Painted Fabrics from India and Iran*

ALTHOUGH the Indus civilisation has been known and its relation with the west recognised for more than ten years, its comparative study has scarcely begun. An attempt is here made to define more precisely the problems raised by its western relations.

A common tradition in the potter's craft between Mesopotamia and Sindh-Punjab can be traced back to the fourth millennium B.C. in the Uruk period. By the middle of the third millennium, this had been given a very specialised and individual expression in the Indus valley, the peculiarity of which is a free use of repetition motives, which has no parallel elsewhere in the third millennium, except perhaps in the Middle Minoan of Crete. In a random sample of sherds from Mohenjo-daro, 35 per cent of the designs were based on vegetation motives and the remaining 65 per cent were repetition motives. Indus pottery is accordingly the specialised product of a sophisticated civilisation. Moreover, it displays an astonishing uniformity over a vast territory, extending from Amri in southern Sindh to Harappa on the Ravi, five hundred miles north, which corresponds with the economic and geographical unity of the area watered by the Indus.

Sir Aurel Stein has collected a great deal of pottery from the hill country west of the Indus; but the native pottery of the hills is stylistically barbarous and shows a bewildering variety of local styles. This is due to the character of the country, broken by gorges and steep ranges. But nevertheless the wares of Baluchistan and Waziristan seem closely allied to one another and to the Indus wares, both technically and in motive. On the other hand, there are more prominent western elements than are discernible in the Indus ware, such as the sigma pattern, common in southern Baluchistan, and the 'goat motive'. These features may be due to archaism —elements which had not survived in the busy cities where a more sophisticated style had been elaborated.

Nevertheless in the funerary pottery from Shahi-tump connexions with the west that are more than mere survivals can be discerned; but these connexions are with Susa I and Samarra, not with the later cultures that flourished in Mesopotamia in the second half of the fourth and the beginning of the third millennia. The connexion with Susa I is to be seen both in forms and in specialised motives, such as the 'Maltese' square decorating the centres of dishes at both sites and also at Samarra. Sherds illustrate the transition from the prevailing grey to pink, and in Sistan the same transition is illustrated, as well as that to the green tint common at al 'Ubaid. The Shahi graves reveal an extension eastward in a very pure form of Frankfort's 'Highland Culture' and precisely that form of it represented at Susa. This is no mere survival at Shahi-tump, and as all the burials are at least a thousand years later than those at Susa I and Samarra, the direction of the migration is unambiguously defined: it must have come eastward. But this affords no clue to the sources of the common elements in the Indus and Sumerian ceramic traditions.

Light will be shed on this problem when Mr. Majumdar's excavations at Amri in southern Sindh have been published. The results promise to clarify the connexion between the ceramic technique of the Indus valley and that of Mesopotamia in the fourth millennium; and they also offer a solution of some of the obscurity surrounding the Baluchi wares. It will appear that the pale-slip group is not contrasted with that of lowland India, but that the same tradition lies behind the classical Indus ware. The Amri evidence will also explain the character of the pottery from Nal and Nundara in Baluchistan, which is more sophisticated and shows a deliberate style. This might be regarded as a development of the black-on-red-on-pale-slip ware from Amri which is older than the classical Indus ware, and in turn has technical and stylistic affinities to the Jemdet Nasr ware of Mesopotamia.

* Substance of a paper read by Prof. V. Gordon Childe on September 12 to Section H (Anthropology) at the Leicester meeting of the British Association.

Atomic Weights of Potassium and Carbon

HÖNIGSCHMID and Goubeau in 1928 described experiments on the analysis of potassium chloride and bromide leading to an atomic weight of potassium of 39·104, which agrees with a value found by Richards and Archibald in 1903, but is nearly 0·01 unit higher than the value, 39·096, obtained in 1907 by Richards and Staehler and by Richards and Mueller. Since the discrepancy is much greater than the apparent experimental error of the comparatively simple analytical operations involved, a redetermination was desirable. Zintl and Goubeau in 1927 confirmed the higher value by the conversion of potassium nitrate into the chloride. The ratio determined from the weights in air corrected to vacuum, however, and that determined from the weights of material actually weighed in vacuum, fall on opposite sides of the value to be expected from the results of Richards, Staehler and Mueller ($N = 14·008$).

Baxter and MacNevin (*J. Amer. Chem. Soc.*, August), in a long series of analyses of potassium chloride, by comparison with silver, using potassium salts of different origin, find a value in satisfactory agreement with that of Richards, Staehler and Mueller, and they conclude that the atomic weight of potassium is very close to 39·096. No indication of a higher atomic weight was found, and the authors also report that unpublished experiments by Titus show no appreciable adsorption of air by potassium chloride and nitrate. The values found with one specimen of potassium chloride (39·084 – 39·098) were low and irregular, a result not explained. No evidence of variation in the isotopic composition of potassium assimilated by plants was found by the examination of material from wood ash.

In a second paper in the same journal, Baxter and Alter report that the atomic weight of 'heavy' potassium prepared by von Hevesy by 'ideal' distillation in 1928 is 39·109, which is in exact agreement with the value for this material found by

Hönigschmid and Goubeau, whose value 39·104 for ordinary potassium could not, as stated above, be confirmed. A further check on the value of ordinary potassium gave 39·096. The difference between the two values is thus 0·013, as contrasted with 0·005 found by Hönigschmid and Goubeau. The maximum difference to be expected in the distillation had been calculated as 0·010, but this was based on a percentage of K^{41} in ordinary potassium of 5·2, from an atomic weight 39·104, and integral values of the isotopes. A recalculated value is 6·6, whilst the experimental result leads to 7·3.

Since the discovery of the isotope C^{13} it has become clear that the value for the atomic weight of carbon accepted by the International Commission, namely, 12·00, is too low. The atomic weight of C^{12} on the old O^{16} basis, according to Aston, is 12·0036, which, when reduced to the chemical standard [isotopic mixture] oxygen = 16·000, becomes 12·0010 or 12·0023, depending on the factor used for conversion from O^{16} to O = 16·000. The chemical value found by Richards and Hoover in 1915 from the ratios Na_2CO_3 : NaBr : Ag varied in individual measurements from 11·997 to 12·008, the mean being uncertain by ±0·011 per cent of a unit. Physico-chemical methods depending on the densities and compressibilities of gaseous compounds of carbon have given values from 11·996 to 12·008.

It is obvious that the uncertainty in this important constant is considerable. Woodhead and Whytlaw-Gray (*J. Chem. Soc.*, July) now report a range of measurements at a series of pressures of the relative densities of oxygen and carbon monoxide by the use of a microbalance in such a way that no values of the compressibilities were required. Very concordant earlier density measurements by Leduc, Rayleigh, and Pire and Moles exist, and the new value gives an atomic weight of carbon, 12·011, in close agreement with Rayleigh's, but considerably higher than the accepted chemical value. The compressibility had also been fixed between narrow limits by Bateucas, Maverick and Schlatter. The density ratios of carbon monoxide and oxygen of Rayleigh and Leduc, and the compressibilities at 0° $(1+\lambda)$ 1·00048 and 1·00094, give 12·011(8) and 12·015(5), respectively; Pire and Moles' value, with the weight of a normal litre of oxygen, 1·42892, found by Moles and Gonzalez, gives 12·008(5). There was, therefore, already little doubt that the value was nearer 12·01 than 12·00, and the new value 12·011 confirms this result and is in agreement with other observations. The proportion of the C^{13} isotope must, therefore, be so high as 1 per cent, in close agreement with the results recently obtained by band spectrum methods by Jenkins and Ornstein.

Lamarckian Inheritance and Learning in the Rat

ONE of the most interesting papers read before Section J (Psychology) at the recent British Association meeting at Leicester was that by Prof. F. A. E. Crew, of the Department of Animal Genetics, University of Edinburgh, on "An Attempt to determine the Factors operating in Professor McDougall's Lamarckian Experiment". Prof. McDougall's findings are that:

(1) his experimental rat stock has, in the course of many generations, come to differ from his control stock in that the average number of errors made per rat by the individuals of the experimental stock is now significantly less than that made by the individuals of the control stock;

(2) that with the passing of the generations the average number of errors per rat made by individuals of the experimental stock has decreased gently and progressively; and

(3) that the rats of the control and of the experimental stocks respectively are to be readily distinguished by marked differences in their behaviour in the water tank.

Prof. Crew complained that the details regarding the performances of the rats which Prof. McDougall has published have never been given in full and that for this reason it has been impossible for anyone to gather from them whether or not the figures themselves are significant. He maintained that the method of recording adopted by Prof. McDougall could not possibly be expected to allow anyone to determine whether or not genetic factors are operating in the production of the increased facility for mastering the task. He showed the records of six generations of tank-trained rats and of a large number of control groups, and demonstrated that there is no significant difference between the performances of any of these generations amongst themselves or between the experimental groups and the controls, and that whatever improvement has been achieved can be explained as a result of deliberate and favourable selection. The first generation of tank-trained rats in respect of the average score was equal to the twenty-third generation of Prof. McDougall's, whilst the average score of some six hundred controls was also equal to that of this twenty-third generation.

Prof. Crew showed that, in the case of his own stock, though in respect of behaviour in the tank individual differed from individual, it is quite impossible to distinguish between control and tank-trained stocks. So that out of the results of three years' experimentation, involving nearly one thousand individuals, nothing emerges which supports Prof. McDougall's conclusion that in the case of his own stocks the results are only to be explained on the assumption that modifications acquired by the parents as a result of training have become transmitted to their offspring.

Prof. McDougall took part in the discussion which followed. He pointed out that the actual conditions of Prof. Crew's experiments were different from his, that the tank was different, and that the intensities of the lights used were different. He also defended the method of averages which he had used.

A paper on an allied subject was that by Prof. E. C. Tolman, who described three investigations which are in progress at the University of California. The first is an experiment on the genetics of maze-learning ability. Using a 17-unit *T*-maze as the measure of the rat's learning ability, Prof. R. C. Tryon has been selecting for a strain of 'maze-bright' rats and also for a strain of 'maze-dull' rats. In the *F*9 generation, the two strains had become so separated that only one or two of the bright strain proved duller than the brightest of the dull strain. No evidence for a Lamarckian effect, such as Prof. McDougall claims, has been found; that is, the rats