it out in biology, nor does he give us the sociological equivalent of natural selection, philosophically expressed by Herbert Spencer in the phrase 'indirect equilibration.' Adaptation is an indirect social equilibration, the complete analysis of which remains to be made. Tarde, indeed, dwells on the fact that adaptation consists in a certain harmony and unity in the social world, from which it is clear that he sees the dependence upon it of the social order. Between adaptation and invention, in Tarde's wide use of both terms, we have an antithesis which in its essential aspects is the same as the antithesis between order and progress. It is just here that sociology naturally falls into the two great subdivisions of social statics and social dynamics.

It may be objected to the above analysis that it does not follow closely enough the method of the work under review, and that it goes back to the author's other works and even lays the conceptions of other authors under tribute. But this could scarcely be avoided in anything beyond pure exposition. As a matter of fact very little is said in this book of the great law of invention. But how could this be avoided in any glance at his system? The aim has been rather to summarize that system and present it as a whole, while laying special stress, as Tarde claims to do in this work, on the relations that the leading laws sustain to one another. But the system is a large one. It is thoroughly elaborated in a long series of books, and different readers may see many things very differently. Again, the excessive condensation necessary to a short review compels the omission of so many important things that no claim is made to having done justice to that system.

The English text forms a neat and convenient little volume, printed in clear type and tastefully brought out. The translation is free and the original is rendered in elegant English without obscurities or gallicisms. In a few cases it is open to the charge of being just a little too 'liberal.' Only one such need be referred to. On page 168 the original: "Et ce cas tend à se généraliser par les progrès de la machinofacture," is rendered by: "And this sort of case tends to become more general with the improvements in the manufacture of machinery." Aside from the fact that this does not convey the idea of the original, there is certainly a loss in avoiding the word *machinofacture*. This is a word of Tarde's special mintage, struck off with all due reserve in a footnote to page 174 of the *Logique Sociale*, and freely used thereafter, often as here, without italicizing, on the assumption that his readers now understand it. But it is as good English as French, and while in both languages the word *manufacture* has lost its literal implication of *handmade*, and embraces machine-made products as well and for the most part, still it was a fine stroke to call attention by this new term to the primitive form of industry, and to emphasize in one word the enormous stride that industry has taken, which, with all its blessings, is at the same time the fundamental cause of the chief socio-economic problem of modern times.

LESTER F. WARD.

Die Conchylien der patagonischen Formation. Von H. VON IHERING. Mit 2 Tafeln. *Neuen Jahrbuch für Mineralogie, Geologie und Palæontologie.* Jahrg. 1899. Bd. II. (S. 1–46 Taf. I., II.).

In this paper Dr. von Ihering has made an important addition to the invertebrate paleontology of the Patagonian beds. The paper is based upon a collection of invertebrate fossils recently made by Mr. C. Bicego of the Sao Paulo Museum, from the typical Patagonian beds at the mouth of the Santa Cruz river in southern Patagonia. According to Dr. von Ihering about 50 species are represented in the collection. Among these are nine new to science and some three or four new varieties.

Not the least important features of Dr. von Ihering's paper are the geological questions discussed in it. Following Dr. Ameghino, von Ihering considers the Patagonian and Supra Patagonian (Santa Cruz) beds, as quite distinct and proceeds to set forth at some length the paleontologic and lithologic features which according to him are characteristic of each. Happily we have here for the first time a definite locality given where the Patagonian beds may be observed in their typical development and exhibiting those lithologic and paleontologic features, which, according to Dr. von Ihering, dis-

tinguish them from the Supra Patagonian beds. This alone is a most important point, since it gives us a definite base from which to start in a comparative study of the Tertiary formations of Patagonia, as they are understood by Drs. von Ihering and Ameghino. It is to be hoped that the latter author will also, in the no distant future, realize the importance of giving at least some one definite locality at which each of the various geological horizons (Mesozoic and Tertiary) that have been named by him at various times may be found and studied. It is alone by such frankness, which should characterize the work of naturalists everywhere, that we shall be able the more easily to arrive at a true solution of the age and relations of the various geological formations of Patagonia.

According to Dr. von Ihering (see page 4 of his paper), the fossil shells of the Santa Cruz (Supra Patagonian) beds are usually enclosed in a soft, sandy matrix, while those of the Patagonian beds are firmly imbedded in very hard clay stones. Dr. von Ihering does not contend that these conditions are absolute throughout the two series, but that the former prevails in the upper series while the latter predominates in the lower. He also finds the faunas of the two deposits to be quite distinct. On pages 6 and 7 he gives a list of 67 species as belonging to the Patagonian beds. He finds only 16 of these 67 species in the Santa Cruz (Supra Patagonian) beds. On page 38 he gives a number of genera and species which according to him are characteristic of the Santa Cruz (Supra Patagonian) beds.

Regarding the lithologic characters given by Dr. von Ihering, it should of course be remembered that he has himself never visited Patagonia, and has therefore to rely upon the nature of the matrix adhering to the fossils and the reports of Mr. Bicego, whose observations in southern Patagonia have been limited to the region about the mouth of the Santa Cruz river. But even in that locality Mr. Bicego certainly could not have failed to observe that the lithological conditions given by Dr. von Ihering, as prevailing in the Patagonian beds, are in reality, of extremely limited extent when compared with the entire thickness of fossil-bearing rocks at this locality. There are, as Dr. von Ihering says, many instances of hard clay-stones or other concretions literally filled with the shells of mollusca, and occasionally a stratum of hard sandstone, which is also fossiliferous. The superior resistance which such materials offer to erosion are apt to mislead the not too careful collector as to their relative importance, and with such material at hand, and to be had only for the picking up, he is likely to overlook many of the real gems which will richly reward the collector if he turns to the several hundred feet of soft sand and clays and examines them *in situ*. On weathering away, however, the usually soft delicate shells are reduced to powder and rendered worthless. If Mr. Bicego had occasion to examine the bluffs along the south side of the Santa Cruz river, between the village of Santa Cruz and Direction hill at the mouth of the river, he must have seen numerous shell layers in the soft crumbling sands and clays, which constitute by far the greater portion of the 350 feet of sediment exposed in the bluffs. A notable example of this is to be seen in the bluff of the river about one and a-half miles above Direction hill and just above where formerly stood the temporary observatory erected a few years ago by the United States Steamer *Brooklyn* (?). At this point the bluffs rise directly from the river and there is a continuous stratum of loose sand, filled with shells. This stratum is about six inches thick and a quarter of a mile in length. It is located at a height of only five to ten feet above high water and can scarcely fail to attract the attention of anyone passing along the foot of the cliff. At various altitudes above it, other similar shell-bearing layers may be seen in the same bluff. At Direction hill and along the coast to the southward are many other strata of soft materials rich in fossils, while if any one will take the trouble at low tide to walk out over the surface of the beach he will frequently see the soft tosca literally filled with fossil shells. In one soft stratum near the mouth of the river the writer found a bed about eight inches thick and 20 to 30 feet in length, composed almost entirely of the shells of *Struthiolaria ornata*, which according to von Ihering is characteristic of the Patagonian beds, mingled with a few

specimens of *S. Ameghinoi*, which, according to the same author, is found only in the Supra Patagonian (Santa Cruz) beds. Moreover, there are a number of blocks of the hard matrix from the mouth of the Santa Cruz river and now in our collections in the museum, mingled together in the same block are to be seen various species, some of which, according to von Ihering, are characteristic of the Patagonian and others of the Supra Patagonian (Santa Cruz) beds.

Dr. Ortman, who is making a thorough study of our collections of Tertiary invertebrates from Patagonia, is entirely unable, from the list of species given by Dr. von Ihering (page 38), as characteristic of the Patagonian and Supra Patagonian (Santa Cruz) beds, to refer any of the numerous horizons from which our collections have been made to either the one or the other series of beds, on account of the mingling of these alleged characteristic species. He finds represented in our collections from the typical Patagonian beds at the mouth of the Santa Cruz river all but one of the genera and species given by von Ihering (p. 38) as characteristic of the Supra Patagonian (Santa Cruz) beds. This one exception (*Voluta ameghinoi*) he finds in our collections from the Mt. of Observation associated with *Cardium puelchum*, *Cardita patagonica* = *inæqualis*, *Siphonalia noachina*, which according to von Ihering are characteristic of the Patagonian beds.

Of the sixty odd species given by von Ihering (pp. 6–7) as coming from the Patagonian beds, Dr. Ortman is able to at once designate thirty-five of them as occurring in our collections associated with one or more of the characteristic species of the Supra Patagonian (Santa Cruz) beds as enumerated by von Ihering (p. 38), while every single one of the latter species has been found with von Ihering's characteristic Patagonian species. It will thus be seen that it is clearly impossible to distinguish these two formations by their faunas, while the lithologic characters are even less distinctive. Nevertheless there are in certain instances decided lithologic and faunal differences at the various localities, and it sometimes happens that such differences are quite marked even in the same actual horizon and at neighboring localities. To such local differences due to the varying conditions attending the deposition of the beds, is due the confusion regarding their stratigraphic relations. Before making more extended observations, the present author like Drs. von Ihering and Ameghino, was in favor of considering these beds as composed of two distinct formations. Subsequent observations, made at many different localities, have convinced me, however, that the Patagonian and Supra Patagonian beds do not represent distinct time intervals, but that sedimentation was continuous from the base to the top of the series, and that the strata of which they are composed all belong to one formation (the Patagonian formation). The rocks composing these beds were laid down, as the fossils clearly indicate, either in a shallow sea or as littoral deposits. The shallow sea deposits constitute the Patagonian phase of the series, while in the Supra Patagonian phase are included the sands and muds that were accumulating simultaneously along the shores and smaller estuaries as their included fossils clearly indicate. The Patagonian phase prevails at the base and the Supra Patagonian at the top of the series, but neither is restricted to any definite horizon within the limits of the entire series.

On page 29, Dr. von Ihering enters upon a discussion of the age and relative position of the various sedimentary formations of Patagonia, giving a review of the conflicting opinions expressed at different times by various authors on these questions. He also points out the erroneous ideas formerly held by Dr. Ameghino regarding the relative, stratigraphic position of the *Patagonian, Supra Patagonian and Santa Cruz beds*. In this general *résumé* he has fallen into an error regarding the position taken by myself in a former paper with reference to the stratigraphic position and age of the *Pyrotherium beds* of Ameghino. Since others, more especially Drs. Ameghino and Roth, have also misunderstood the position taken by me at that time on this question I shall improve the present opportunity to explain a little more fully my views concerning the Pyrotherium beds. I did not, as these authors seem to think, place the Pyrotherium beds above the Santa Cruz beds. I placed them in the Cretaceous, where according to Ameghino they belonged.

I did, however, seriously question both their Cretaceous age and the stratigraphic position assigned to them by the Ameghinos. From a study of Dr. Ameghino's description of the mammalian fauna found in them, I advanced the opinion that there were mingled together in the so-called Pyrotherium fauna, representatives from two or more distinct horizons. This opinion Dr. Ameghino has since admitted to be a fact and has separated his Pyrotherium beds into two distinct formations which he separates by a long time interval. My succeeding two years of field-work in Patagonia have further convinced me as to the correctness of my former views regarding the *Pyrotherium beds*.

In referring on page 30 to the paleontologic evidences advanced by myself regarding the age of the Pyrotherium beds, Dr. von Ihering is quite right in saying that the tooth mentioned and figured by myself as belonging doubtfully to Pyrotherium, is a tooth of Astrapotherium, and also in maintaining that in the process of development of any mammalian phylum, certain organs may early attain a considerable degree of specialization, while the animal as a whole remains quite primitive in its structure. Everyone I presume will readily grant this, but would Dr. von Ihering have us entirely overlook the extremely close relationships, brought out on almost every page of Dr. Ameghino's papers on the Pyrotherium fauna, as existing between the so-called Cretaceous fauna of the Pyrotherium beds and that of the Santa Cruz beds, which latter are now known to be not older than Miocene? Many of the mammals described by Ameghino from the Pyrotherium beds are scarcely specifically distinguishable from allied forms in the Santa Cruz beds. In a few instances Ameghino has himself admitted that he can not distinguish forms from the Pyrotherium beds from well-known Pliocene and Pleistocene animals. Among such may be noticed the large gravigrade edentate which he is unable to distinguish from Mylodon, more than likely for the very good reason that it is a tooth of Mylodon from the Pleistocene deposits that occur throughout the greater part of Patagonia.

Considering the highly specialized character of the Pyrotherium fauna and its remarkably close relationship as a whole to the Santa Cruz fauna, in connection with what we already know of the character of the stratigraphic work of the Ameghinos in Patagonia, the Cretaceous age of the Pyrotherium beds can no longer be seriously considered. Moreover the stratigraphic observations of Dr. Roth, Señor Mercerat and myself are all at variance with such a position for them.

On page 45 Dr. Von Ihering includes the Cape Fairweather beds in the Tehuelche formation as is also done by Ameghino. If I mistake not the term Tehuelche formation was proposed by Doering for the great bowlder or shingle formation of Patagonia. Unfortunately I have never been able to see Doering's paper. If I am correct in this the Cape Fairweather beds should not be included in the Tehuelche formation since they are quite distinct and unconformable as I have been able to observe at several different localities. The Cape Fairweather beds are Pliocene while the Bowlder formation is unquestionably Pleistocene. A curious account of the relations of these two deposits has been published by Dr. Ameghino in the *Geological Magazine*, for January, 1897. On page 17 in speaking of these two series of beds he says, after quoting at some length from a letter from his brother, Charles Ameghino: "According to this the bowlders were deposited at the bottom of the sea and over them there extended at other periods a vast formation of marine shells." In this instance Dr. Ameghino has again reversed the true stratigraphic relations as he did for many years with the Patagonian, Supra Patagonian and Santa Cruz beds.

J. B. Hatcher.

Geological Survey of Canada. By George Mercer Dawson, C.M.G., F.R.S., etc., Director. Annual Report. (New Series.) Vol. X. Ottawa, December, 1899.

This volume, comprising 1046 pages of text accompanied by eight maps and illustrated by twelve plates and a number of figures in the text, has just been issued by the Department and forms publication No. 679 of the Catalogue of volumes published by the Canadian Survey. It is addressed to the Hon. Clifford Sifton, M.P., Minister of the Interior, and contains many valuable reports of exploratory and geo-