place to place. At one point triassic beds, sloping away at varying angles from the flanks of the mountain, rest directly upon the Archæan beds; at another point, the lower beds of the cretaceous; at still another, and this more rarely, the carboniferous limestones are exposed, resting against the Archæan; while above them, always conformable, are found the triassic, Jurassic, and cretaceous formations, as one follows the section in an ascending geological sense. These facts make it evident that these beds have not been folded into a long anticlinal fold, the crest of which was subsequently planed off by erosion, but that the exposed Archæan parts represent an ancient continent or island along whose shores the younger beds were deposited. The lithological character of the series confirms this view, as they bear internal evidence of being a shore deposit. The Colorado Range is the most extensive of these ancient land-masses. Originally the western boundary of the Park area consisted of two or more masses, forming a general line of elevation parallel to the Colorado Range. Through the south-eastern portion of this area, and parallel with its longer axis, runs the valley of the Upper Arkansas River, which, however, during paleozoic and mesozoic times, did not exist.

The Mosquito Range was not formed until the great dynamic movement in the Rocky Mountain region at the close of the cretaceous. Enormous masses of eruptive rocks are found in this region crossing the sedimentary strata to greater or less elevations, and then spreading out in immense sheets along the planes of division between the different strata. From the fact that these interbedded sheets of eruptive rocks are found practically conformable with their bounding strata, and, like them, folded into sharp folds and cut off by faults, Emmons concludes that the eruptive activity preceded the uplift of the Mosquito Range. The latter was effected by a pushing-together from the east and from the west, a secondary movement acting in a north-and-south direction. The Archæan masses, between which the conformable series was deposited, the resistance of which caused the crumpling of the beds, must have participated in the folding.

A special chapter is devoted to the discussion of the geological phenomena and theoretical questions. The most important of these are the discussion on the folds and faults, and a comparison of the monoclinal folds and the great faults of the Great Basin with those of the Rocky Mountains. Emmons believes that the former are folds similar to those of the eastern mountainous region. He considers them true plications, and believes, that, could the structure beneath the valley be seen, the missing faulted-down members of the fold would be found. His principal objection against the reading of the geological structure of the Great Basin accepted by many scientists, that it is a region of faulted blocks uplifted in different directions, and practically without plication, is, that this theory would involve the actual annihilation of considerable wedge-shaped segments of stratified beds by the simple action of faulting. His theories of the origin of mountain-ranges are in accordance with Suess's theories. He denies the existence of an uplifting force, but considers the faults as caused by contraction and consequent sinking, while the folding is caused by tangential pushing and crumpling of superficial strata of the earth's crust. Another object which he discusses fully is the origin of dolomites and serpentine, the origin of the intrusive masses, and the improbability of sedimentary rocks being absorbed by eruptive masses.

The second part of the volume deals with the mining industry, with the origin of the metal deposits, and the methods of smelting. The atlas contains, besides numerous sections, a reprint of the Hayden map of Central Colorado, and a topographical map of the Mosquito Range drawn so that the light falls from the north-west and at an angle of 45° upon the mountains, by which method the topographical features appear very clear and distinct.

An Inquiry into Socialism. By THOMAS KIRKUP. New York, Longmans. 12°.

THE author of this book declares himself a socialist, but he means by socialism something quite different from what usually passes by that name. He does not favor communism, nor State socialism, nor an equal division of property; and he condemns all anarchical and revolutionary methods. He would extend the powers of government to a certain extent, especially in the municipalities. But he means by socialism chiefly what other folks call co-operation, — the ownership of the means of production by voluntary associations of laborers. He remarks, as many others have done before him, that the main defect in our present industrial organization is the divorce of the laborers from land and capital. But as the individual ownership of land and capital is becoming impossible, the only way out of the difficulty is by the joint ownership of both by associations of laborers. Yet he does not propose, like most of those who call themselves socialists, to take the property away from those who now possess it without giving them compensation: he proposes to pay for it. Moreover, he does not favor doing it by the action of the State, but by the gradual extension of voluntary co-operation. In short, he lays down as the cardinal principle of socialism, that, "whereas industry is at present carried on by private capitalists served by wage-labor, it must in the future be conducted by associated or co-operating workmen jointly owning the means of production" (p. 94).

Now, it is clear that such a system as this is very different from what is commonly called socialism, and we believe that most of those that style themselves socialists would repudiate it. Certainly they show at present no inclination toward voluntary co-operation; for if they really favored it, as Mr. Kirkup does, they would set about organizing co-operative societies. We admit, however, that Mr. Kirkup's socialism is a great improvement on that which is commonly so called; but then it does not differ essentially from what economists have always advocated under the name of 'co-operation.' Most economists of the orthodox school would disagree with Mr. Kirkup in regard to extending the functions of government; but otherwise they would have little to say against the system he advocates as an ideal for the future. He paints the evils of the present system, with its millionnaires and its beggars, in a vivid light, and with too little attention to its better features; yet he admits that skilled laborers, at least, are better off now than formerly. With regard to the prospects of the system he advocates, he does not speak in the most sanguine terms; and he clearly recognizes the difficulties in the way of its establishment. Indeed, he expressly says, that, "without a great moral advance, socialism may be regarded as impracticable" (p. 159), — an opinion in which most advocates of co-operation will be likely to agree. Mr. Kirkup's style is fairly good, and he has made an interesting book; but we very much doubt if it will meet with much approval among the mass of those who call themselves socialists; while at the same time his use of the term 'socialism' to designate the system he advocates is liable to raise a prejudice against it in the minds of others.

NOTES AND NEWS.

M. MOISSAN describes, in the *Annales de Chimie et Physique*, his long-continued experiments for isolating fluorine. While all former attempts to reach this result failed, M. Moissan, after many failures and disappointments, succeeded in his endeavors by electrolyzing anhydrous hydrofluoric acid in which the double fluoride of potassium and hydrogen was dissolved. *Nature*, in describing Moissan's experiments, gives a *résumé* of the remarkable qualities of fluorine as observed by Moissan. Sulphur, brought near the orifice, at once melted and inflamed; selenium behaved in like manner; as did also tellurium, with incandescence, forming fumes, and becoming coated with a solid fluoride. Phosphorus at once took fire, forming tri-, penta-, and oxyfluorides. Powdered arsenic and antimony combined with incandescence, the former yielding drops of AsF_3. A fragment of iodine placed in the gas combined, with production of a pale blue flame; in an atmosphere of iodine vapor, fluorine itself burned with a similar flame. Vapor of bromine lost its color, and the combination was sometimes accompanied by detonation. Cold crystalline silicon at once became incandescent, and burned with great brilliancy, sometimes with scintillations. On closing the little tubes containing it with the thumb, and opening under water, the silicon tetrafluoride formed was absorbed and decomposed, with precipitation of silica. Any undecomposed silicon was found to have been fused. Debray's adamantine boron also burned in the gas, becoming incandescent, and giving off fumes. Fluorine has a most extreme affinity for hydrogen: they combine in the dark, with explosion. In one of the

experiments the electrolysis was allowed to continue several hours, so that eventually the small quantity of undecomposed acid remaining in the **U**-tube was insufficient to keep the two gases apart: the experimenters were consequently suddenly startled by a violent detonation. The hydrogen and fluorine had combined in the dark at the low temperature of — 23°. The same detonation was afterwards brought about on a smaller scale by reversing the current. On bringing the wide-mouthed delivery-tube of a hydrogen-generator near the orifice, the detonation at once occurred, and the hydrogen inflamed. Metals are all attacked with more or less energy by fluorine, forming fluorides. Cold sodium and potassium were at once rendered incandescent. Calcium, magnesium, and aluminium acted similarly, in a more modified manner, becoming incandescent when slightly warmed. Powdered iron and manganese, on gently warming, burned with bright scintillations. Lead was attacked in the cold, and tin at a slightly elevated temperature. Mercury, as suspected, entirely absorbed the gas, forming yellow protofluoride. Silver, at a gentle heat, became coated with a beautiful satin-like fluoride, soluble, unlike the chloride, in water. Gold and platinum at 300°–400° became coated with their respective fluorides, which were decomposed again at a red heat, with evolution of free fluorine. Perhaps the strongest evidence of the intense chemical activity of fluorine is exhibited in its action upon cold potassium chloride: the chlorine was at once expelled, filling the air with its disagreeable odor, and was identified by the usual chemical tests. Chlorine was also expelled from its combination with carbon in carbon tetrachloride. All organic compounds are violently attacked by fluorine; a piece of cork at once carbonized and inflamed; alcohol, ether, benzene, and turpentine took fire immediately in contact with it. Glass, as might have been expected, is at once corroded by fluorine: some very delicate experiments were carried out with perfectly dried glass, with the same result. Many other re-actions, all interesting and all showing the immense energy with which the atoms of fluorine are endowed, were performed, but one especially ought to be noticed; viz., the action of fluorine upon water. It is a singular fact, that, whenever oxygen is liberated in the cold, there is a great tendency to form ozone: hence, when fluorine is attempted to be collected over water, the gas collected is not fluorine, but ozonized oxygen; water is decomposed by the fluorine, forming hydrofluoric acid, while the oxygen is set free, and a considerable quantity of it is converted into the more condensed form of ozone.

— A new journal for promoting the teaching of physics and chemistry is being published in Berlin (*Zeitschrift für den physicalischen und chemischen Unterricht*, Springer). It is edited by Dr. F. Poske. In an introductory note, the editor emphasizes the educational value of the teaching of physics. He says that it must show how the knowledge of physics originates, — historically and logically, — and that by doing so it is as valuable a means of education as any other science. The first number contains a paper by the eminent physicist and philosopher, E. Mach, on the teaching of the physics of heat, and another by M. Koppe on Foucault's pendulum experiment. There are numerous descriptions and illustrations of simple apparatus for demonstrating physical experiments in school.

— The third annual meeting of the Indiana Academy of Science was held at Indianapolis, Dec. 28 and 29. The following is a list of the papers read: D. W. Dennis, 'The East-West Diameter of the Silurian Island about Cincinnati;' C. R. Dryer, 'The Kames of Allen County, Ind.;' J. T. Scovell, 'Erosion in Indiana;' D. A. Owen, 'A Geological Section of Johnson County, Ind.;' D. W. Dennis, 'The Transition of *Orthis occidentalis*, Hall, into *Orthis sinuata*, Hall;' O. P. Hay, 'Notes on Some Fossil Bones found in Indiana;' O. P. Jenkins and W. V. Brown, 'Location of Eel River Falls;' J. C. Branner, 'A Sketch of the Geology of Arkansas' and 'The meanderings of the Arkansas River below Little Rock;' J. U. Nef, 'On Carboxylated Derivatives of Benzoquinone;' W. A. Noyes, '*Beta* para Nitro-toluic Acid;' J. U. Nef, 'On Chloranil;' J. L. Campbell, 'The Reversal of the Electric Current in the Holtz Induction Machine;' C. A. Waldo, 'A Method of Determining the Epicentrum of an Earthquake;' B. W. Evermann, 'The Fishes of Carroll County, Ind.;' W. P. Shannon, 'A List of the Fishes of Decatur County, Ind.;' D. S. Jordan, 'The Isthmus of Panama as a Barrier to Marine Fauna;' O. P. Jenkins, 'Notes on Some Southern Indiana Fishes;' D. S. Jordan, 'Blind Fishes and Natural Selection;' F. M. Webster, 'An Unusual Appearance of *Apatura celtis* along the St. Francis River in Arkansas;' J. S. Kingsley, 'The Origin of Anthropods;' G. G. Hubbard, 'List of Butterflies of Jefferson County, Ind.;' W. P. Shannon, 'List of Butterflies of Decatur County, Ind.;' F. M. Webster, 'Drouth, and its Effect upon Insect Increase and Decrease,' 'Distribution of Some Species of Injurious Insects, throughout Indiana, during the Season of 1887,' and 'The overflow of the Mississippi River, and its Effect upon the Species of *Simulium* (Buffalo Gnats) infesting the Smaller Inland Streams of the Adjacent County;' Amos W. Butler, 'Some Rare Indiana Birds;' Maurice Thompson, 'The Secondary Functions of the Hyoid Cornua in *Picus* and *Colaptes*;' Amos W. Butler, 'Suggestions concerning a Law for the Protection of Birds;' D. S. Jordan, 'The Origin of Genera;' C. W. Hargitt, 'Some Curious Monstrosities in Egg-Formation;' W. S. Windle, 'The Skull of *Necturus lateralis*;' J. M. Coulter, 'Evolution in the Vegetable Kingdom' (presidential address); C. W. Hargitt, 'Notes on *Scaphiopus holbrookii*;' O. P. Hay, 'Observations on the *Amphiuma*;' B. W. Evermann, 'The Occurrence of the Star-nosed Mole in Indiana;' A. W. Butler, 'Notes on Some Indiana Reptiles and Amphibians;' O. P. Hay, 'Some Additions to the List of Indiana Reptiles;' Lillie J. Martin, 'A Chemical Study of *Juglans nigra*,' and 'The Value of Organized Work in Plant-Chemistry;' O. M. Meyncke, 'The Late Drouth and its Effect on Vegetation;' Stanley Coulter, 'Histology of the Foliage Leaf of *Taxodium distichum*;' John M. Coulter, 'Stomata of *Tillandsia usneoides*;' G. G. Hubbard, 'Additions to the Flora of Indiana;' J. N. Rose, 'Characters in *Umbelliferæ*;' O. M. Meyncke, 'Companion Plants;' Walter H. Evans, 'Lichens of Indiana;' J. C. Arthur, 'Life-History of the Plum-Leaf Fungus;' O. M. Meyncke, 'Notes on the White-spored Agarics of Franklin County, Ind.;' T. B. Redding, 'Man an Evolution: Biological Proofs.'

— A meeting for the purpose of organizing the American Folk-Lore Society was held at University Hall, Harvard University, Cambridge, Mass., on Wednesday, Jan. 4. Rules for the government of the society were enacted, of which the first declares that "the American Folk-Lore Society has for its object the study of folk-lore in general, and in particular the collection and publication of the folk-lore of North America." The rules further provide that the society shall consist of members who subscribe an annual fee of three dollars; that each member shall be entitled to a copy of the journal to be issued by the society; that an annual meeting shall be held; and that the affairs of the society shall be conducted by a president and a council of fourteen members, to be elected annually. Prof. E. J. Child of Harvard University was elected president.

— The *Railway Review* of Jan. 7 says that on Dec. 31, 1885, there were 10,746 miles of railways in operation in South America, of which 4,378 were situated in Brazil. We have compiled the statements given in the *Annuario do Imperial Observatorio do Rio de Janeiro* of 1887. It appears that on Dec. 31, 1886, approximately 4,820 miles of roads were in operation, while 2,530 miles were being constructed and surveyed. The statements given in the *Annuario* are not sufficiently clear to give exact figures for the lines. The value of the information given in the annual is enhanced by tables giving the elevations of the stations. According to the *Annuario* of 1886, 4,607,213 miles of telegraph-lines were in operation, of which 1,325,894 miles are in the Province Rio Grande do Sul.

— A course of eight lectures on subjects of general interest is to be given by leading scientific men in behalf of the Marine Biological Laboratory, under the auspices of the Boston Society of Natural History. The Marine Biological Laboratory is to be a permanent station on the New England coast, where suitable opportunities and conveniences may be had for teachers, professional naturalists, and others, to collect and study the animals and plants of the sea. The project has the support of the naturalists of the country and of many liberal citizens, who have already contributed several thousand dollars toward the funds needed. The receipts from the lectures will be applied to increase the funds. If a sufficient sum is

obtained now, the laboratory will be opened next summer. The following is a list of the lecturers and their subjects: Jan. 18, Prof. W. H. Niles of the Massachusetts Institute of Technology, 'Mountain Sculpture;' Jan. 25, Maj. J. W. Powell, director of the United States Geological Survey, 'Savagery, Barbarism, and Civilization;' Feb. 1, Prof. H. N. Martin of the Johns Hopkins University, 'A Hen's Egg;' Feb. 8, Prof. George L. Goodale of Harvard College, 'Seeds;' Feb. 15, Prof. F. W. Putnam, director of the Peabody Museum of American Archæology and Ethnology, at Cambridge, 'The Serpent Mound and the Ancient People of the Ohio Valley;' Feb. 22, Prof. Alpheus Hyatt, curator of the Boston Society of Natural History, 'A practical Example of the Evidence for Evolution;' Feb. 29, Dr. Henry P. Bowditch, dean of the Harvard Medical School (subject to be announced); March 7, Prof. Edward S. Morse, director of the Peabody Academy of Science, Salem, 'Reptilian Affinities of Mammals.'

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Trinity Formation of Arkansas, Indian Territory, and Texas.

DURING the past field-season the writer has had an opportunity to study the small mesozoic area in the south-west corner of the State of Arkansas and south-eastern Indian Territory, which is the north-eastern termination of the great area so well developed to the southward in Texas. By courtesy of Dr. John C. Branner, State geologist, I am permitted to publish the following note in advance of the more detailed official report which will soon be published by him.

In previous papers (*American Naturalist*, Feb. 1887; *American Journal of Science*, April and October, 1887) I have shown that the mesozoic strata of the Texas region, instead of belonging to the uppermost cretaceous as had been previously supposed, really embraced a large series of lower cretaceous and perhaps Jurassic beds. To the last-named period I intimated that the strata in Parker County, Tex., provisionally termed in my section the 'Dinosaur Sands,' would probably be found to be related. The studies of the past season in Arkansas have shown that these strata exhibit great uniformity of deposition along the paleozoic and mesozoic parting from south of the Brazos River in Texas, to the Little Missouri River near Antoine, Pike County, Ark., a distance of over three hundred miles, and that they rest directly upon the highly disturbed carboniferous rocks. In Texas the areal extent of this formation coincides with the eastern half of the Upper Cross Timbers, and in Arkansas it extends from the point above mentioned westward to beyond Ultima Thule. Its width, except for a few miles on each side of Red River, never exceeds a few miles. The formation consists of alternations of fine, closely packed white sands and red and blue gypsiferous marls, with occasional alternations of thin but extensive, fissile, arenaceous, and crystalline limestones, highly fossiliferous, often wave-marked, and seldom more than ten inches in thickness. Extensive strata of pure saccharoidal gypsum also occur in places, and the formation is the source of the salines and salt licks throughout its extent, and probably also of the 'brackishness' of the rivers which intersect it.

This formation is clearly distinguished from the overlying cretaceous (which deposits are later and later as we proceed eastward along the contact) and the underlying carboniferous. West of Weatherford the basal Comanche series may be seen resting directly upon it, while, at the point of its disappearance under the newer strata in Arkansas, it is directly covered by the uppermost cretaceous of Hilgard's Mississippi section.

The fauna of this formation is littoral and of great uniformity throughout its extent, and, upon hasty observation, conveys an impression that it is later than it really is. It consists of characteristic molluscan species which are hardly distinguishable from certain characteristic European forms specially indicative of the Upper Jurassic and Wealdan. I hope to give more detail concerning these fossils in a special paper hereafter. In Texas I found what are at present supposed to be dinosaurian remains; and occasional vegetal remains are met with.

To the continuous formation the name of 'Trinity' is applied, from the rivers of that name which arise in it. This includes the strata which I termed 'Dinosaur Sands' in my Texas section.

The discovery of these trans-Mississippi beds of Jurassic affinities is of importance, in that it indicates a close relation and possible continuity between the pre-cretaceous mesozoics of Colorado and the Texas Pan-handle, and the Tuscaloosa and Potomac beds of the cis-Mississippi region. ROB'T T. HILL.

U. S. Geol. Surv., Washington, D.C., Jan. 6.

Children's Development.

RECENTLY I became interested in the vocabulary of my boy, thirty months old, and for one day noted all words used by him, except proper names. No effort was made to exhaust the child's stock of words by questioning. He used three hundred and fifty-two words, of which fifty-four per cent were nouns, eighteen per cent verbs, and eleven adjectives. It is probable that the child's entire vocabulary of dictionary words includes four hundred or more. G.

Washington, D.C., Jan. 4.

Is there a Venomous Lizard (Heloderma)?

THIS animal has been an object of considerable interest to naturalists because of the question whether or not it presents the anomaly of a venomous lizard. Just before leaving the United States, last September, I had under my care about twenty so-called 'venomous lizards' of various ages and sizes; and, as I believe the biography of this animal has been but slightly touched on, a few observations in regard to them may not be out of place.

They varied in length from 19 to 49.5 centimetres. The larger ones, say above 43 centimetres, were all females. Their colors ranged from almost a brick-red to pale pinkish white, with markings from black to vandyke brown, which showed no regularity in details, appearing as if each lizard had been the subject of some Chinese artist who aimed only at the general effect. They all came to my father's establishment, in Rochester, by express; and the shaking-up and lack of freedom that they had undergone served to make them very irritable. When first liberated from their confining boxes, their first desire was to get hold of the nearest person, and, although usually very sluggish, they would then move with surprising agility, turning end for end, and making short dashes hither and thither with great swiftness. When one succeeded in fastening its teeth in my clothes, it held on with the tenacity of a bull-dog, occasionally giving a vicious shake to its head, as if trying to tear away a piece of the cloth. Nor was this pugnacity confined alone to the time of their arrival, but continued in lesser degrees during the entire time that I had them under observation. Once I saw a pitched battle between two. One had its teeth firmly fixed in the throat of the other, who, in turn, had a leg of the first in its jaws. Together they rolled and twisted over the floor, neither relaxing its hold for a period of fifteen minutes. Blood was drawn on both sides, yet neither afterwards appeared the worse for the conflict. I then tried two of them on a hen, to ascertain if they would prove poisonous to her. Having first shaved the thigh of the hen, so that the feathers might not interfere wth the entrance of any poison, I induced one of the lizards to take hold. This it readily did, and retained its grip for five minutes, occasionally shaking its head in a savage manner. During the operation the hen appeared quite impassive, and, although not tied, made no attempts to escape, evidently charmed by the lizard. A little blood was drawn, showing that the flesh had been thoroughly pierced. For perhaps a half-hour afterwards the hen appeared a trifle stupid, but soon regained its normal condition, and gave no signs at all of poisoning. Two days later I repeated the experiment with another lizard, with a similar lack of results. I then caused one of them to bite the edge of a saucer, and, with a hypodermic syringe, injected the fluid obtained in the breast of a pigeon. No effect. Then, exciting one so that it viciously bit a small piece of wood, I drew a considerable quantity of fluid direct from its mouth, which, injected into the pigeon's breast, produced no results.