsula has occasioned some unusual topographic features. Owing to the surface mantle of sand, the porous limestone and the general flatness of the country, a very small part only of the rainfall passes off as surface water, the greater part going at once into the ground. The dissolving effect of surface water is shown in the enlargement of stream basins through limestone. The solvent effect of underground water is indicated by numerous sink-holes throughout parts of the peninsula. By far the greater number of these sinks are small. Some, however, reach considerable size. All are more or less perfectly circular. In time the banks become less steep through decay of rocks, and the sink thereby enlarged. In limestone regions with little or no clay above, sinks often remain open at the bottom, thus forming natural underground entrances for such rivulets or streams as drain to them. In regions holding some clay the sinks are likely to become permanently clogged and fill with water, affording a starting point around the sides for the hardwood species of plants. Occasional sink-holes occur of such size as to be entitled to mention as small lakes. Illustration of this kind of lake is taken from a series of sinks on the proposed university grounds at Gainsville. The largest of these spreads over something more than an acre. The banks are thickly clothed with the hardwood, or 'hammock' types of vegetation, and while steep on one side are sloping on the other. The overflow in the rainy season is carried away by a small stream heading near the sink. The sink presents many of the features of a small lake, yet is not so old or so far developed that its sink-hole origin is not clearly evident. Small, circular, possibly solution, lake basins are ex-

ceedingly numerous in Florida. The 'sink-hole' origin is assumed, however, to apply to a very few only of these.

Old Age in Brachiopods: H. W. Shimer.

Brachiopod shells show old age along lines parallel to that exhibited by higher animals; when maturity is passed the tissues cease growing so rapidly and finally begin to shrink. As the mantle, the principal shell-secreting organ, shares in these states, it must express them in its growth. After a species has attained its fully mature size, which size varies in different individuals, the decreasing rate of growth is shown in the more or less sudden change in the angle of curvature from the beak to the front of the shell. This is followed in very old individuals by the development of a groove at the contact of the two valves, indicating that actual shrinkage of the mantle has occurred. Some of the other accompaniments of old age are the lamellose condition of the concentric growth lines, development of spines and nodes, and the thickening of the valves by internal addition, especially around the muscular impressions. Externally, old age characters appear first at the cardinal angles and advance progressively to the front of the shell.

Dipnoan Affinities of Arthrodires: C. R. Eastman.

By means of a new interpretation of the jaw parts of Arthrodires, which is here suggested, homologies are established between them and the corresponding elements of dipnoans. The arrangement of mylostomid dental plates is shown to be closely paralleled in early stages of *Neoceratodus,* and the functional lower jaw is similarly articulated with the head-shield. Intimate structural resemblances, not only as regards cranial characters, but throughout the entire organization, are brought out through comparison of Arthrodires with modern lung-fishes, and these are scarcely to be explained except on the theory of a common origin. All available evidence points to the correctness of Newberry's original interpretation of Arthrodires as armored dipnoans, a view which is not now commonly entertained. Their origin is traced through primitive ancestral ceratodonts to the elasmobranch stem, independently of crossopterygians.

The Great Catalogue of the Heber R. Bishop Collection of Jade: G. F. Kunz.

The magnificent collection of jade which was made and presented by Mr. Heber R. Bishop during his lifetime to the Metropolitan Museum of Art, in New York, has been installed in a room which Mr. Bishop himself designed and had decorated by the noted firm of Allard Frères, of Paris, to make it the finest example on this continent of the style of Louis XV. The collection is here placed in some fifteen elegant cases, of gilt, bronze and plate glass, all in Louis XV. style, which with the decorations of the room illustrate a permanence and richness of material never excelled even in the time of the artistic French monarch himself.

The catalogue which is the subject of this note is issued in two magnificent volumes, and is limited to an edition of one hundred copies, none of which goes to a private individual and none of which will be sold. These volumes (stately folios) are printed on the finest quality of linen paper, and weigh, respectively, 69 and 55 pounds, or 124 pounds together. They contain 570 pages (Vol. I., 277 pp., Vol. II., 293 pp.), measuring nineteen by twenty-five inches. There are 150 full-page illustrations, in the highest style of execution—water-color, etching and lithog-

raphy—and nearly three hundred pen-and-ink sketches in the text.

No expense or care was spared in the execution of the work; some thirty scientific men and art specialists, both in Europe and in America, were engaged to contribute their views upon various aspects of the whole subject; and the illustrations were prepared in the finest manner possible, Chinese and Japanese artists being employed to execute many of them, and color experts being freely consulted, under the supervision of Mr. Bishop himself. The catalogue has, moreover, a special value from the fact that all the scientific investigations described therein were made upon material taken from the specimens in the collection itself.

This whole work, from its inception by Mr. Bishop in 1886 to the final distribution of the volumes, has required about twenty years, and was entirely planned and thought out by him. It is a cause of much satisfaction that the enterprise has been so fully and successfully completed along the lines which he laid down; but it is also a source of profound regret that he could not himself have lived to witness its final accomplishment. The whole cost has been met by the liberality of Mr. Bishop's provision, carried out by the care and thoughtfulness of his executors.

Attendance at the meetings of the section was discouragingly small, there being but seven geologists present during the whole time of the association meeting, and two of these did not arrive until after the adjournment of the section.

The foregoing account of the meeting has been prepared from the full notes kept by the secretary *pro tem.*

EDMUND OTIS HOVEY,
Secretary.
AMERICAN MUSEUM OF NATURAL HISTORY.

MORPHOLOGY AND PHYLOGENY.[1]

WE are at the present time passing through a season of morphological thaw. The doctrine of definite and fixed morphological types has been somewhat slower than that of the fixity of species, in melting under the fierce light, which beats on all scientific generalizations; but its disappearance has not been less final or less complete. This breaking up of the ice of morphological formalism, which has so long needlessly restrained the course of morphological and phylogenetic research, is not altogether unattended with the dangers which accompany the opening of a new spring. On the part of some there is fear or even hope, that not only the ice, but the banks of the river as well, will be swept away by the raging flood. There is, however, no more need to dread the final result for phylogeny, than there was to fear the disappearance of the doctrine of fixity of species, half a century ago, as subversive to taxonomy. On the contrary, we may reasonably expect that, as in the case of the sister science, morphology and phylogeny will in the long run vastly benefit by getting rid of the constraint of mere formalism.

It is now more than a generation since any considerable number of biologists has believed that species were created once and for all, and unchangeable until they became extinct. At the present time this doctrine enjoys scarcely even a pagan persistence in some of our more belated schools of learning. Whatever may be our individual views in regard to the doctrine of descent or evolution, we are in general agreed that species are derived by modification and change from previous species and not by a special creative *fiat*. This conclusion, as Darwin pointed out many years ago, in his 'Origin of Species,' is at bottom a mor-

[1] Presidential address delivered before the Society for Plant Morphology, Ann Arbor, December 29, 1905.