problem arises: Can we recommend any ration in which imported or other products, cheap in price because they are not now needed by the community, can replace and liberate from the farm home-grown produce that is wanted elsewhere? Time will not allow of a full investigation, and the advice must often be based on foreign work or on past experience elsewhere. Short, rapid trials alone will meet the case. It is not necessary that the whole stock should be liberated; an increased sale of only 10 per cent. from every farm would add very materially to the quantity available for the community.

The replacement, of course, must be done without prejudicing the total food supply; thus we must not advise the production of grain at the expense of milk or of meat; our main concern will be to increase the saleable output.

Another type of product is only temporarily affected. A certain amount of guano which used to go to Belgium is now available. Shoddy or wool waste may be confidently expected in quantity whilst the Yorkshire mills are kept going so busily. There are also considerable amounts of sulphate of ammonia obtainable.

In time of peace cereals are often grown simply on residues of previous crops. Probably in every district the agricultural adviser knows of some manurial scheme that would make use of these products and increase the yield. It cannot be too strongly urged that demonstrations should be put in hand as speedily as possible to show how this can be done. The cost of the manurial scheme should not be too high; these are not times when speculative propositions can be undertaken, but only those that are likely to prove successful. It is certain that the area under wheat has been increased this year; the efforts of the agricultural adviser should be extended now to an increase in the yield per acre. Potash must remain a difficulty until the present search for new supplies is rewarded with success.

A third problem of importance is this:—Are any rearrangements possible whereby products not likely to be in much demand shall cease to be produced? This applies more particularly to horticulturists and market gardeners than to agriculturists. Early cucumbers, for example, have hitherto gone almost entirely to Germany, and this fact was realised in time to prevent growers from trying to raise them. The production of certain fruit and other market garden produce may require similar readjustment.

In conclusion, the time is appropriate to urge on all our farmers the need for reducing all waste to a minimum. The ordinary farm compares badly with modern manufacturing concerns in this respect; considerable amounts of material are left to waste on the plea that it is not worth while doing anything better. It can never be too strongly urged that waste is a sign of bad farming, and the present is a good time for reform.

NEW CANADIAN DINOSAURS.

TWO very remarkable new types of Canadian Cretaceous dinosaurs are described by Mr. Barnum Brown in the first and last of a consecutive series of three papers published in vol. xxxiii., pp. 539–65, of the Bull. Amer. Mus. Nat. Hist. The first of the triad is devoted to Anchiceratops, a member of the horned group (Ceratopsia) from the Edmonton beds of Alberta, characterised by the great size of the knobs bordering the nuchal flange, and the pair of large oval vacuities by which the latter is pierced. Special interest attaches to this type from the fact that it serves to explain the mode of origin of the ceratopsian flange. In the smaller and less specialised type represented by Monoclonius the supra-occipitals form a pair of hook-like opposing processes on the hind border of the upper surface of the skull, leaving a mushroom-shaped interval between them, and a pair of very large vacuities in the skull-roof. In Anchiceratops the supra-occipital processes have united in the middle line, where only a remnant of a central fontanelle is left, while the vacuities in the lateral portion of the cranial roof are very much smaller. Finally, in Triceratops, which is both the largest and latest member of the whole group, all vacuities have disappeared from the cranial roof and the nuchal flange attains its maximum development.

In the second paper the author describes and illustrates a nearly complete skull of the aforesaid Monoclonius from the Belly River beds of Alberta, which exhibits very clearly the features just referred to. But by far the most interesting of all is the skull (associated with the skeleton) of a trachodont dinosaur from the formation last mentioned, remarkable for the elevation of the cranial region into a tall, helmet-like crest, formed by the nasals, prefontals, and frontals. This unique conformation recalls the skull of the helmeted cassoway—a feature commemorated in the specific portion of the name (*Corythosaurus casuarinus*) proposed for this new type. As minor features of the skull (the figure of which is herewith reproduced on a reduced scale) may be mentioned its relative shortness, the narrow beak, and the small size of the narial aperture.

Skull of *Corythosaurus casuarinus*. About one-tenth natural size. *Den*, dentary; *Ex.O*, exoccipital; *Fr*, frontal; *Ju* jugal; *La*, lachrymal; *Mx*, maxilla; *Na*, nasal; *Pmx*, premaxilla. *Po.f*, postfrontal; *Pr.den*, predentary; *Pr.f* prefrontal, *Qu*, quadrate; *Sur*, surangular; *Sq*, squamosal.

At the close of this paper Mr. Brown proposes a revised classification of the Trachodontidæ, which he divides into the two families Trachodontinæ and Saurolophinæ, the latter characterised by the presence of a cranial crest which is lacking in the former. The first group is represented by the genera Trachodon, Kritosaurus, Hadrosaurus, and Claosaurus, and the second by Saurolophus, Hypacrosaurus, and Corythosaurus. R. L.

GEOLOGY IN AUSTRIA-HUNGARY.

THE widely representative character of the work of the Geologische Reichsanstalt of Vienna is fully maintained in recent issues of the *Jahrbuch*. One of the most notable publications from the point of view of students and teachers of geology is that by O. Ampferer and W. Hammer, entitled "Geologischer

Querschnitt durch die Ostalpen vom Allgäu zum Gardasee" (lxi. Bd., 3 u. 4 Heft, p. 513). This includes a critical description, district by district, of a coloured section drawn on the horizontal and vertical scale of 1 : 75,000, and published with this double part of the *Jahrbuch* as a folded illustration three and a half metres in length. The authors acknowledge their indebtedness to the administration by the Reichsanstalt of the Urban Schlönbach travelling-fund. Bibliographies are appended to each division of the description, and the whole may be regarded as a development and replacement of the remarkable single-handed work of Rothpletz, published in 1894. The authors point out (p. 535) that Rothpletz recognised the influence of great overthrusts, being in this matter a pioneer well ahead of most of his contemporaries.

The geological section includes subsidiary profiles in the overfolded limestone Alps of the Lechtal area, which have since provoked some criticism in the *Verhandlungen* of the institute; a traverse of the upper Inntal under the Piz Lischanna; the Trias of the Ortler, with schists overlying it on the north; the injection-gneisses of Monte Tonale; the huge masses of tonalite in the Adamello mountains; and, finally, the contorted Triassic series of the Val Sabbia, leading down to the Lake of Garda. Numerous detailed sections are added in the 180 pages of text. The systematic exposition that characterises Ampferer's work is recognisable in the account of the structure of the northern limestone Alps (pp. 669–83), accompanied by diagrams that would have delighted the heart of G. P. Scrope, and in the general summary (pp. 697–709), in which stress is laid on the absorption of masses of rock into the depths as a source of mountain-folding. It is urged that the structures now visible are based on much that is invisible, and that the folded matter is not merely superficial, but represents the crests of masses which have sunk deeply into the crust. The complete alteration, largely by thermal processes, of these sunken masses, renders the discovery of root-regions for the folded upper layers impossible. These upper layers assume anomalous positions in regard to one another through fracture and overthrusting, and not through the formation of flattened and continuous overfolds. While a localised region of the deeper crust is softened and gives way, the more rigid masses on either side close in and crumple the weakened portion, pressing a large part downward, but leaving the superficial layers above it contorted and even upthrust above the general surface. "Der grosze Massenüberschusz an der Oberfläche ensteht durch Einsaugung tieferer Zonen erdeinwarts." The authors argue that the visible crystalline masses beneath the strata that are overthrust, or, on the Decken theory, overfolded, form far too narrow saddles, and could not have underlain the broad region that would be occupied by the upper rocks if these were spread out in their original positions. Hence something has disappeared from the lower zones by absorption into the unseen regions of the crust.

O. Ampferer is also concerned (lxii. Bd., p. 183) with a scheme for the representation of far more detail than is usual on geological maps. He indicates the actual strike of outcropping strata by continuous coloured lines on the contoured topographical sheet, so that we can see at once how the edges of the rocks lie on mountain-slopes or across valley-floors. He also proposes to show, by a scheme of dots of various shapes and colours, the character of detritus on the surface and its origin from the several rocks that enter into the structure of the district.

R. v. Klebelsberg (lxii. Bd., p. 461) reviews the marine fauna of the Ostrau Beds of Moravia and Silesia, and concludes that the marine intercalations represent transgressions, in Middle Carboniferous and Lower Coal-Measure times, from the sea that lay continuously over Russia in the Carboniferous period. He hopes for a correlation of these overflows with those of Britain, Belgium, and Westphalia, since they may record events of wide significance, though of short duration. The positions of these marine bands in the Ostrau Beds is shown in sections by W. Petrascheck (lxiii. Bd., plate 14). The marked folding of the Upper Silesian coalfield occurred in Permian times.

E. Hartmann, of Munich, inspired by Rothpletz, furnishes a detailed study of "Der Schuppenbau der Tarntaler Berge am Westende der Hohen Tauern" (lxiii. Bd., pp. 207–388). Numerous types of rock are described that are due to deformation and mylonitisation during overthrusting, and the glaucophane-schists (p. 332) are referred to a mixture of diallage-hornblende rock with the slates into which it has intruded. The three flake-like sheets that have been piled on one another by the Alpine overthrusting are held to have been folded later (p. 376) by earth-movements from north-west to south-east, and, to a less degree, from east to west. The author, like many workers in the eastern Alps, finds that the phenomena are explicable by overthrusting, rather than by a transference of material from a distance as part of a great overfolded sheet.

Franz Kossmat (lxiii. Bd., p. 171) deals with the folded structure of the interesting region of potash salts in the Miocene system of East Galicia. Franz Toula (*ibid.*, p. 621) continues his work in western Bosnia, and describes a number of Triassic cephalopods, which appear to differ little from species established by Mojsisovics. G. Schlesinger (lxii. Bd., p. 87) discusses the ancestry of the proboscideans in the light of an unexpected discovery of *Elephas planifrons* in Lower Austria. The remains come from strata that are at the latest Middle Pliocene, though younger than the Pontian, with its Pikermi type of fauna (p. 93), and the occurrence in Europe of this typical Siwalik species leads the author to trace the known species of elephants from their source in the Fayûm to Europe and North America. He regards *E. planifrons* as passing from India through Europe to Africa, and as the direct ancestor of *E. meridionalis* (p. 150). The dwarf elephants of the Mediterranean islands are referred to a double origin, both the ancestors, *E. planifrons* and *E. antiquus*, being, however, normally large forms (p. 171), and Schlesinger adopts Abel's view that their degeneration in teeth and size arose from the close interbreeding necessitated by geographical changes.

Franz Kretschmer's studies on the "Kalksilikatfelse" in the gneiss of Moravia (lxii. Bd., p. 359) form an important addition to the literature of eclogites and amphibolites. It is now well recognised that these rocks, which are so common as inclusions in fluidal gneiss, are, in a great number of cases, residues of calcareous strata invaded by a granite magma.

The series of papers published in the *Verhandlungen* of the Reichsanstalt often contain new stratigraphical conclusions, new records of fossils, and at times illuminating criticisms. The controversy as to the structure of the imposing limestone mass of the Wetterstein, which forms the northern wall of Tyrol above Partenkirchen, is sustained by O. Ampferer (1912, p. 197) and O. Schlagintweit (1912, p. 313). The former demolishes, with accompanying diagrams, certain impossible readings of the local structure; the latter opposes Ampferer's view that the mass has been thrust from east to west, and continues to connect it with the overthrust sheet of the Inntal, and not with the underlying Lechtal sheet. The Cainozoic

beds north of the Carpathians are studied by W. Petrascheck (1912, p. 75), who indicates (p. 92) an interesting groove, parallel with the range, in which they assume an unexpected thickness above the Coal-Measures. The problem of their faulting-down, infolding, or original deposition in a hollow of erosion, reminds us on a smaller scale of that of the Indo-Gangetic plain (see NATURE, vol. xciv., 1914, p. 347). W. von Friedberg, of Lemberg (1912, p. 367) compares the fossil contents of the Polish Miocene with those of Miocene beds in Austria, North Italy, and France, and concludes that the Burdigalian is absent, that the salt-series is Helvetian, and that the Tortonian extends below and also above the gypsum-bearing strata of Podolia. The beds with the brackish-water mollusc Oncophora are held to be somewhat younger than those of Bavaria, and to represent (p. 387) the first arrival of the Miocene sea in Podolia in Upper Helvetian times. References to these beds in Moravia will be found in a note by A. Rzehak (1912, p. 344).

An interesting feature in mountain-structure is shown in sections by G. Geyer (1913, p. 293) of the Toten Gebirge on the border of Styria and Upper Austria, where gypsum-bearing beds have been squeezed up like dykes into limestones of much later date. As an example of critical reviewing, we may cite the extremely valuable summary by F. Katzer (1911, p. 387) of Cvijić's researches in Macedonia and the Balkan peninsula as far as the Dardanelles, which have been mostly published in the Servian language. The origin of the Bosporus-Dardanelles river-cut comes in question (p. 417). We have kept until the last a mention of a discussion by O. Ampferer of Penck's well-known association of terminal moraines and outwash-plains (1912, p. 237). While we think that Ampferer distinctly underestimates the amount of water that may escape from an ice-front of continental magnitude through a loosely piled block-moraine, his citation of the filtering effect of a terminal moraine is distinctly useful. He thus cannot admit the association of a large terminal moraine with an extensive "apron." The two structures, for him, should be in inverse proportion. Ampferer does good service (p. 238) in pointing out an anomaly in Penck's diagram of a double moraine-wall enclosing a "Zungenbecken." This figure has been extensively reproduced, but has puzzled other geologists. How was the outer moraine piled up if the inner one was not destroyed? On the other hand, if it is the older of the two, why do its outwash-products overlie those of the inner wall?

G. A. J. C.

ON SALTS COLOURED BY KATHODE RAYS.[1]

PERHAPS a part of the phenomena which I am about to discuss is already familiar to you all. I shall not bring forward many hypotheses. So you will perhaps ask why I should speak at all. And, in fact, apart from reference to certain facts not published hitherto, my intention is mainly to invite the interest of men younger and abler than myself in a class of phenomena which seem to constitute a new condition of matter, but on which very few have yet worked.

If kathode rays fall on certain salts—for example, common salt, or chloride of potassium, or potassium bromide—vivid colours are produced immediately on these salts.[2] Thus common salt becomes yellow-brown (like amber), potassium chloride turns into a beautiful violet, potassium bromide becomes a deep blue colour quite like copper sulphate. Here you see a specimen of common salt transformed in this way on the surface of the single crystals into a yellow-brown substance. I show also sodium fluoride, which takes a fine rosy colour.

The colours so acquired in a very small fraction of a second may be preserved for a long time, even for many years, if the coloured substances are kept in the dark and at low temperatures. But in the daylight, and also under heat, the colours will gradually disappear until the original white condition is reached again.

The colours of different salts are sensitive to heating in a very different degree. I could show you the yellow sodium chloride, prepared some months ago in Europe, but I cannot show you here the violet KCl and the blue KBr, because these colours, even in the dark, do not stand the heat of the equator. The same salt, if dissolved, may keep very different colours, according to the medium in which it has been dissolved, even when the pure medium itself cannot be coloured at all by kathode rays. I am speaking of *solid solutions*, produced by fusing a small quantity—for instance, of common salt or of certain other alkali salts—together with a great mass of a salt which remains itself colourless in the kathode rays, as, for example, the pure potassium sulphate. Lithium chloride acquires a bright yellow colour in the kathode rays; but if dissolved in potassium sulphate a lilac hue is produced, as you may see in this specimen. Likewise the pure carbonate of potassium acquires a reddish tint, but after dissolving it in the potassium sulphate it becomes a vivid *green* in the kathode rays, as you see here.

Very small admixtures are sufficient to produce intense colours. So 1/25,000 of carbonate will produce the green colour in the potassium sulphate; even 1/100,000 gives a marked colour, and an amount of certain admixtures, which I estimated as 1/1,000,000 only, may produce a slight but quite perceptible coloration in some salts. So if you work with potassium sulphate which you obtain from chemical factories guaranteed as chemically pure, you may observe a set of different colours in these preparations under the kathode rays, by which you will detect the nature of the different small admixtures which adhere to the pretended pure preparations of the different factories. In this way a new analytical proof, much more sensitive than the ordinary chemical methods, is obtained, and impurities may be detected even when a certain specimen of salt contains more than a single impurity, because the colours produced by different admixtures generally disappear with different speed in the daylight or under rise of temperature. For instance, the ordinary potassium sulphate turns to a dark grey with a slight greenish tint at first. After a short while the very sensitive grey will disappear, simply under the ordinary temperature of the laboratory room, and a vivid green comes out. The grey hue indicates a very small amount of sodium chloride, 1/100,000 or so, and the remaining green indicates the admixture of a carbonate. Here are some preparations of potassium sulphate each containing a single small admixture (K_2CO_3, Li_2CO_3, LiCl, KCl, KBr). You will notice how different are the colours of the originally white substance, varying from green to bluish-grey, ash-grey, greyish-blue, and violet.

By fractional crystallisation one may finally get a really pure preparation of potassium sulphate, which

[1] By Prof. E. Goldstein. A paper read before Section A of the British Association at the Australian meeting, and ordered by the General Committee of the Association to be printed *in extenso*.

[2] E. Goldstein, *Wiedem. Ann.*, liv., 371; lx., 491; *Phys. Zeitschr.*, iii., 149; *Sitzungsber. Ber. Akad. d. Wiss.*, 1901, 222.