objections, and the investigations now recorded tend to show (1) that the seams are not all similarly anthracitic, and though each seam is generally more anthracitic than the one above it, there are many exceptions to the rule; (2) that the anthracitic character was not due to faults, but existed before the faults were formed; (3) that the anthracite existed as such before the coalfield was reduced by denudation to its present dimensions; and (4) that the percentage of ash diminishes *pari passu* with the decrease of bituminous matter. These conclusions point to the variations in the composition of the coals having been either original or at least of very early date. Indeed, of all the suggested causes of alteration subsequent to deposition, none appear to have been adequate to produce more than a slight modification of the differences due to original composition.

Written in faultless literary style and edited with scrupulous accuracy, this valuable addition to geological literature will appeal to a wide circle of readers, and the authors deserve great credit for the success they have achieved in the first attempt to define the distribution of anthracite and to explain its origin on purely experimental grounds.

## VITALISM.

*Versuch einer Begründung der Deszendenztheorie.* By Prof. Karl Camillo Schneider. Pp. viii + 132. (Jena: G. Fischer, 1908.) Price 3 marks.

A COUPLE of years ago Prof. K. C. Schneider published six admirably clear and objective lectures as an introduction to the study of the evolution-theory. It was a useful exposition of the facts of variation and heredity, and of the Darwinian and Lamarckian interpretations. The present volume is critical and personal, and is not easy reading. We cannot do more than indicate the author's point of view. The first half of the book deals with stimulus, psyche and consciousness, subject and individuation, sensation and heredity, need and purpose, and Darwinism. The second half deals with mutation, potency, and structure; orthogenesis and extinction; trophic stimulus; vitality; entelechy and heritability; phylogeny, and the becoming of man.

The author's general position is closely akin to the positivism of Mach and Avenarius, which is, he thinks, the stable foundation for that part of the biological edifice that now requires building. Biologically he is perhaps nearest Weismann, but he believes that the psychical is the most important biological factor; he will not hear of the transmission of somatic modifications, but he believes that the transmigration of souls is almost self-evident. In discussing Lamarckism he points out that it has two sides; on the one hand, it is an erroneous theory of passive transformation conditioned by external stimulus; on the other hand, it is a true theory of the subjective response of a creative agent. He develops this second idea—which he calls by the extraordinary name of "Eulamarckism."

Prof. Schneider is a neo-vitalist who has the courage to say out and out that he believes in a specific vital energy, in a living substance. There are some who deny this, and maintain that life may be described as a succession of fermentations and the like, but this view ignores the phenomena of regulation and correlation, not to speak of memory and the power of profiting by experience. There are others who deny a living substance, and refer regulation and mental processes to an immaterial principle or agent, which deals directively with metabolism, though it is not of it. Schneider does not sympathise with either of these positions; he supposes a special vital substance, the vehicle of the specific vital energy, just as the ether is the medium for radiant energy. But this vital substance is not a particular kind of matter; it consists of psychical substances residing in the structural units of the organism. The relation between Psyche and Physis is illustrated by the mutual relations in thermochemical processes. The physical processes in the plasma, which are set going by stimuli, correspond to the chemical processes; the associated psychical energy corresponds to heat. On the one hand there is molecular movement, on the other there is cell-sensation. Life depends on the sensations of cells, as heat on the movements of molecules. As temperature is the intensity-factor of heat, structure is the intensity-factor of vitality, the measure of vital potency.

In a short notice it would not be for edification to try to expound the author's views on the four-dimensional character of consciousness or the law of the conservation of the psyche, or his theory that the mysterious process of assimilation represents a particular kind of gravitation, and that the psychical analogue of the force of cohesion is the entelechy or soul—the formative principle of the organism.

Prof. Schneider believes strongly in mutation, but the essential factor in species-formation is "*Descension*"—which means a thorough-going change in organisation, such as getting a notochord or gill-clefts. To study descensions is at present the most urgent task of ætiologists. What brings about a "Descension"? It is a step in the "entelechialen (synthetischen) Umprägung" which seems to be the most characteristic secret of the organism.

J. A. T.

## OUR BOOK SHELF.

*Arithmétique graphique. Les Espaces arithmétiques; leurs Transformations.* By Gabriel Arnoux. Pp. xii+84. (Paris: Gauthier-Villars, 1908.) Price 3 francs.

THE title of this little work does not indicate, as the English reader might expect, another addition to the ever-growing list of treatises upon geometrical methods of calculation or the graphical solution of ordinary problems. It might rather be described as an essay upon the geometrical interpretation of the theory of numbers.

The author has attempted a systematic exposition of what may be called the geometry of abacs and magic squares. By an *arithmetical space* he understands the set of all points (in a geometrical space of any number of dimensions) the coordinates of which are integral, and he has worked out the properties of such point-systems. Many theorems true for con-



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