FIELD MUSEUM OF NATURAL HISTORY
FOUNDED BY MARSHALL FIELD, 1893

PUBLICATION 280

ANTHROPOLOGICAL SERIES VOLUME XVIII, No. 2

GEOPHAGY

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CHICAGO, U. S. A.

1930

PRINTED IN THE UNITED STATES OF AMERICA
BY FIELD MUSEUM PRESS

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INTRODUCTION

The bibliography appended to this study may appear impressive at first sight, and a glance at it may even convey the impression as though a novel investigation of the subject were superfluous, but such an impression would be a delusion. The only really profound and serious research is represented by the fundamental work of Ehrenberg, which has unfortunately been forgotten or overlooked by the majority of those who have subsequently written on the subject. Ehrenberg, a geologist by profession, has studied and analyzed many hundreds of specimens of edible earths from all parts of the globe, and has had a wider and deeper knowledge of the subject than all his successors combined. Science does not always progress consistently in a straight line. Many articles cited in the bibliography are informative on special lines and useful, particularly the work of Hooper and Mann, which is important as far as India is concerned. The whole subject, however, is deserving of a new treatment in the light of fresh material and from the standpoint of the universal history of mankind.

In this article is given for the first time a correct exposition of the facts concerning geophagy, as revealed by Chinese records which are abundant. It will be noticed that these are very instructive and contribute important material toward the evaluation of the whole question of geophagy. For this reason China opens this investigation. The days are gone when the discussion of a problem started with the Greeks and Romans whose importance in the history of civilization is not much greater than and in many respects inferior to that of the Asiatic nations. Next to China the relevant conditions in Indo-China, Malaysia and Polynesia, Melanesia and Australia, India, Burma, and Siam, Central Asia and Siberia, among Persians and Arabs, in Africa, Europe, and America will be reviewed and discussed. In all these sections a great many new data unknown to previous investigators will be found. America especially has never before been adequately treated.

Geophagy is a convenient term which comprises a series of most varied phenomena resulting from entirely different causes and moving along different psychological lines.

In regard to the various earths and clays used by mankind Ehrenberg's work gives the best possible information, and any new geological and chemical researches should continue where he left his task. As a rule, not every kind of earth is eaten, but only those kinds which recommend themselves through certain qualities, such as color, odor, flavor, softness, and plasticity. The most important from the standpoint of edibility is what is called diatomaceous earth or kieselguhr, popularly known as "mountain meal" or "fossil meal" (in Chinese "stone meal" or "earth-rice"), which is a very light, porous earth resembling chalk or clay and consisting of the siliceous remains of very minute aquatic organisms or diatoms in several thousand varieties (hence, also styled "infusorial earth"). It varies in color from white to different shades of gray to black. Earths used as medicines or for enjoyment are almost without exception fine, fat, and usually ferruginous clays. They are consumed either in their natural state or lightly baked. Diatomaceous earth is at present of great industrial importance (cf. N. Goodwin, Diatomaceous Earth, *Chemical and Metallurgical Engineering*, 1920, pp. 1158-1160; R. B. Ladoo, Non-metallic Minerals, 1925, p. 190).

Geophagy has been characterized by previous authors as an "evil" or a "vice," while others have qualified it with such attributes as "disgusting" or "depraved appetite." Such characterizations are subjective and meaningless, and do not help us in understanding the phenomenon. Man, at the outset, will taste and test everything offered to him by nature; and consuming earth, mud, or clay is no more surprising than eating salt, pepper, bark, insects, snakes, or monkeys, or chewing gum, coca leaves, betel, or tobacco.

Earth or clay is nowhere used as an ordinary and regular article of diet, on a par with vegetal and animal food-stuffs; as it essentially consists of inorganic matter, it is naturally indigestible. It was used, however, and may still be used by many peoples in times of scarcity and famine as a food substitute to allay the pangs of hunger, giving as it does a sensation of fullness to the stomach; as a sort of condiment or relish, usually in combination with articles of food; mixed with acrid tubers or acorns as a corrective of taste; as a dainty or delicacy for its own sake; as a remedy for certain diseases; as a part of religious rites and ceremonies. These are the normal applications of clay and earth. There is, further, an abnormal or morbid use produced by or accompanying certain diseases, or due to nervous conditions.

Most writers have indulged in the sweeping assertion that geophagy is a universal phenomenon and was practised in times of antiquity. Neither of these statements is true. Generalization is the worst of all setbacks in scientific research and unfortunately an only too common sin in ethnological studies. This or that custom is observed in a single or a few individuals or in a single settlement, and it is at once fastened on the whole community or tribe or country. A traveler may have seen a certain person lick or chew a bit of earth, and the nation to which this individual belongs will go down in history as one of geophagists. Lasch (p. 216) asserts that earth-eating is exceedingly diffused over Africa, but this notion of a wide diffusion is merely fortified by a total of seven references. What is needed in ethnology is application of statistical methods or judicious restriction to really observed cases. Geophagy is not universal; it is unknown, for example, in Japan ancient and modern, Korea, Polynesia excepting New Zealand (while it occurs in Malaysia and Melanesia), Madagascar, as well as in many parts of Africa and Europe, and in the southern part of South America. It was likewise unknown in ancient Egypt and Babylonia as well as among the ancient Semites in general. It was equally foreign to the Greeks and Romans of classical times, while in the Hellenistic period the use of clay was confined to that of a medicine; neither Greeks nor Romans were geophagists. In China, Indo-China, India, and Persia earth-eating was practised to a certain extent, and is still widely practised in India and Persia, but in none of these countries is there an ancient record of this custom preserved; at least I have found none that would antedate our era. Maybe, this is fortuitous; maybe, it is not; the coincidence of the lack of ancient records in all great civilizations of Asia, at any rate, is suggestive.

While geophagy is not a universal phenomenon, yet it occurs sporadically almost anywhere. It has nothing to do with climate, race, creed, culture areas, or a higher or lesser degree of culture. It is found among the most civilized nations, even in our own midst, as well as among primitive tribes. It occurs in the Old and New Worlds alike. On the other hand, the habit is not general in any particular tribal or social group, and none can positively be labeled with a clear distinction as geophagists or non-geophagists. There are individuals who eat earth, and there are other members of the same tribe who abstain from it and even disapprove of the habit or may even see fit to dissuade their countrymen from indulging in it. In other words, the habit is more or less individual, not

typically tribal; and this is exactly the point which has aroused my interest in the subject. We are wont to look upon the life and thoughts of a primitive people as something typical and collective, as a standard adopted and followed by all members of the community. This in general is true, but there are also features in primitive cultures which are left to individual decision and which require careful study. One of these is geophagy, the causes of which lie chiefly in the physical and mental constitution of the individual. Imitation, as in all human habits, has, of course, been a powerful factor in contributing toward the expansion of the custom. It could not have been diffused so widely all over India in all classes of the population unless by contamination of example. Again, if women during the period of pregnancy are especially devoted to clay-eating in a continuous area—Persia, India, Malaysia, and Melanesia—while this is not the case in China, Indo-China, Europe, and America, we must believe in an historical dissemination over the aforementioned area. In other words—while, on the one hand, geophagy may spring up anywhere spontaneously and independently, it has, on the other hand, assumed certain forms which can be explained only through contact and diffusion.

Clay-eating, consequently, cannot be interpreted as a racial characteristic or as a peculiar trait of this or that group of peoples, as has been done by Sarat Chandra Mitra, who expressed the opinion, "It seems that the use of clay for food is more confined to the Indian branch of the Aryan race, some Dravidian races and the various peoples belonging to the Mongolian stock, than to any other offshoot of the Aryan family or to any other race." This conclusion has also been antagonized by Hooper and Mann. In fact, the custom is not more characteristic of one tribe than of the other and pervades all classes of Indian society without distinction.

Clay-eating is not exclusively a poor man's habit either. In the Panjab "the very rich and the very poor are not free from it" (Hooper and Mann, p. 253). In Assam "the best working classes are affected by it" (*ibid.*, p. 252). It is likewise as common in the cities of India as among the peasantry; it prevails among all castes, regardless of race and creed.

There is a medical angle to this subject which is beyond the scope of this article. It has been suggested that geophagy is a symptom of ankylostomiasis and can be subdued together with this disease (H. Prowe, *Zeitschrift für Ethnologie*, 1900, p. (354)). Which is the cause and which is the effect seems not to be certain.

Certain it is that cases of ankylostomiasis do occur without being accompanied by geophagy; this disease, for instance, is widely diffused throughout China and Formosa (J. L. Maxwell, Diseases of China, pp. 174-182; G. Olpp, Beiträge zur Medizin in China, pp. 86-87), but neither Maxwell nor Olpp mentions any clay-eating on the part of patients. There is a disease known as cachexia africana, which is a disorder of the nutritive functions among Negroes and in certain kinds of disturbances of health among women, in which there is a morbid craving to eat clay (for details see p. 159). This so-called pathological geophagy is of limited interest to the ethnologist, but belongs properly to the domain of the physician. That inordinate and indiscriminate clay-eating is injurious to health and may lead to untimely death is obvious; even a Chinese author of the seventeenth century has plainly pointed it out. On the other hand, the perils of the indulgence have been overstated, and there is no doubt that occasional consumption of diatomaceous earth or a sprinkling of earth or clay over ordinary food is harmless. Again, the situation is not the same everywhere. In India, where the habit perhaps is more widely spread than in any other country and where it has developed into a veritable passion with many individuals, especially women, the appalling effects have grown proportionately. Here again, however, experiences recorded as to ill effects of clay-eating vary a great deal. One observer in India who made wide inquiries from women habitually eating clay was invariably informed that they experienced no ill effect whatever. Another correspondent who has known numerous instances of earth-addicts in Mysore reports that "the habit once contracted by women is rarely, if ever, abandoned by them, and is invariably followed by fatal results" (Thurston, p. 553).

"Reports are almost unanimous in stating that the habit when indulged in causes anaemia. Cases of intense anaemia are recorded with the history that the patients were perfectly well until they took to mud-eating. It is, however, almost certain that anaemia gives rise to the habit, and most probable that the habit is both the cause and the consequence of anaemia. Clay is eaten by people who are already anaemic, and the more they eat it, the more anaemic they become.

"Earth-eaters are frequently troubled by worms, but whether they are caused by earth-eating, or their presence is a contributory cause of the habit, is not quite decided. The most general idea

among medical men who have had to deal with large numbers of cases is that anaemia accompanied by morbid gastric sensations is most often due to the commencement of the habit. The anaemia due to the ankylostoma worm is particularly accompanied by gastric cravings. Dr. Brooks says it may or may not cause ankylostomiasis of which anaemia is in his districts nearly always a symptom" (Hooper and Mann, p. 264).

Clay-eating is seldom openly practised and does not belong to the obvious things lying at the surface that would come within the ordinary traveler's observation. Many natives feel that the habit displeases the white man and will keep it secret or are loath to talk about it. It is reported that the female coolies of the Cochin hills "seem to be ashamed of the habit and, if other people see them eating clay, try to hide it" (Thurston, p. 525).

While the effects of geophagy are comparatively easy to recognize, it is more difficult to account for its causes.

Deniker is inclined to ascribe the habit of eating earthy substances to the need of supplying the deficiency of mineral substances (calcareous or alkaline salts), which induces the use of salt. F. W. Krickeberg (in Buschan, Vergl. Völkerkunde, I, 1922, p. 146) likewise regards the craving for salt as the cause leading to geophagy.

This theory is most improbable. In the first place, the clays consumed by man, as a rule, contain no salts, or if so, only a negligible quantity. Second, if Deniker's opinion were correct, we should justly expect that the maximum of clay-eating would be reached by people who command little or no salt and that with the growth of the salt supply the habit of clay-eating would proportionately decrease. This, however, is not the case. To cite but one example—the Iroquois and related tribes formerly did not make use of salt, but nothing is known about clay-eating on their part (cf. F. W. Waugh, Iroquois Foods and Food Preparation, pp. 150-153, Canada Geol. Survey, Memoir 86, 1916). The fact remains that all geophagists have access to salt, and probably more easily than to clay. Hooper and Mann (p. 263) point out that among children of India the salty nature of the ingredients of some earths is the recommendation for their use, but add judiciously, "This, however, can be the reason in but few cases of the habit." In another passage (p. 258) they dissociate completely the use of salt earths from the habit of earth-eating, contending that the use of the former can only be referred to as occurring commonly in districts where salt is expensive. In India, accordingly, earth-eating and the use of salt earth are

two distinct and unrelated phenomena. The same is the case in China. In ancient China a great amount of salt was obtained from saline earth (J. O. von Buschman, Das Salz, II, 1906, pp. 4, 9; F. von Richthofen, China, I, 1877, p. 102), but such saline earth was never consumed, while other kinds of earth free from salt were eaten by the people. The same situation, again, is met with in some parts of Africa (Buschman, II, p. 278). A seeming exception occurs in South America. Brazil is very deficient in salt (Buschman, II, p. 413), and the Indians take recourse to various substitutes for salt in preparing their food, usually by burning saline plants and using the salty ashes; sometimes a reddish earth which has the appearance of salt ashes is resorted to for the same purpose. F. d'Azara, who traveled in South America from 1781 to 1801 (German translation by C. Weyland, 1810, p. 19), has some interesting notes on a salty clay (called by the Spaniards *barrero*) craved by the grazing cattle which cannot be kept away from it even by blows and which frequently feed on it to such an excess that they will die. A few travelers in South America report the consumption of salty clay on the part of Indians in lieu of salt, but the notes assembled in the chapter on South America (p. 184) demonstrate abundantly, that the widespread habit of eating non-salty clays throughout South America springs from causes which are entirely independent of the hunger for salt.

H. Schurtz (Katechismus der Völkerkunde, 1893, p. 21) believes that the original object of earth-eating was to silence the hungry stomach for a short while with an indigestible morsel.

Hooper and Mann (p. 270) are inclined to attribute the cause of geophagy "primarily to the purely mechanical effect it seems to have in comforting gastric or intestinal irritation. This may or may not be due to disease; if it is so due, the result is quickly to aggravate the disease it is taken to alleviate; if not, it rapidly produces effects which bring on disease. Gastric or similar irritation is inseparable from certain periods in a woman's life, and these are precisely the periods when the earth-eating habit is contracted. Once indulged in, the wish for similar alleviation becomes a craving; and the habit, as is usually the case with similar ones, strengthens itself, and brings on disease of the digestive canal. In the cases where men indulge, probably the habit has some similar origin."

The two last statements quoted assuredly contain some elements of truth, but do not explain all the phenomena connected with geophagy, and a formula applicable to the subject in its entire

range can hardly be found, as geophagy appears in so many widely varying forms. It is best to emphasize a few specific cases. When we hear that the Pomo Indians of California mix clay with acorn-meal, their staple food, we may at first be inclined to dismiss this case as an unusual or queer practice; but when we further read that exactly the same thing is done by the peasants of Sardinia, we pause and think. As an historical contact between the Pomo and Sardinians is out of the question, the cause for this practice can only be physiological. The Zuñi swallow a bit of white clay with the tubers of *Solanum fendleri*, and it has been suggested that this is done to counteract or reduce the acridity and astringency of the tuber; this explanation may be correct as far as it goes, although it remains unexplained why it is just clay that is resorted to as a corrective. This is a matter that awaits the investigation of a physiologist.

Chemical analyses of edible clays are all right as far as they go, but are of no great utility to the ethnologist in understanding the problem. Moreover, most of the analyses made date a considerable time back when chemistry was not yet so perfected as it is at present, and when the usual conclusion of the investigators has been that the clays consumed by mankind contain neither nutritive nor medicinal properties. Maybe this is true, maybe it is but partially correct; but we need more solid and renewed information from a biochemist and physiologist, in the light of modern science, especially as to the effects of clays on the human organism. If these pages should have the good fortune to attract the attention of a biochemist and physiologist and to stimulate them to a fresh investigation of the problems involved, I should feel amply rewarded for the trouble and time I have taken in gathering this material from all parts of the world; but it must be studied comparatively. It cannot be fortuitous, for instance, that the identical phenomena appear in the most diverse regions and peoples, as the example of the Pomo and Sardinians just mentioned, or the craving for the bucaro pottery made of a reddish, odoriferous clay on the part of Peruvian and Portuguese women alike.

When we read again and again that to people living widely apart certain clays have an agreeable and spicy flavor and that they are attracted to them irresistibly and experience a pleasant and beneficial effect on their systems, we cannot simply brand such folks as maniacs, but there must be a physiological cause for such behavior.

For the geophagy of the pregnant Lasch (p. 219) has tried to give an explanation which does not satisfy me. According to him, the stomach does not bear substances like earth and clay, which will result in more or less violent vomitings which will cause, especially during the last months of pregnancy, contractions of the uterus and may facilitate delivery. This is theoretical speculation, but is not based on really observed facts. None of the authors who reports the craving of the pregnant for clay (and this is chiefly the case in Melanesia, India, and certain parts of Africa) says a word about vomiting, while the majority of women addicted to clay-eating take it habitually, whether pregnant or not; it is only during the periods of menstruation and pregnancy that the habit appears more intensified. It is clear, moreover, that a woman would not enjoy clay-eating and continue the habit if it really operated as an emetic. It is curious that Lasch himself cites Modigliani, who refers to the clay eaten by the Toba-Batak of Sumatra, as saying that it has the property of stopping the vomiting of women during pregnancy—the opposite of his theory—and this is far more probable. The Greeks used the earth of Samos as a means of stopping the vomiting of blood (Dioscorides), and the Arabic pharmacologists recommended the clay of Nishapur as a good remedy to relieve or stop nausea and vomiting (L. Leclerc, Traité des simples, II, p. 426).

The craving for earth so universally displayed by infants and young children, even in our midst, is presumably not pathological, but is simply due to insufficient roughage or insufficient mineral matter in their regular diet, and to an instinctive desire for roughage, which is usually supplied by wheat bran, potato-skins, green vegetables, and cereals. The case is known to me of a man (American) who for a few years swallowed two teaspoonfuls of white sand twice a day and declared that it kept him feeling fine in every respect; then he developed sarcoma of the intestine and died; whether the sarcoma was caused by his sand-eating habit has not been determined.

Explanations given by natives for earth-eating must be taken, of course, with a grain of salt. How many of us are able, if the question were put to us unceremoniously, to give an intelligent answer as to why we use salt and have a more intense craving for salt at one time than another. The common explanation given by primitives is that they believe earth or clay is good for them, that it benefits the stomach and promotes digestion. Others are satisfied

with the notion that it has a pleasant odor and taste, that it tickles the palate and gratifies the stomach; others are merely attracted by the peculiar bright colors of some clays.

It seems that in its origin geophagy is not allied with religious ideas, in particular, as one might think, with the worship of earth as a deity or the notion of mother-earth. China, as will be seen, affords the best example to this effect (p. 125).

It is curious that tribes which make an extensive use of clays ceremonially, for instance, in body painting, do not take to eating it; for example, the Andamans (A. R. Brown, The Andaman Islanders, 1922, pp. 90, 99, 102, 106, 111, 122, etc.) and the Cheyenne (G. B. Grinnell, The Cheyenne Indians, 1923, II, pp. 235-236, 242).

On the other hand, geophagy frequently enters into religious ceremonies, notably in ancient Mexico and among some Malayans, who consume earth in ordeals, or among the Chins of Burma and the Negroes of Barbados who swallow it in affirmation of an oath. In China, diatomaceous earth was regarded as being of supernatural origin, as the food of dragons and immortals; and the discovery of such earth was hailed as a happy omen, and its consumption could not fail to have a beneficial effect on the health and welfare of pious believers.

Earth is also eaten by animals. Ehrenberg (II p. 19) mentions a case of earth-eating horses from Africa. Examples are known of wolves eating earth. Yet Wilken's theory (Handleiding van der vergel. volkenkunde van Ned.-Indië, p. 21), that man hit upon the idea of earth-eating in imitation of animals, is not convincing and must be rejected. The physiological causes driving both animal and man to earth-eating possibly are identical, and if so, the assumption of a mutual imitation is superfluous.

I wish to express my thanks to Dr. S. A. Barrett, Mr. Elsdon Best, Mr. C. Daryll Forde, Mr. I. Lopatin, Mr. Marshall H. Saville, Dr. Frank G. Speck and Mr. J. Eric Thompson for specific information. Their contributions are quoted verbatim under their names and may be easily traced by consulting the index.

CHINA

As regards geophagy in China, three different ways of using earth must be distinguished: (1) the magical method of the Taoists, (2) the medicinal employment, (3) earth as a famine food.

In European literature we meet only a few casual references to the subject with reference to China. As far as I know, Edouard Biot, who took a profound interest in all scientific questions, first called attention to this singular phenomenon. In his "Etudes sur les montagnes et les cavernes de la Chine, d'après les géographies chinoises" (*Journal asiatique*, 1840, p. 290), he has the following observations:—

"On Mount Lo-pao, department of Lin-ngan fu (Yün-nan), the mountain-people make the earth of this mountain into balls; it is fat and soft, and according to the text of the *Kwang yü ki*, they feed on it habitually."

This translation, as will be seen presently, is not exact. The name of the mountain is Lo-jung 樂榮, not Lo-pao. Biot adds the remark, "This is a new example of the depravation of taste observed for the first time by de Humboldt among the Ottomac."

The account of the *Kwang yü ki*, alluded to by Biot, which is a geographical description of China, is as follows: "Mount Lo-jung (or yung) 樂榮山 is south of the prefectural city (Lin-ngan fu 臨安府 in Yün-nan). The earth of this locality has a fine odor, and is made into cakes used for purposes of cauterizing. When cooked (or heated), it can be eaten. The women of the P'o 焚 are fond of it." This text occurs in the original edition of the work, published in 1600 (chap. 21, p. 6b), as well as in the subsequent reprints of 1686 and 1744 (chap. 21, p. 11b). The question is of an edible clay; but the point emphasized by Biot, that the people feed on it habitually, is not directly brought out by the text, while he makes no reference to the P'o tribe; and this is an important feature. It is, accordingly, not the Chinese, but an aboriginal tribe of T'ai stock, which indulges in the habit; and, again, it is especially their women, who have developed this appetite. A similar reference to an aboriginal tribe is made in the *Nan chao ye shi*: "When the Li-su suffer hunger, they swallow earth mixed with honey" (C. Sainson, Histoire particulière du Nan-tchao, p. 181).

According to the *King chou ki* 荆州記, written by Sheng Hung-chi 盛弘之 in the fifth century A.D., there is in the district Wu-tang 武當 a ravine on the banks of which there is a clay of fresh-yellow color; also it is eatable (*T'ai p'ing yü lan*, chap. 37, p. 8). It is not stated, however, that this clay was actually eaten, although this probably was the case.

The *Shen sien chuan* 神仙傳, attributed to Ko Hung of the fourth century, contains the following story:—

"Wang Lie 王烈 lived solitary in the T'ai-hang Mountains 太行山 when all of a sudden he heard a crash on the east side of the mountain and the earth rolling like thunder. Lie proceeded to find out what had happened. He noticed that the mountain was cracked, and that the rocks were split over a distance of a thousand feet. Both sides of the road were covered with green stones exhibiting holes more than a foot in diameter. These holes were filled with a green mud which flew out like marrow. Lie took a sample of this mud, examined it, and formed it into a pill. Instantaneously it became hard like stone, as if hot wax were formed, and hardened immediately. It had an odor like boiled rice; and when he chewed it, it also tasted like rice. Lie collected several such pills of the size of peaches. He took these along and returned to Ki Shu-ye 嵇叔夜, with the report that he had found a strange object. Shu-ye, very pleased, took one of the pills and examined it; it changed into a green stone, and when struck, gave a sound like copper. Shu-ye then went along with Lie to inspect the spot, but the mountain which was previously torn asunder had resumed its normal shape."

There are several mountains bearing the above name—two in Shan-si (in P'ing-yang fu and Tse chou) and three in Ho-nan (in Chang-te fu, Wei-hui fu, and Hwai-k'ing fu). As follows from a notice in the *Kwang yü ki* (chap. 6, p. 26; original edition of 1600), the T'ai-hang of the prefecture of Hwai-k'ing is hinted at in the above story; for an abstract of it is given under the name of this mountain.

A landslip 山崩 in the T'ai-hang is reported in the year A.D. 265 under the Emperor Yüan 元帝 of the Wei (*T'ung chi*, chap. 74, p. 29b), and it is plausible that this catastrophe forms the historical background of Ko Hung's story.

The Gazetteer of Yi-hing 宜興縣志 has this story:—

"As to Yao Sheng 姚生, it is unknown from what place he came. Once he traveled to the Chang-kung Grotto 張公洞 and,

a torch in his hand, entered it. There he met two Taoists 道士 seated opposite each other and engaged in a game of *wei-k'i*. Sheng expressed the wish to obtain some food. The Taoists pointed to several lumps of blue (or dark) clay or mud 青泥. He chewed a morsel of it, and found it very fragrant. The Taoists then bade him go and not speak to mortals about his adventure. Sheng bowed and thanked them, and carried away in his bosom the remains of the clay. He left the grotto and met Kia Hu 賈胡, who became frightened and said, 'This is the food of dragons. Clay is produced in grottoes, in the same manner as rocks.' " In a Chinese tale, entitled "The Nine-headed Bird," a youth meets a dragon in its cave and notices it lick a stone; the youth, tortured by the pangs of hunger, follows the dragon's example and no longer experiences hunger (R. Wilhelm, Chinesische Volksmärchen, 1927, p. 14).

Under the heading *t'u fan* 土飯 ("earth-rice"), a fundamental document, hitherto not indicated, is contained in the *K'ien shu* 黔書 ("Records of Kwei-chou Province"), written by T'ien Wen 田雯 (*hao* Mung-chai 蒙齋). In the edition of the *Yüe ya t'ang ts'ung shu* (chap. 4, pp. 25b-26b) it is as follows:—

"During the period Wan-li (1573-1620) of the Ming dynasty, the district Tse-yang 滋陽 (in the prefecture of Yen-chou, Shantung) was struck by a great famine. Suddenly appeared there a Taoist monk with a star-cap, gourd, and sword, and pointing to a lot of waste-land, said, 'Beneath this spot there is earth-rice, which may serve as food.' He vanished at once, and the crowd regarded him as a strange apparition. The people dug the soil more than a foot deep, and found earth of a bluish color, which somewhat had a flavor like grain. The famished people swallowed it eagerly, and as they greatly enjoyed it, quarrelled about the same piece. Several thousand men took so much of this earth away that it resulted in a pit several acres wide and about twenty feet deep. The following year, when wheat had matured, the Taoist monk came down to the same spot, as if he had something to fill out the pit. All of a sudden it was full, and again the people began to dig; however, they found nothing but sandy earth which could not be eaten; for the fairies 仙家 are crafty and make such earth only to help men. Further, in the year *ping-tse* 丙子 of the period Tsung-cheng (1636), there was an intense drought north of the Yang-tse, and in the Fung-yang mountains 鳳陽山 this earth was produced. Many people depended on it to keep themselves alive. In examining the records of K'ien 黔志, I find

that for a number of years and in former times people used to dig earth on the occasion of great famines and to subsist on it. People unable to procure food, even when there was no drought, continually consumed such earth; nor is this astounding in view of the poverty of the populace of K'ien. When I heard of this, I was moved to sympathy with the people. Then I searched for this earth in order to examine it: it is white and unctuous like rice or meat-cakes. I tried it and found that it is flat of taste, but has no special characteristic. It is swallowed with some difficulty; when it has reached the stomach, however, one is satiated, but with a feeling of depression. Excessive eating of earth will cause obstructions and evil effects, and will ultimately lead to death. Ordinarily, people doomed to death from starvation have no leisure to select wherewith to fill their stomachs; anything is appetizing to them, and their thoughts are occupied day and night with devising new means of subsistence. Those who escape death owe it to the fact that they had mixed other things with the clay. This earth, therefore, is not to be regarded very highly, and does not even satisfy as much as chaff."

It is obvious that the specimen of white clay examined by T'ien Wen is not identical with the earth-rice of bluish color eaten by the people at the instigation of a Taoist monk. The former was a common inorganic clay, the latter a kind of kieselguhr containing organic substances and in principle identical with the "stone flour" to be discussed presently.

A substance *shi mien* 石麵 ("stone meal" or "mineral flour") is mentioned by Li Shi-chen in his *Pen ts'ao kang mu* (chap. 9, p. 22b) published at the end of the sixteenth century. Apparently, it is not pointed out in any previous *Pen ts'ao*. "*Shi mien* is not a substance of ordinary growth, but is an object of good augury 瑞物. According to some, it is produced only in times of famine. In the third year of the period T'ien-pao 天寶 (A.D. 744), under the reign of Hüan Tsung of the T'ang dynasty, in the districts Wu-wei 武威 and P'an-ho 番禾縣 [in Liang-chou fu, Kan-su], a sweet spring suddenly arose and brought forth stones, which were transformed into flour.[1] This was taken and eaten by the poor. In the fourth year of

[1] Inexact and incomplete translations of the text of the *Pen ts'ao* have been given by Biot (p. 216), Schott (in Ehrenberg I p. 145), and F. de Mély (Lapidaire chinois, p. 101). Biot translates, "Une source miraculeuse sortit de terre," omitting the geographical names entirely. Schott renders, "A source in Wu-jin (now Liang-chou fu) threw stones out." De Mély has, "La source de Li produisit une pierre"; in his translation, based on the unreliable text of the *San ts'ai t'u hui* (also utilized by Biot), all geographical names are eliminated, which renders

the period Yüan-ho 元和 (A.D. 810), in the mountain valleys of the three chou—Yün, Wei, and Tai—of Shan-si 山西雲蔚代三州, stones were transformed into flour, which was consumed by the people. In the fourth month of the fifth year of the period Siang-fu 祥符 (A.D. 1012), under the reign of the Emperor Chen Tsung of the Sung dynasty, there was a famine in the populace of Ts'e chou 慈州 [now Ki chou 吉州 in P'ing-yang fu, Shan-si]; the mountains in the district Hiang-ning 鄉寧縣 [in P'ing-yang fu] produced a greasy substance on stones like flour, which could be made into cakes and eaten. In the third month of the seventh year of the period Kia-yu 嘉祐 (A.D. 1062),[1] under the Emperor Jen Tsung, the soil around P'eng-ch'eng 彭城 [in Chi-li] produced flour; in the fifth month [of the same year] the soil in the district of Chung-li 鍾離 [in the prefecture of Fung-yang, An-hwi] produced flour. In

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the information valueless for scientific purposes, and the Chinese dates are not even correlated with those of our chronology. As the above quotation relates to the T'ang period, it is necessary to consult the geographical section of the T'ang Annals in order to understand this terminology. There we find (*T'ang shu*, chap. 40, pp. 7b-8a) that the district Wu-wei 武威郡 in Liang chou 涼州 was divided into six *fu* 府; namely, Ming-wei 明威, Hung-ch'i 洪池, P'an-ho 番禾, Wu-ngan 武安, Li-shwi 麗水, and Ku-ts'ang 姑臧; in the year A.D. 744, a hill came forth from under a sweet spring (*li ts'üan*), and in consequence of this event the name was changed into T'ung-hua 通化.—The natural event, as described above, was doubtless caused by a landslip. In 48 B.C., we read (*T'ung chi*, chap. 74, p. 29), mountains collapsed in Lung-si (Kan-su), and water-springs burst forth to the surface (山崩水泉涌出). The same phrase (水涌出) occurs in two passages of the *Hou Han shu* (chap. 26, pp. 3b, 4) in connection with landslips.—The "sweet spring" (*li ts'üan* 醴泉) was prominent among the phenomena of good augury. It was regarded as the essence of water, of sweet and fine taste, and was believed to come forth only at a time when the sovereign practised righteous principles. This first happened in A.D. 25 under the Emperor Kwang Wu of the Han, when those suffering from chronic diseases and partaking of this water were all cured. It appeared again in the beginning of the reign of the Emperor Wen of the Wei and in A.D. 435 under Wen of the Liu Sung dynasty (*Sung shu*, chap. 29, p. 41). In A.D. 1008 a sweet spring came forth on the T'ai-shan (*Shan-tung t'ung chi*, chap. 63, p. 8); and in the same year, the same event is reported in Ju chou 洧州, Ho-nan (*Ju chou ts'üan chi*, chap. 9, p. 63). A *li ts'üan* with a wine-like aroma exists on the sacred Hwa-shan in Shen-si (*Hwa yo ts'üan tsi*, ed. 1597, chap. 2, p. 3). *Li* is not the name of a river, as conceived in de Mély's work, but *li ts'üan* designates only "a spring of sweet water of miraculous origin."

[1]The date is erroneous. The passage is copied from the *Sung shi* (chap. 66, p. 18), where the date is given as the first year of Kia-yu (A.D. 1056). Moreover, the locality is more exactly defined as the village Pai-hao 白鶴 in the district P'eng-ch'eng; and it is added, "The soothsayers stated, 'When the earth produces flour, the people will be stricken by hunger.' "

the fifth month of the third year of the period Yüan-fung 元豐 (A.D. 1080), under the reign of Shen Tsung, all stones in Lin-k'ü 臨朐 and Yi-tu 益都, in the prefecture of Ts'ing-chou 青州 [Shan-tung] were transformed into flour, gathered and eaten by the people. Inquiring into this phenomenon, it must be accounted for by the desire to secure food. As to the taste of this substance, it is sweet and non-poisonous. As to its healing powers, it benefits the breath; and eaten, when mixed with other things, it stops hunger."

Li Shi-chen does not state that he has ever seen or examined this substance; and in view of his assertion that it does not ordinarily occur in nature, but appears in a prodigious or miraculous manner, this is not even probable. It is no longer known in China under this name, and is not given, for instance, in the "List of Medicines," published by the Imperial Maritime Customs. Li Shi-chen seems to be the only author who has reference to this matter, for the *T'u shu tsi ch'eng* cites no other text under this heading. There is no description of the substance preserved; and what it was, must remain more or less a matter of guesswork. Read and Pak (Minerals and Stones, *Peking Soc. of Nat. Hist. Bull.*, III, pt. 2, 1928, No. 72) also give *shi mien* as unidentified.

We may positively state, however, what it was not: it was not a famine-food. The intimation that it only appears in famine-times is a gratuitous speculation; for under the dates recorded there were no famines, nor is it said that the people were driven by hunger to eat this substance; they ate it, simply because it was found and thought to be eatable. On the other hand, in the numerous records of famines under the Sung dynasty, it is not stated in a single case that people subsisted on this mineral flour. On the contrary, whenever food-substitutes are mentioned in such cases, they are given as leaves, wood, roots, chaff, ferns, mosses, rats, and human flesh.

A. J. C. Geerts (Produits de la nature japonaise et chinoise, 1883, p. 388) has a brief notice on *shi mien* (Japanese *seki-men*), saying that he has in his collection under this name a grayish white friable clay coming from Iwakimura in the province of Kaga and not containing organic matters. "Mixed with flour," he adds, "this is eaten in China in times of famine as a supplement of an insufficient nutrition, but it appears that in Japan where bad harvests are fortunately much more seldom than in China geophagy is not practised." This statement lacks sense and logic. If the Japanese abstain from eating earth, how is any one to know that a clay specimen from Japan is edible and how is it possible to assert

that this Japanese specimen is identical with the Chinese "stone meal"? As a matter of fact, the former has nothing to do with the latter, and Geerts' note is no contribution to the problem.

In my opinion the "stone meal" of the Chinese is a fossil earth or kieselguhr, akin to the "mountain meal" of Germany (p. 168).

The last of the events mentioned by Li Shi-chen is also referred to by a contemporary writer, Wang P'i-chi 王闢之, in his *Sheng shwi yen t'an lu* 渑水燕談錄 (chap. 9, p. 19, and chap. 10, p. 9b), written toward the end of the eleventh century. This author reports a famine which took place in Lin-tse 臨淄, in the prefecture of Ts'ing-chou 青州 (Shan-tung), during the period Yüan-fung (A.D. 1078-86); it then happened that in the mountains and plains grew everywhere a white flour and white stone 白麵白石 like lime 灰, but unctuous; the people obtained several tens of *hu* 斛 of this substance and mixed it with flour made into gruels and cakes, which could be eaten and proved very helpful. The author assures us that he made this observation with his own eyes.

Under the heading Kwan-yin fen 觀音粉 ("powder or flour of Kwan-yin," Avalokiteçvara), the *Pen ts'ao kang mu shi i* (chap. 2, pp. 28b-29b; written by Chao Hio-min in 1650), which is a supplement to the *Pen ts'ao kang mu*, gives the following additional information on edible clays:—

"According to the Gazetteer of Ch'u-chou fu 處州府志 [in Che-kiang], there is a white clay of muddy appearance in the Yün-ho Mountains 雲和山. It is mixed with water and beaten on a stone; flour of glutinous rice is added, the proportions being half and half. This compound is steamed and consumed. It is capable of appeasing hunger, and is called Kwan-yin flour.

"There is an earth or clay produced in mountains, which in its interior is as white as flour, very fine and glossy. In years of dearth the villagers hastily dig it up, mix it with wheaten flour, and bake the mass into cakes which they use as food. But moderation must be observed; in case too much is eaten, there is danger of the belly being closed, as the natural properties of this clay are apt to obstruct the stomach and bowels. Earth produced in caves must not be administered for fear lest it might be poisoned with the saliva of venomous snakes.

"Cheng Chung-k'wei 鄭仲夔, in his *Leng ch'ang tai* 冷嘗載, tells this story: In the year *ping-tse* 丙子 there was a dearth in the villages I-yang and Shi-wo. The Buddhist monk in charge of the temple there had a dream in which the Mahāsatva 大士 announced

that in the soil at the foot of the mountain there was a mineral flour (*shi fen* 石粉), which might be taken to satisfy hunger. In accordance with these words he set out to dig and obtained this mineral flour, which was very much like fern flour (*küe fen* 蕨粉).[1] He ground it finely and made it into cakes which were steamed until well cooked and of pleasant taste, quite unusual. The villagers, as soon as they received the news, vied with one another to gather this flour. Some placed it in cabbage oil which made it so bitter that it was unfit to eat. This substance was what is called 'flour of the Mahāsatva' (*ta shi fen* 大士粉).

"The mineral flour discussed in the section 'Stones' of the *Pen ts'ao kang mu* is exactly the same. It is regarded as something extraordinary and grows imperceptibly. Now everywhere in mountains there are lakes on the banks of which is found a kind of earth that has curative properties, inasmuch as it stops hunger, benefits the breath, and adjusts the inner organs. When eaten, it stops hunger unconsciously. It has the merit of removing moisture, and in this respect is superior to *ts'ang shu* 蒼朮 (*Atractylis* sp.), for even earth may perform the function of the element water. Its taste is a bit sweet and bitter; its nature is even, it neutralizes poison caused by insects, it cures dropsy, clears the eyes and heals jaundice caused by moisture."

In the Gazetteer of the district of Hwa-yang, which with Ch'eng-tu forms the prefectural city of Ch'eng-tu and capital of Se-ch'wan Province (*Hwa-yang hien chi*, chap. 43, p. 3), it is reported that "in the forty-ninth year of K'ien-lung (1784) an ochre-colored earth was produced in the town of Hwa-yang and that the people picked it up and ate it, as it was as fine as flour." There was no famine at that time, and there was no necessity of consuming this earth. It simply appealed to the people for the reason that the appearance of this earth was an unusual natural occurrence and that it was distinguished as to color, fineness, and possibly flavor.

An allusion to "mineral flour" is perhaps contained in the following tradition which is pointed out by J. F. Davis (On the Poetry of the Chinese, p. 95, Macao, 1834), but which I have not been able to verify from Chinese records. "When Yung-lo usurped the whole empire (A.D. 1403), one of his nephews, the proper heir, shaved his head, and assuming the habit of a priest, retired to the

[1] The young shoots of some kinds of fern are eaten, and a kind of arrow-root is made from the rhizomes, which, after proper washing and cooking, are also eaten, in spite of their bitterness—only as substitutes in times of famine (G. A. Stuart, Chinese Materia Medica, p. 173).

depths of the mountains. The living rock there opened, and poured out a constant supply of grain for the support of the royal refugee. After his death, the miracle still went on, until a covetous priest, not satisfied with the quantity of grain thus obtained, enlarged the hole or fissure in the stone through which it flowed—when the supply immediately stopped altogether, as the proper reward of his cupidity."

Rockhill (*J. R. A. S.*, 1891, p. 267) was informed that an eatable clay is found in holes in the low ground near the river at Wu-tai shan in Shan-si.

From the notices of the *Pen ts'ao kang mu* and *Pen ts'ao kang mu shi i* it follows that medicinal properties also were attributed to edible clays. Li Shi-chen has devoted chapter VII of his work to earthy and clayish substances, discussing sixty-one species and their administration in the pharmacopoeia. This subject belongs to the history of pharmacology and has no direct bearing on geophagy; these medicinal clays were administered in small quantities in the form of pills, and were usually blended with other ingredients. Such pills surely were not capable of leading one into a habit of or passion for earth-eating. In this connection, however, attention must be drawn to the fact that it was the Taoists again who inaugurated the employment of earth as a remedy against disease. There is a story of a Taoist, Ch'en Nan 陳楠 by name, who was possessed of the power of curing disease with a medicine which he made by kneading earth and charmed water together into a bolus. In consequence he was nicknamed by his contemporaries Ch'en Ni-wan 陳泥丸; that is, Mud-pill Ch'en (cf. W. P. Yetts, *New China Review*, I, 1919, p. 17).

Rains of earth are also recorded in Chinese chronicles, thus in 1098 B.C. in the Bamboo Annals (E. Biot, Tchou chou ki nien, 1842, p. 29); others during the period Shi-yüan (86-80 B.C.), in A.D. 503, 535 ("yellow dust"), 536, 550 ("yellow sand"), 580 ("yellow earth"), and 582 ("earth"); see *T'ung chi* 通志, chap. 74, p. 4. In no case is it recorded, however, that such earth was consumed, presumably because an earth rain was considered an evil augury.

Ehrenberg (I p. 144) has analyzed two specimens of edible earth from China. One of these, a white earth, he received from A. von Humboldt, while the latter resided in Paris, and forwarded from China to Paris by French missionaries. The other specimen was a yellow earth which Ehrenberg obtained in 1847 from one of

the large geological collections of London and which proved to be a sort of loam.

The text quoted above from the *K'ien shu* demonstrates clearly that clay also served occasionally as a famine food and that it was a Taoist monk who pointed it out to the populace. It must be emphasized, however, that, comparatively speaking, geophagy has been a very rare occurrence in China in times of famine.

Famines, droughts, inundations, and other similar catastrophes, to which the country has so frequently been subject, are listed with minute care in the chapters of the Annals, entitled *Wu hing chi* 五行志 ("Records relating to the Five Elements"). In the majority of cases, merely the fact of a famine is recorded under a given year (see, for instance, *Sung shu*, chap. 34, p. 31; and *T'ang shu*, chap. 34, p. 14), while food-substitutes used in famines are but seldom mentioned in the Annals. The gruesome phrase 人相食 ("men ate one another") recurs constantly. In A.D. 939, when locusts ravaged the fields of Chu chou 諸州 (Shan-tung), the people were forced to subsist on grass and leaves (*Kiu Wu tai shi*, chap. 141, p. 6b).

In A.D. 1127 when the city of Pien-liang (now K'ai-fung, capital of Ho-nan Province) was stricken by a great famine, the price of a pint of rice soared to three hundred copper coins, a single rat reached a high mark of several hundred copper coins, and people subsisted on aquatic plants and leaves of trees like *Sophora japonica* (*Sung shi*, Annals of the Sung Dynasty, chap. 67, p. 2). In A.D. 1148 when the eastern part of Che-kiang Province was visited by a famine, food was reduced to distillers' grains, chaff, grass, and wood (*ibid.*). In A.D. 1640 there prevailed a drought, locust-plague, and in consequence a famine in Ju chou 洧州 (Ho-nan) when leaves of cotton-trees and other plants sold for a hundred copper coins the catty; crows and magpies deserted the country and flew southward, leaving their nests empty (*Ju chou ts'üan chi*, chap. 9, p. 63). We read also that people driven by hunger gnawed at crossbows or even boiled shoes, armor, leather, or sinews.

Grass, foliage, weeds, wild herbs, and tree-bark have always been the principal food-substitutes in famine times up to the present day. The best known historical example of recent times is the so-called "sweet dew" (*kan lu*) consumed by the T'ai-p'ing rebels during the siege of Nanking in 1863. Li Siu-ch'eng 李秀成, the so-called Chung Wang 忠王 ("King of Loyalty"), as he tells in his memoirs, induced the T'ien Wang ("The Heavenly King"), the leader of the

T'ai-p'ings (Hung Siu-ts'üan 洪秀全), to issue a decree with suggestions to meet the distress of the famished population. "The decree was that they should eat 'sweet dew' in order to support themselves, whereupon I asked, 'How can they subsist on sweet dew?' The T'ien Wang replied, 'Let them take of the things which the earth brings forth'—this, it appears, was what he called 'sweet dew.' In concert with others I then represented that such was not a fit article for food, whereupon the T'ien Wang observed, 'Bring some here, and after preparing it, I will partake of some first.' As no one complied with his request, he gathered several herbs from his own palace garden and, having made them up into a ball, he sent the ball outside with orders to the people to prepare their food in like manner . . . . Three or four years prior to the present crisis orders had been issued to each household to collect ten piculs of 'sweet dew,' and deliver it into the treasury. Some obeyed and contributed their quota, others did not. The T'ien Wang for many days ate this stuff in his palace, and if my chief could do so, there was no reason why I should not do the same" (The Autobiography of the Chung Wang, translated from the Chinese by W. T. Lay, p. 62, Shanghai, 1865).

Some examples of geophagy in times of famine, which have come to my notice, may now follow. Such cases have occurred indeed, though rarely, and clay has been the last resort of the people when all other means of subsistence were exhausted.

The *Kiu hwang hwo min shu* 求荒活民書 is a monograph dealing with famines, droughts, and other catastrophes and the means employed on such occasions in saving human life. This work was written under the Sung by Tung Wei 董煟 (title Ki-hing 季興), who graduated as *tsin shi* in A.D. 1194, and has been reprinted in the collection *Ch'ang en shu shi* 長恩書室 published in 1854. Several examples of geophagy during times of famine are cited in this book (chap. 拾遺, pp. 2 and 11). Thus, in A.D. 618, at a time of scarcity, people gathered bark and leaves of trees, or pounded straw into a powder, or baked earth and ate it.

It once happened under the T'ang (A.D. 618-906), when military forces besieged Lo-yang and supplies were exhausted in the city, that people ate grass, roots, and leaves. When all this was finished, they subsisted on cakes made from pulverized rice dipped in floating mud. All fell ill, their bodies swelled, and their feet weakened until finally they died. In the period K'ien-tao (A.D. 1165-74),

when a great famine prevailed in Kiang-si, there were people who ate white clay (*pai shan t'u* 白 墡 土) and choked to death.

It is on record in the *Wu Tai shi* 五 代 史 (Annals of the Five Dynasties of the tenth century): "When the town Ts'ang chou 滄 州 was besieged by Liu Shou-kwang 劉 守 光 [he died in A.D. 912], the inhabitants ate pieces of clay mixed with their food" 雜 食 堇 塊 (cf. Couvreur, Dictionnaire classique chinois, p. 172).

In the Gazetteer of the District of Wen shwi 文 水 (*Wen shwi hien chi*, chap. 1, p. 7b), in the prefecture of T'ai-yüan in Shan-si Province, it is on record that in A.D. 1586 there was no rain during the entire year, so that a huge famine prevailed and people ate grass, roots, and white clay or kaolin (*pai t'u* 白 土), with a very large number of dead in consequence.

In 1834 the Chinese missionary Mathieu-Ly, stationed in the province of Kiang-si, reported in the *Annales de la Propagation de la Foi* (No. XLVIII, 1836, p. 85), "Several of our Christians will surely die of starvation this year [1834]. God only can remedy so many and so great needs. All crops have been swept away by the inundation of the rivers. For three years numerous people feed on the bark of a tree which grows here; others eat *a light, white earth* discovered in a mountain. This earth can only be bought for silver, so that not every one is able to procure it. The people first sold their wives, then sons and daughters, then their utensils and furniture; finally they demolished their houses in order to dispose of the timber. Many of them were wealthy four years ago." Reporting on the great famine which overtook Shen-si Province in 1900-01, F. H. Nichols (Through Hidden Shensi, p. 232) states, "In order to buy food the farmers sold first their scanty stock of furniture and farming tools, then the roofs of their houses, and, lastly, their children."

"Regarding the straits as to food to which the sufferers by famine were put, various details are given. As a general rule, when famine was at its height, the sufferers from it, as long as they were able to do so, were in the habit of gathering grass, weeds, and other herbage they could find in the fields, and of eating these alone, or with such scanty supplies of better food as they were able to get. Others betook themselves to a soft *clayey slate*, which for a time allayed the pangs of hunger, but had a very injurious effect upon them. Those who had bean-cake, cotton seeds, and grass seeds swept from the roadsides, or bark and dried leaves, were considered fortunate. In Shan-si *stone-cakes* were somewhat

extensively made use of as food, and were exposed for sale. The stone of which they chiefly consisted was the same as that of which English soft slate pencils are made. This was pounded to dust and mixed with millet husks, in greater or less proportions according to the poverty of the people, and then baked. It did not look bad, but tasted like what it was—dust. Elsewhere the people made use, as food, of a kind of *white earth* brought from the mountains, and which has much the appearance of corn-flour. Many of the people, for want of other sustenance, supported themselves upon this 'mountain meal.' In many places it was impossible to see any trees with the bark upon them; it had all been stripped off to be reduced and so consumed as food. Of another locality it is recorded that the most common food of the people consisted of leaves, mainly willow-leaves, weeds, and elm-bark; that the trees in summer were so stripped of foliage as to look bare as in early spring; the very weeds fast getting used up. Near T'ai-yüan fu, at the extreme northern limit of the famine in Shan-si, the roots of rushes were all eaten up; there were no trees left to bark except the poisonous ones, and hunger made the people often try these. In the same locality every family lived on the seeds of thorn-bushes or wild herbs, which they ground and mixed with a little corn-flour. In the southern part of that province every tree whose bark was not actually bare was stripped bare, and the dead trunks were cut up as firewood; in one district there some fine persimmon (*Dyospyros kaki*) orchards were left nearly uninjured, from which circumstances it was concluded that the bark of that tree could not be eaten, notwithstanding the excellent quality of its fruit. Elsewhere in that province, the root of the flag-rush (*Typha?*), stems of wheat, millet, maize, etc., and leaves of the willow, peach, plum, apricot, mulberry, and persimmon were eaten; also wild herbs, too numerous to name, *oily earth*, and many other articles not usually consumed. In some instances it was recorded that by means of small sums of money given by the several agencies of relief, those who were living on straw and reeds ground up with a little mud or chaff or boiled bark, were able by the addition of more substantial food thus put within their reach to tide over the time pretty well until the autumn harvest was cut" (Surgeon-General C. A. Gordon, An Epitome of the Reports of the Medical Officers to the Chinese Imperial Maritime Customs Service, from 1871 to 1882, pp. 387, 388, London, 1884).

In the report of the great famine in northern China during 1920 and 1921, mention is made of "flour made of ground leaves, fuller's

earth, flower seed, etc." used in the daily diet of the famine-stricken (W. H. Mallory, China: Land of Famine, p. 2, New York, 1926).

Speaking of steatite or soapstone found in the environment of Lai-chou, Shan-tung Province, A. A. Fauvel (La Province chinoise du Chan-toung, p. 163, Bruxelles, 1892) remarks that steatite in a pulverized state is still employed in Shan-tung for the purpose of rendering wheat flour white and heavy; during the famine of 1876-77 many unfortunate people ate such flour in the hope of deceiving their stomachs and appeasing their hunger; the result was a terrible constipation which entailed death.

The Chinese and also the Japanese have a class of literature styled "treatises of eatable things" and devoted to a discussion of vegetal and animal foods for human consumption. None of these books makes any reference to earth or clay as an article of diet or as a relish; nor have I ever heard or read of an habitual earth-eater in China. The Chinese, although they regarded diatomaceous earth as a marvel of nature and occasionally ate it and although the destitute when driven by starvation occasionally resorted to earth-eating, cannot be classified as geophagists.

Finally I deem it my duty to refute a few of the many errors and misrepresentations from which this subject has suffered on the part of previous writers. Ehrenberg (I p. 144) asserts that clay-eating goes back in China to ancient times. There is no evidence for this generalization. Ancient Chinese literature contains no reference to such a practice. In this case, negative evidence may claim some degree of validity; for the Chinese have always been keen observers of the soil, its formation, color, and other properties, for purposes of agriculture and industry. The chapter Yü kung of the *Shu king* is the best witness thereof: the nature of the soil in each of the Nine Provinces is briefly characterized; for instance, as "whitish and rich," as "red, clayish, and rich," as "yellow and mellow," etc. In no passage, however, is any mention made of geophagy. In the *Chou li*, the various qualities of soils are set forth, and five classes are assumed according to aptitude for cultivation, productions, and physical characteristics of the inhabitants (E. Biot, Tcheou-li, I, pp. 194, 276). There are, further, numerous references to earths and clays in technical literature, which, however, maintains complete silence as to edible sorts (cf. Beginnings of Porcelain in China, Field Museum Anthr. Series, XV, No. 2, pp. 111-117).

Earth colored and plain played a great role in the worship of the god of the Soil and in the ceremony of investiture with a fief when a clod of earth enveloped by the white herb *mao* 白茅 was bestowed upon the vassal by the liege-lord (cf. Chavannes, Le T'ai Chan, 1910, pp. 450-459; Le royaume de Wou et de Yue, *T'oung Pao*, 1916, p. 187; J. Przyluski, *Bull. de l'Ecole française*, X, 1910, p. 347).

A clod of earth was the symbol of the land and sovereign power over it. In 643 B.C. when Ch'ung-er 重耳 left Wei, he begged some food from a villager, who handed him a clod of earth. The prince became irritated and was about to whip him, but Tse-fan 子犯 restrained him, saying that this is a gift of Heaven. Ch'ung-er then touched the ground with his forehead, received the clod, and took it with him in his carriage (*Tso chwan*, V, Hi kung, 23d year; cf. Legge, Classics, V, p. 186; Couvreur, Tch'ouen Ts'iou et Tso Tchouan, I, p. 342). These examples are instructive in demonstrating that the sacred character of earth did not lead to earth-eating.

D. Hooper and H. H. Mann (p. 251) assert that "the Chinese are addicted to the habit and eat a white clay free from all organic remains." No authority is cited for this bold generalization,[1] but reference is made to D. Hanbury's "Science Papers" (p. 219), where an aluminous and an argillaceous earth, used for medicinal purposes, are described; but Hanbury does not state that they are ever taken as food. Hooper and Mann, further, remark that the Chinese, in many parts, mix gypsum with pulse, and thus form a jelly, which they greatly relish. What is meant here is doubtless traceable to F. Porter Smith (Contributions toward the Materia Medica of China, p. 108), who says, "The mineral gypsum is largely used as an ingredient in the bean-curd of ordinary diet. It enters into the composition of some sorts of putty, and is used to give rice a whiter face, after hulling and preparing it for sale." This phenomenon, however, is radically different from clay-eating. The question is here merely of an adulteration of food-stuffs, but the Chinese certainly have no craving or appetite for gypsum.

R. Lasch (p. 216) states, "In China, earth-eating is widely diffused. Pater Du Halde mentions a clay from the province of Shen-si utilized by Chinese women in order to render their complexion pale. Such clays are also found in many other places of China, and as in

[1] The sentence is evidently taken from the article of Sarat Chandra Mitra, who says (p. 288), "The Chinese, the Annamites, etc., are also addicted to this habit." Almost all data in the first chapter of Hooper's and Mann's treatise are derived from Mitra's article without acknowledgment. Who has ever observed an earth-addict among the Chinese?

Persia and Java, are publicly sold." He quotes Du Halde's work, but gives no exact page-reference. In fact, Du Halde says nothing of the kind; at least he does not say that Chinese women eat clay to bring this effect about; he does say (Description of the Empire of China, I, p. 281), "It is affirmed that they rub their faces every morning with a kind of paint to make them look fair and give them a complexion, but that it soon spoils their skin and makes it full of wrinkles." It is an old story that Chinese women, besides rice powder, use pulverized clay as a face powder, but they never took it internally. The *Ling piao lu i* (chap. A, p. 4, ed. of *Wu ying tien*), written at the end of the ninth century by Liu Sün (Sino-Iranica, p. 268), for instance, points out a pit of white clay north of the city of Fu-chou 富州 (in the province of Hu-pei), the material being dug and traded by the people of the district and being used as a face powder by women.

INDO-CHINA

The brief communication of E. T. Hamy (see Bibliography) is based on information received by him from G. Dumoutier at Hanoi, who sent him specimens of earth cakes dried or cooked and consumed in four provinces of Tonking—Nam-Dinh, Thai-Binh, Hai-Duong, and Sontay. These cakes are said to be regarded rather as dainties than as articles of food, but their consumption is not connected with any superstitious idea or any belief in medicinal virtues of the substance; it is, according to Dumoutier, a simple depravation of taste maintained by local tradition. There are two kinds of these cakes; one consisting of thin shavings cut off from a compact block and rather dried than cooked over bricks made red hot by fire. The natives call them "cat-ears tiles" (*ngoe tai mèo*). They sell on the market on an average at 18 silver dollars for 600 grams. The other specimen looks like a thin tile, and has a beautiful red color in consequence of a rather strong roasting; its price is the same as for the preceding one. At the end of Hamy's notice a few chemical observations are made by E. Demoussy. The cakes in question have the physical properties of clay, unctuous to the touch, almost completely free from grains of sand, sticking to the tongue like kaolin and having the same flavor as the latter or rather lack of flavor. The clay includes a bit of iron and lime without an appreciable proportion of limestone, a little phosphoric acid, and a quantity of azote in that proportion generally found in a good soil; that is, about 15 per cent. The only characteristic that distinguishes these specimens from ordinary earth is that they contain a bit of combined ammonia, but in a quantity not sufficient to convey to them the slightest flavor. In short, they do not contain any ingredients that would justify their use as an article of food.

As the information given by Dumoutier seemed little satisfactory to me, I applied to the Ecole française d'Extrême-Orient of Hanoi, and the then secretary, Noel Péri, whose premature death is much to be deplored, was good enough to transmit to me in 1919 the following precise information which had been communicated to him by Dr. med. Paucot after the latter's own observations. "Cases of geophagy were observed only among the Annamese, not among the Muong. There is in Tonking no fossil edible clay. The cases known date more than twenty years back, the last being recorded in 1899-1900. The question was of eaters of an alluvial potter's clay observed in only two villages, one located a few kilometers south-

east of Hanoi on the right bank of the Red River, the other on the same bank opposite the town Yên-bay. There was but a small number of such persons, all in a wretched condition, who seemed to have acquired this habit in consequence of famines. How they got this idea could not be determined. The habit of eating a few mouthfuls of earth at their meals persisted even when it was possible for them to return to a normal state of nutrition, and they consumed this earth jointly with other foods. The clay was cut up into the shape of thin tiles of small size and simply dried in the sun. This consumption of clay resulted in the following symptoms: increase in volume of the intestines; extensive dilatation of the stomach which in some cases dropped to a point beneath the umbilicus; frequent helminthiasis; ankylostomiasis in all cases; state of emaciation and cachexy within the lapse of one or two years. From time to time cases of morbid geophagy are observed among children in the Annamese population; the parents are generally annoyed and alarmed and consult a physician. These cases are of interest only from a medical point of view, but seem to be devoid of interest to the ethnographer."

Monsieur Péri added that these earth cakes were never regarded as dainties, that they occurred until a few years ago not far from Hanoi in the provinces of Hà-dông and Son-tây, but that this custom appears to have almost vanished at present owing to the cessation of famines, as he was assured by a high Annamese functionary. Mitra (p. 288), without citing an authority, asserts that "the Annamese look upon the pasty and tasteless clay as a great delicacy."

MALAYSIA AND POLYNESIA

The earliest mention of geophagy with reference to Java is made by Labillardière (Relation du voyage à la recherche de la Pérouse fait en 1791-92 et 1798, II, p. 322 or Account of a Voyage in Search of La Pérouse, II, p. 338, London, 1800). In the villages between Surabaya and Samarang he noticed with surprise in the markets of several villages shops filled with little square, flat loaves of a reddish potter's earth which the inhabitants called *tana ampo*. This term means "clay earth." In his Malay vocabulary appended to his work (p. 376) the author defines it as "potter's clay which the Javanese eat." "I had at first imagined," Labillardière writes, "that they might probably employ these cakes for scouring their clothes; but presently I saw the natives chew them in small quantities, and they assured me that they made no other use of them." A specimen of this loam was sent in 1847 by Mohnike to Berlin, where it was analyzed by Ehrenberg (Bericht über die Verhandlungen der Berliner Akademie, 1848, pp. 222-225). Dutch scholars have since done considerable work in studying the edible clays used in Malaysia, above all J. J. Altheer, a chemist, who has examined and analyzed eleven specimens from Java and Borneo, and J. Heringa, who has investigated a clay coming from the west coast of Sumatra.

The word *ampo* is explained by J. Rigg (Dictionary of the Sunda Language, p. 13, Batavia, 1862) as follows: "Said of animals, particularly buffalo and deer, which lick the places where salt has been deposited, or are in the habit of licking the ground or rocks which contain some saline matter. *Batu ampo* is ampo stone which is found in many parts of Java and eaten by the natives. It is either a rock in a high state of decomposition, from having undergone a sort of *caries in situ*, or in other cases may be an aggregation of minute animal exuviae."

In a letter addressed to A. von Humboldt, Leschenault has given the following information: "The earth sometimes eaten by the Javanese is a sort of reddish ferruginous clay. It is spread out on rather thin leaves and then rolled into the shape of small tubes (almost in the form of the cinnamon of commerce) which are toasted over a fire. In this state the clay is called ampo, and is sold in the markets. The ampo has an insipid and empyreumatic flavor. It is rather absorbing, sticking to the tongue, and dries it up. Only women will eat it,

especially during the period of maternity or when attacked by the malady known in Europe as pica. Some men also eat ampo, for the purpose of checking obesity. I believe that ampo only acts on the stomach as a substance which absorbs the gastric juices" (Camilli, p. 188).

Hekmeyer, who was an officer in charge of the distribution of drugs in the Dutch Indies, stated that the Javanese first remove sand and other hard substances from the edible clay, and then reduce it to a paste by kneading it with water. The dressed clay is then molded into small cakes or tablets of about the thickness of lead pencils. The latter are baked in an iron sauce-pan, and when thoroughly roasted, look like pieces of dried pork. The Javanese often partake of small figures roughly made from clay in the form of animals or little men like those made by pastry-cooks (Mitra, p. 288). E. Ferrand gives illustrations of such clay figures representing a girl astride a dog, a woman holding a child, and a dancing girl. It is reported also that the women of Java eat pieces of a red pottery made at Samarang (Heringa, p. 186) and that at Batavia red pieces of clay wrapped in dried leaves of pisang or other plants are sold in the market (Altheer, p. 84).

The women of Java are also said to eat earth when attacked by chlorosis or pica. Others resort to it as an alleged means of reducing weight, because a slender figure is regarded as beautiful.

The preparation of ampo in Java forms an industry of its own which is practised by professionals, called *tukang ampo* (A. Maass, Durch Zentral-Sumatra, II, p. 252).

A red-brown earth is eaten by the Batak women on the west coast of Sumatra (Heringa, p. 186).

In the highlands of Padang in Sumatra earth is eaten, especially by pregnant women. To bring about abortion, a pap made of leaves and eatable clay is heated and applied to the abdomen. In Nias women put hot slices of clay on the abdomen to the same end (A. Maass, *op. cit.*).

The Encyclopaedie van Nederlandsch-Indië (2d ed., I, p. 3) gives the following brief summary under Eetbare aarde:—

"Eating earth is a custom encountered throughout the Archipelago, both in Java and Sumatra among Malayans and Batak, among the Dayak of Borneo, in Sumbawa, and even in New Guinea. The earth which is eaten, called *ampo* in Java, consists of a fat clay white, yellow, reddish, yellow brown, or gray green in color, and which besides the common components of clay contains bituminous and organic substances. It is carefully cleaned; when it has settled

after a night, it is rubbed and formed into disks or tubes. The cakes are often covered with a solution of salt, smeared with coconut oil, and are then roasted. The earth is usually eaten as a delicacy, sometimes also by pregnant women, that the unborn infant may be fond of it. Its use leads to constipation and illness."

Other writers say that Javanese pregnant women eat clay in the belief that their foetus is fond of it.

Aside from this realistic geophagy, there is a ceremonial form of it. Eating of earth features in the ordeals of the Javanese: when a dispute arises about a boundary, it is believed that a bit of the controversial earth swallowed will swell the wrong-doer or burst him (P. J. Veth, Java, IV, 1907, p. 146). This custom may be traceable to India (below, p. 141).

In the island of Timor earth-eating played a role in ordeals. When the oath was sworn, a bit of rice was scattered, and some earth was eaten while the Mistress of the Earth was invoked (Riedel, Die Landschaft Dawan oder West-Timor, *Deutsche Geogr. Blätter*, X, p. 280; and A. H. Post, Grundriss der ethnologischen Jurisprudenz, I, 1895, pp. 482-483).

H. L. Roth (The Natives of Sarawak and British North Borneo, I, 1896, p. 385) quotes from Sir Spencer St. John (1862) that "in their boat expeditions Borneo people take a supply of red ochre to eat, in case of becoming short of other provisions; and we once found in some deserted Seribas' prahus many packets of a white oleaginous clay used for the same purpose"; and from Bishop McDougall (1863) that "there is a certain slimy clay which the Sakarran Dyaks always provide themselves with when they make their excursions in their boats, and which they suck when their stock of rice is exhausted: they say it is very nutritious." Roth was informed that the Undup occasionally eat a clay much resembling fuller's earth; they did not like it, but thought it a healthy thing to do—they seemed to think it acted as a purifier.

A. W. Nieuwenhuis (Quer durch Borneo, I, 1904, p. 83) informs us, "The fact is noteworthy that the natives of central Borneo sometimes crave a peculiar relish; thus, I observed that men and women, particularly pregnant women, sought in the soil of the banks for a yellowish or reddish loam consisting of weathered slate."

O. Beccari (Wanderings in the Great Forests of Borneo, 1904, pp. 335, 337) tells of Dayak of Borneo hunting among the pebbles of a torrent for a peculiar stone and nibbling it greedily as if it were a sweetmeat. It was a kind of clayey schist, soft and brittle and greasy

to the touch. At Ruma Sale he saw again some Dayak eating clay schist with evident relish and observes, "It certainly was not eaten to appease hunger, but as a delicacy or perhaps to assuage an instinctive craving of the stomach for some alkaline substance."

H. W. Walker (Wanderings among South Sea Savages, 1909, p. 220) writes, "I made the discovery that some of my Dayak friends were addicted to the horrible[!] habit of eating clay, and actually found a regular little digging in the side of a hill where they worked to get these lumps of reddish gray clay, and soon caught some of the old men eating it. They declared that they enjoyed it." Clay-eating seems to be quite general among the Dayak (see also Altheer, pp. 85-87).

Among the Kayan of Borneo "it frequently happens that the woman begins to crave to eat a peculiar soapy earth (*batu krap*), and this is generally supplied to her" (C. Hose and W. McDougall, Pagan Tribes of Borneo, II, 1912, p. 153).

I. H. N. Evans (Among Primitive Peoples in Borneo, 1922, p. 114) writes, "At Tuaran the women have the abnormal habit of eating earth, which is also found in other parts of Borneo, in Java, and the Federated Malay States. Not far from the Chinese shops at this station there is a gully, which at the time of heavy rains has a small stream running at the bottom of it. The sides of the gully are made of a bluish gray clay with one or two bands of a hard dark purplish red clay running through it. At about six o'clock in the evening it is usual to see anything up to about a dozen women digging out this red clay with pointed sticks or small knives, and putting it into baskets. I have been told that the clay is roasted before being eaten, and that some women consume very large quantities. It is said to be a good medicine for women who are enceinte. I have several times dug out a sample and eaten it myself; it has rather the consistency of chocolate, but is almost tasteless."

With reference to the same locality O. Rutter (The Pagans of North Borneo, 1929, p. 72) supplies the following interesting information: "The women of the Tuaran group have a habit of eating a dark red clay which is found near the Chinese shops at the Tuaran Government Station, and tastes something like unsweetened chocolate. Mr. E. A. Pearson, who was stationed at Tuaran for some time, tells me that this earth is eaten by women who wish to bear children, since it is supposed to have particular effect at or about the time of the menstrual periods. That is, it is eaten as a means of securing pregnancy and not as a medicine during pregnancy, as Mr. I. H. N. Evans states. It seems to be rather a stealthy habit

and the women (naturally enough) are shy about admitting that they eat it; they dig it out of the ground quite openly, but it is always 'for someone else.' Some women undoubtedly become addicts and cannot give up the habit, even when they are long past childbearing. One elderly Dusun crone told Mr. Pearson that she would rather give up her betel-nut than her daily whack of clay."

The analysis of an edible clay from Borneo is given in *Zeitschrift für Ethnologie*, III, 1871, p. 273.

In the Moluccas, a grayish white clay is eaten at Abubu in Nusalaut and in Saparua, notably by women during the period of pregnancy, and as stated by one informant "for the purpose of giving birth to white children" (K. Martin, Reisen in den Molukken, 1894, p. 55).

No case of genuine geophagy has become known to me from the Philippines. The following instances in which earth is used ceremonially and medicinally by the Tinguians have been kindly communicated to me by Dr. F. C. Cole.

The second day following a marriage is known as *sipsipot* ("the beginning or the start"). The couple go with their parents to the fields, and after the boy has cut grass along the edge of the land, he takes a little of the soil on his headaxe. Both bride and groom taste of this, "so that the ground will yield good harvests for them."

As a cure for dysentery and cholera, leaves of the sobosob (*Blumea balsamifera*) are placed in a jar of water. Above this a ball of clay is suspended, and banana leaves are placed over the mouth of the jar to prevent escape of the steam. The leaves are boiled for a time, and then the ball of clay is crushed and mixed with water, and this is given the patient to drink.

At the beginning of the rice harvest, the woman of the family goes alone to the fields until she has cut a hundred bundles of rice. During this time she uses no salt in her food, but sand is used as a substitute.

Throughout the Islands it is a common thing to mix the earth taken from nests of "white ants" with water and give it to patients troubled with bowel complaints. It is also mixed with water and applied to sores.

The nest of the *nido* (a small cave bird) is mixed with water, and is used as a cure for coughs and consumption.

As regards Polynesia, some forms of geophagy are reported from New Zealand, and possibly it was anciently known in Tahiti.

A. S. Thomson (The Story of New Zealand, I, 1859, p. 157) refers to "a clay called *kotou*, with an alkaline taste and an unctuous feel, which was eaten by the New Zealanders when pressed by hunger."

E. Best (The Maori, I, p. 432, Wellington, 1924) writes that "in times of great scarcity a kind of clay (*uku*) was eaten, as during the long siege of Kura-a-renga at Te Mahia; hence that fortified village was afterwards known as Kai-uku ('clay eating')."

The same scholar, a well-known authority on Maori agriculture and life, has been good enough to favor me with the following notes:

"In 1824 the Puke-karoro fortified village at Te Mahia was occupied by some hundreds of the Ngati-Kahu-ngunu tribe, when it was surrounded and besieged by a large force of raiders of the Tuhoe, Ngati-Maru, and other tribes. The siege continued for some months, until the besieged were reduced to cannibalism, families exchanging children so as to be guiltless of eating their own. Other non-combatants were also eaten, also quantities of the bluish diatomaceous clay called *uku*. Hence the siege and fort are often referred to as Kai-uku ('clay eating'). Cf. *Journ. Polyn. Soc.*, X, 1901, p. 26; XIII, 1904, p. 2; XVI, 1907, p. 20; *Transactions New Zealand Institute*, XXXV, p. 81.

"Some form of mud or clay was eaten in the Rotorua District in times of scarcity; a favored deposit of it was at Rotomahana.

"The Rev. R. Taylor mentions an unctuous clay or earth of a yellowish color that was eaten under similar circumstances."

The Maoris living around Taupo Lake are said to have eaten a fine, gray yellow ooze ejected by the volcanoes of the north island and called "native porridge" by the English settlers (Lasch, p. 217).

J. C. Crawford (Recollections of Travel in New Zealand, 1880, pp. 135, 139), who visited Lake Taupo, mentions mud springs the deposit from which is chiefly siliceous, and writes that the Maoris employ steam and mud springs for stewing food and the boiling springs for boiling it and for scalding pigs, but he does not say that this substance is eaten.

No accounts of edible earth are available for the other Polynesian islands, but from a legend given by W. Ellis (Polynesian Researches, I, 1831, p. 68) it would appear that a kind of red earth was formerly consumed in Tahiti. The tradition in question is an attempt at explaining the origin of the breadfruit. Under the reign of a certain king, when the people ate red earth (*araea*), there were a husband and wife who had an only son whom they tenderly loved. The

youth was weak and delicate; and one day the husband said to his wife, "I compassionate our son, he is unable to eat the red earth. I will die and become food for our son." He died, and from his organs planted in the ground sprang a breadfruit tree. The mother directed her son to gather a number of fruits, to take the first to the family god and to the king; to eat no more red earth, but to roast and eat the fruit of the tree growing before them.

Earth is used by the Polynesians for industrial purposes. Red ochre is found in several islands, and in Rurutu and some others its color is so strong as to enable the people to form a bright red pigment for staining or painting their doors, window-shutters, canoes, and mixed with lime, the walls of their houses (Ellis, I, p. 24). This presents another example for the fact that industrial utilization of earth does not necessarily lead to earth-eating.

R. Bruce (Annual Report on British New Guinea from 1899 to 1900, p. 102, Brisbane, 1901) saw white clay eaten in New Guinea. The cakes looked like white sausages, with a string running through their center which joined a lot together. After many inquiries as to the use of this clay he found that it was scraped down with a shell and used as a relish to food. He tasted it and fancied that it contained arsenic. He adds that "many natives of Torres Straits and New Guinea eat red-fat earth which contains iron; the women of the Straits eat it when pregnant so as to make the child light-skinned, etc." W. N. Beaver (Unexplored New Guinea, p. 144, Philadelphia, 1920), alluding to the report of Bruce (he locates the edible white clay at Tapamone on the Bituru River), writes that this clay is also found near Sui, a small village near the mouth of the estuary; there are one or two villages located on the northwestern side on Mount Lamington in the valley of the Kumusi River, the inhabitants of which are clay-eaters and invariably carry supplies of this "food" about them. In fact, from all accounts they pine away when deprived of it.

R. Neuhauss (Deutsch Neu-Guinea, I, 1911, p. 275) informs us, "Everywhere in Kaiser-Wilhelmsland [former German New Guinea] the blacks eat earth; it is an exceedingly fine-grained gray, yellow, or reddish material. In Bukaua the gray white clay comes from the mouth of the Bulesom; it is eaten, without special preparation, mainly by pregnant women. At the Sattelberg it is a reddish, ferruginous clay which is taken in a dried state. At Sissanu this delicacy has a gray yellow color, and is swallowed without further preparation. These clays are devoid of any nutritive values, but are agreeable in taste, especially the clay from the Sattelberg."

L. M. d'Albertis (New Guinea: What I did and what I saw, II, 1881, p. 89) writes that a red clay is chewed and even eaten by some of the people of Hall Sound and that he found this red clay.

Edible clays were located by P. Wirz (Die Marind-anim, pt. 1, 1922, p. 96) in Dutch Southern New Guinea. He describes them as gray or yellowish white and of acid taste. According to appearance, flavor, or origin various sorts are distinguished; they are partially much appreciated and used for barter. A white clay found and dug near Senajo is especially popular. It serves both as a cosmetic for painting face and body and as a relish. When the people of Senajo visit the coast, they will bring this clay along and exchange it with

the people of the coast. Another gray, recent marine clay, called *dave*, occurs in many places on the beach; it has likewise an acid flavor and is said to be good for the stomach; it is particularly eaten by expectant mothers. At Mevi Wirz saw a pregnant woman fashion this clay into loaves and dry these in the sun; she stated that consumed they are good for the foetus and must be eaten daily till the day of delivery. Wirz also refers to Bali where an edible clay found in the western part of the island is offered for sale in the bazars and is likewise enjoyed by the pregnant.

O. Finsch (Samoafahrten, 1888, pp. 295, 346) observed edible clay on the north coast of what then was Kaiser-Wilhelmsland (now Australian mandated territory); it was offered in the shape of flat cakes 20 cm wide and perforated in the center for the passage of a cord.

The title of the brief article of Meigen (see Bibliography) is misleading, for the edible earth analyzed by him did not come from New Guinea, but from New Mecklenburg. According to a communication of Dr. Hahl, then governor of German New Guinea, this sample came from Lakurefange on the east side of New Mecklenburg, and the natives ascribe to it healing powers in stomach and intestinal troubles. It is a fat clay of ochre yellow color, a terra rossa, of a camphor-like odor and of a not disagreeable spicy flavor.

E. Stephan and F. Graebner (Neu-Mecklenburg, 1907, p. 10) mention the eating of earth in New Mecklenburg with reference to the Gazelle Expedition of 1874-76, but offer no more recent information.

In New Caledonia geophagy was formerly widely practised, and partially it is still in vogue. As early as the eighteenth century it is reported by Labillardière (Account of a Voyage in Search of La Pérouse, II, p. 213), who visited New Caledonia in 1793. The natives approached the ship's landing-place and received bits of biscuit for which they asked. He then gives the following interesting account: "I saw, however, one of them come up who already had his stomach well filled, but who nevertheless ate in our presence a lump of a very soft steatite of a greenish color and as big as his two fists. We afterwards saw a number of others eat quantities of the same sort of earth. It serves to deaden the sense of hunger by filling their stomach, thus supporting the viscera attached to the diaphragm; and although this substance does not afford any nutritious juice, it is yet very useful to these people, who must be often exposed to be long in want of food, for they apply themselves little to the culture of their lands, which besides are very sterile.

It is to be remarked that undoubtedly the inhabitants of New Caledonia have made choice of the steatite only because from its great friability it does not remain long in their stomach and intestines. I should never have imagined that cannibals would have recourse to such an expedient when pressed by hunger."

Vauquelin, the chemist, found in this steatite from New Caledonia a not inconsiderable proportion of oxid of copper. In the northern parts of the island steatite occurs abundantly in the ancient slate formation. According to some authors, earth is merely eaten in times of scarcity to appease hunger; according to others, only women take it in doses of the size of a hazel-nut, and children imitate the practice. Among the people of Tiari, near Baladea, Garnier found a few geophagists, but only women who he says were prompted by a morbid craving to eat but a little earth, which is insipid in taste and is called by them *pagute* (*Globus*, XIII, 1868, p. 102). Lemire mentions balls of steatite which are dissolved in the saliva and have a somewhat sweetish flavor (F. Sarrasin, Ethnologie der Neu-Caledonier, 1929, p. 64).

According to Glaumont (*Revue d'ethnographie*, VII, 1888, pp. 85-86, not cited by Sarrasin), the inhabitants of New Caledonia chew a friable grayish earth found on the sides of the mountains. This author holds that the custom of earth-eating is on the same level as betel-chewing or opium and tobacco smoking. Sarrasin was informed by a native of the isle of Baaba in the north of Caledonia that baskets full of gray soft earth were collected there. He refers to another account that women on the march finished a whole basketful of earth, giving preference to it to real food. As steatite is not found everywhere in the island, many tribes must be content with clayish and marly minerals. This is also the case in the Loyalty Islands which consist merely of chalk. In a cave near La Roche on Maré, Sarrasin found weathered yellow marl of which the natives told him that it is crushed and eaten, particularly by women, as a dainty; red earth, too, they said, is eaten there after it has been burnt. This seems to refer to the weathered product of chalk which is colored red by iron.

V. de Rochas (La Nouvelle Calédonie, 1862, p. 140) reports that in the Loyalty Islands people eat an aluminous earth full of organic detritus, which is gathered in caves abounding in humus and which is kneaded into hard balls; these are dissolved in the saliva without leaving a bad taste. Sarrasin thinks that this substance may contain a trace of nutritive value, which is not the case with steatite, marl, and clay.

Earth is eaten in North Santo and Malekula in the New Hebrides. This is a tough, dark brown clay apparently mixed with organic substances and particularly coveted by pregnant women. In East Santo it is said to be flattened out like a biscuit and dried in the smoke. In Malekula the earth is shaped into small balls which are dried and sucked like a sweet-meat; the clay has indeed a sweetish flavor (F. Speiser, Ethnographische Materialien aus den Neuen Hebriden, 1923, p. 133).

Some authors, quite in general, assign geophagy to aboriginal Australia. It seems certain that it occurs among some tribes, but not among others. The following specific cases have come to my notice.

R. Brough Smyth (The Aborigines of Victoria, I, 1878, p. XXXIV) writes, "There is nothing in the records relating to Victoria respecting the use of any earth for the purpose of appeasing hunger; but Grey mentions that one kind of earth, pounded and mixed with the root of the *mene* (a species of *Haemodorum*), is eaten by the natives of West Australia." Seven or eight species of this genus occur in Australia, all of them furnishing roots which are eaten by the natives; they are acrid when raw, but mild when roasted (E. L. Sturtevant, Notes on Edible Plants, p. 297). The case therefore is analogous to what is found among the Ainu, Pomo, and Hopi.

The aborigines of Queensland use huge clay or mud pills, one or two of which at a time are prescribed for diarrhoea (W. E. Roth, Ethnological Studies among the North-West-Central Queensland Aborigines, 1897, p. 163).

E. Eylmann (Die Eingeborenen der Kolonie Südaustralien, 1908, p. 448) mentions medicinal employment of earth, ashes, and sand; women rub their breasts with a pap made of gypsum for the purpose of causing a secretion of milk.

INDIA, BURMA, AND SIAM

In India clay is generally eaten by women and children, rarely by men; by women usually during the period of menstruation and pregnancy, by others habitually at all times.

Examinations and analyses of Indic edible clays have been conducted by Ehrenberg (I pp. 116-177) and by Hooper and Mann (pp. 260-263).

The fact that clay is eaten in India was known in Europe early in the nineteenth century. Curiously enough, the edible clay of India was then designated "clay of the Mogol." G. I. Molina (Saggio sulla storia naturale del Chili, 1810, p. 50), therefore, wrote at that time that the Peruvian women are in the habit of eating pottery sherds as the Mogol women eat the dishes of Patna (como le Mogolesi mangiano il vasellame di Patna). This Indic pottery is described as being gray in color with a yellow tinge, known under the name "earth of Patna" and found principally in the environment of Seringapatnam. From this clay were manufactured vases so light in weight and so delicate in shape that "a breath from one's mouth was sufficient to turn them upside down on the table." Water poured into these vessels assumed a pleasant flavor and odor; and the ladies of India when they had emptied them would break them to pieces, swallowing the sherds with pleasure, especially in the period of maternity (Camilli, p. 188).

The clay consumed by the women of Bengal is a fine, light ochreous-colored specimen fashioned into thin cups with a perforation in the center and then baked in a kiln. In other words, it is ready-made pottery which they consume and which emits a curious smoky odor. It is this particular odor which makes it such a favorite with delicate women. The cups are strung on a cord and sold by the potters at so many pieces for one pice. Formerly these cups were hawked about in the streets of Calcutta, but this is no longer customary. Such a street vendor of baked clay cups once figured in a Bengali play staged in a Calcutta theatre; she recommended her ware in a song, pointing out that her cups are well baked, crisp to eat and yet cheap, and that delicate ladies about to become mothers should buy them without delay, as eating them would bless them with sons (Mitra, p. 286).

Saucer-shaped chips of partially baked clay are sold in the Calcutta bazar for eating (G. Watt, Commercial Products of India,

1908, p. 330). Burnt earth is considered less injurious in India than fresh earth.

The habit of clay-eating, though at present universal in India, cannot be proved to be of ancient date in that country. The earliest literary references to it, first pointed out by Mitra, occur in Kālidāsa's *Raghuvamça*. In one case, the question is of a queen who partakes of baked clay to render her breath fragrant and pleasing to her lord. In another case, the queen of Ayodhya, before giving birth to Raghu, feels a hankering for baked clay (Sanskrit *katikā*, Hindi *khariyā*). Mallinātha, in his commentary to the poem, observes that it is well known that pregnant women eat earth. These allusions contain nothing that would warrant the belief that clay-eating then (fifth or sixth century A.D.) was a general and habitual practice. In Vedic literature, no reference is made to it, nor in the Arthaçāstra. In such encyclopaedic works, as Varāhamihira's *Bṛhat-Samhitā*, where we might expect to find a trace of it, it is not mentioned either. Likewise in the literature on alchemy it appears to be absent, as evidenced at least by Ray's "History of Hindu Chemistry." Notably the Chinese pilgrims who traveled in India have not recorded the practice. Also so keen an observer as Garcia da Orta maintains silence about it, and W. Ainslie, in his "Materia Indica" (1826), ignores it; no reference to it is made in early Portuguese and English accounts of India. While this negative evidence is not in any way conclusive, it must be admitted that the wide diffusion of geophagy, though sporadic cases are on record for earlier periods, is only the result of more or less recent times.

In ancient prescriptions occurs earth from the roots of Jambū trees. This is a vegetable mold or black soil formed with decaying vegetal matter, such as is found in ponds and round the foot of trees (Hoernle, The Bower Manuscript, p. 149). A baked clod of clay with other ingredients was kept in water to relieve morbid thirst (*ibid.*, p. 137).

Indian physicians mention a kind of chlorosis (*pāṇḍuroga*) as being caused by the consumption of earth (Jolly, Indische Medicin, p. 86, who unfortunately does not say which physicians, the older or more recent ones).

The symptoms which appear in confirmed and habitual geophagists in India are usually reported as the face being unnaturally swollen or puffed, the abdomen distended, the limbs shrunk except at the joints which appear enlarged and are said to be painful.

Swelling-up of the face and abdomen may result from clay-eating for a period of twelve months.

White-ants' nests constructed of soft, fine earth, generally of a reddish black color, are consumed in India in the same manner as in Africa. Coolies of Assam are disposed toward white-ant soil taken from the center of the nest, white ants themselves being included as a delicacy (Hooper and Mann, p. 257). Among the mountain tribes of Travancore the men, not the women, eat this earth with the ants inside the cells, sometimes adding honey to it. It is taken, not in small medicinal doses, but in rather large quantities. No evil effects have been noticed to follow its use (*ibid.*, p. 259).

Steatite or soapstone ground to powder and mixed with flour has served in India as a regular famine food, in the same manner as in China (above, p. 124).

Consumption of small quantities of earth from holy places is prevalent throughout India. Such sacred earth is supposed to have healing properties. The followers of the Vaishnava sect keep in their houses the earth of the sacred river Jumna. At the close of their daily worship, a pinch of this earth is placed on the tip of the tongue and swallowed. There is a hill a few miles from Madras; and one particular spot in it is considered sacred, and the earth found there is credited with miraculous, curative properties. Those who visit the hill on a pilgrimage take a handful of this earth along, making it into pills used for various internal disorders as occasion arises (Hooper and Mann, p. 259).

He who is especially interested in the subject should not fail to read the valuable monograph of Hooper and Mann who have dealt with geophagy in India almost exhaustively.

The following interesting case is reported by E. Thurston (Omens and Superstitions of Southern India, 1912, p. 38): "Some years ago Mr. H. D. Taylor was called on to settle a boundary dispute between two villages in Jeypore under the following circumstances. As the result of a *panchāyat* ('council meeting'), the men of one village had agreed to accept the boundary claimed by the other party if the head of their village walked round the boundary and eat earth at intervals, provided that no harm came to him within six months. The man accordingly perambulated the boundary eating earth, and a conditional order of possession was given. Shortly afterwards the man's cattle died, one of his children died of smallpox, and finally he himself died within three months. The other party then claimed the land on the ground that the earth-

goddess had proved him to have perjured himself. It was urged in defence that the man had been made to eat earth at such frequent intervals that he contracted dysentery, and died from the effects of earth-eating."

According to W. C. Smith (The Ao Naga Tribe of Assam, 1925, p. 33), "the Ao eat a whitish clay which they say is salty. The women use it more than the men. The Lakhers eat it and declare it can sustain a man without food for thirty-six hours, and women soon to become mothers are very fond of it."

L. and C. Scherman (Im Stromgebiet des Irrawaddy, p. 55, München, 1922), visiting a bazar at Yawnghwe in the Southern Shan States, found among the articles offered for sale also edible earth or more exactly gray, yellow and reddish clays.

Among the Chin of Upper Burma it is customary to eat earth as a sign of swearing to tell the truth, and earth is administered to witnesses giving evidence in a criminal case. This is considered a very binding oath and more likely to extract the truth from a Chin than anything else (Gazetteer of Upper Burma and the Shan States, I, pt. 1, p. 472, Rangoon, 1900). In a similar manner it was formerly customary among the Angami Naga tribe in rendering an oath to snatch up a handful of grass and earth, and after placing it on the head, to shove it into the mouth, chewing it and pretending to eat it (J. H. Hutton, The Angami Nagas, 1921, p. 146; cf. also J. P. Mills, The Lhota Nagas, 1922, p. 103).

In Siam, it is said, people consume steatite which consists of 65.6 per cent silic acid, 30.8 per cent magnesia, and 3.6 per cent oxid of iron (Altheer, p. 90).

N. Annandale (Fasciculi Malayenses, Anthr., pt. II, p. 62) has observed that both Malay and Siamese women eat a kind of earth dug out of the banks of a river and roasted; this is administered as a tonic.

The Tibetan Kanjur contains a translation of the Buddhistic work *Vinayavastu* in which is embodied a curious story concerning the earlier periods of the world. In the course of these supposed periods a gradual deterioration of man and his foodstuffs is believed to have taken place. First there was the "sap of the earth" (Tibetan *sa-i bčud*, Sanskrit *pṛthivīrasa*) of excellent color, fragrance, and flavor, in color resembling butter, in taste like honey. The bodies of the spiritual beings who partook of this substance waxed hard and heavy and lost their fine luster, whereupon darkness arose in the world. Then originated sun, moon, and stars, and in consequence day, night, months, and years. Men subsisted on that earthly food and reached a high old age. Those who consumed but little were beautiful in appearance, but those who ate too much of it were ugly. The former grew haughty and despised the ugly. The sap of the earth vanished in the wake of this quarrel, and was replaced with an "earth grease or oil" (Tibetan *sa-i žag*, Sanskrit *pṛthivī-pārvataka*, Mongol *gadzar-un tosun*, "earth oil or butter"), which served as food. The same happens as previously, and the earth oil disappears to give way to vegetable foods. This legend has first been excerpted from the Kanjur by A. Schiefner (Über die Verschlechterungsperioden der Menschheit nach buddhistischer Anschauungsweise. Bull. histor.-philol. de l'Académie de St.-Pétersbourg, IX, No. 1, 1851).

A kind of eatable clay is reported from Tibet by Ma Shao-yün and Sheng Mei-k'i in their *Wei Ts'ang t'u shi*, an account of Tibet written in 1792. Near the monastery rDo-rje-'dra, not far from the celebrated temples of bSam-yas (southeast of Lhasa), there is a mountain with a cavern containing an eatable white clay, which has a taste like *tsamba* ("roasted barley-flour," the staple food of the Tibetans). Whenever clay is removed, it will grow again. The cavern must be entered with candles. Behind it there is a large lake (Bitchourin and Klaproth, Description du Tubet, pp. 131-132; Rockhill, *J.R.A.S.*, 1891, p. 267). According to Rockhill, this clay is styled *sa rtsam-pa* ("earth tsamba").

Earth is also used as a medicine in Tibet; *sa smug* is a dark red earth employed medicinally.

The Mongol chronicler Sanang Setsen relates in regard to Öljäi Ilduchi, who lived toward the end of the sixteenth century,

that he and his army, while on a warlike expedition, suffered from want of food, and were compelled to sustain their lives by eating of a stone, called *barkilda* (I. J. Schmidt, Geschichte der Ost-Mongolen, p. 217). The editor and translator of Sanang Setsen's work remarks (p. 413) that he does not feel certain whether this eatable stone or earth is identical with the Siberian "stone butter" described by Pallas. He also alludes to the earth eaten by certain tribes of South America. Nothing can directly be inferred from the Mongol term, which is isolated in this passage and is not known otherwise. Golstunski, at least, with reference to this word in his Mongol-Russian Dictionary, cites solely the text here in question. The word *barkilda*, which cannot be derived from any known Mongol stem, and which does not occur in Turkish, means also "aerolith," and is correlated with Tibetan *ka-tu* or *ke-tu* (that is, Sanskrit *ketu*). It may be, therefore, that the stone mentioned by Sanang Setsen was believed to be of celestial origin. It certainly is not identical with the "stone butter" of Siberia, which is a substance of vitriolic origin, first described, as far as I know, by P. J. von Strahlenberg (Das nord- und östliche Theil von Europa und Asia, 1730, p. 384).

P. S. Pallas (Reise durch verschiedene Provinzen des russischen Reiches, II, 1771, pp. 88, 656, 697; III, 1776, p. 258) found this "stone butter" in the Ural, near Tomsk, on the Yenisei and the Chilok. He explains it as plume alum or stone alum, a white yellowish substance of vitriolic origin flowing out of slate. Some inhabitants of Tomsk boiled from it an impure yellow vitriol which assumed a sand-like hardened shape and which was sold on the market—for industrial purposes only, as, for example, for dyeing leather black (Strahlenberg). According to Pallas, the "proper natural stone butter" is not so frequently gathered that Tobolsk and other Siberian towns could be supplied with it. At Krasnoyarsk only it was offered for sale in abundant quantity, being collected in the neighborhood of the town. It is described by him as very white and light in weight; when burnt at a flame, it flows easily, and when boiled, it emits red vitriolic fumes, while a light, very white and savory earth remains. Several puds of this earth were annually collected and sent to Krasnoyarsk, where the pound sold at from fifteen to twenty kopeks. The common people used this substance chiefly as a remedy in cases of diarrhoea and dysentery or for copious bleeding of lying-in women (cf. also Pallas, Neue nordische Beiträge, V, 1793, p. 290).

J. B. Müller (Les moeurs et usages des Ostiackes, in Nouveaux Memoires sur l'état présent de la Grande Russie ou Moscovie, II, p. 160, Amsterdam, 1725) writes, "On the highest mountains and

rocks of Siberia is found an extraordinary mineral called by the inhabitants of the country *kamine masla* or stone butter. The heat of the sun causes it to flow down the rocks to which it is attached as chalk to walls. It is dissolved in water like salt, and is as strong as vitriol. They attribute to it many virtues and use it in several diseases, especially in dysentery. I believe that we ought not to get accustomed to this remedy, and I know of no one who has ever made use of it."

According to J. G. Georgi (Bemerkungen einer Reise im russischen Reiche im Jahre 1772, St. Petersburg, 1775), the stone or rock butter served also as a specific against syphilis. He reports also that there is in Kamchatka near the river Olontora and in several other localities a lithomarge clay which both the Tungusian tribes and the Russians eat, either alone or dissolved in water or milk. This substance, he concludes, produces in those people merely a light constipation which perhaps is wholesome to them in the spring when they eat an abundance of fish, which will cause diarrhoea. Georgi informs us also that in the countries located between the Volga, Kama, and Ural there is a sort of powdered plaster termed by the inhabitants "rock flour" or "celestial flour." This substance was mixed with flour in times of scarcity, but those who ate such bread almost always experienced fatal effects.

The Sungar picked up earth during earthquakes which do not infrequently occur around the Altai mountains, and placed it on the tongue of a parturient woman, believing that it was a good means of expediting birth and expelling the after-birth (P. S. Pallas, Samlungen histor. Nachrichten über die mongolischen Völkerschaften, I, p. 166).

G. W. Steller, in his famous "Beschreibung von dem Lande Kamtschatka" (1774, pp. 72, 324), speaks of *Sory officinarum* or so-called Siberian *kamenna masla* ("stone butter") and a soft bolus earth which tastes like cream and which is eaten; the latter he calls *semlanoi smetana* ("earth sour cream"). Like the Tungus around Okhotsk, he continues, the Itälmen and Koryak eat a kind of fine white clay which looks like cream and which is not devoid of an agreeable flavor, but is at the same time astringent. According to A. Erman (*Zeitschrift für Ethnologie*, III, 1871, p. 150), who himself visited Kamchatka, the so-called flowing clay or earth cream (i.e. the gelatinous detritus of a trachytic rock) was eaten there but exceptionally and only in certain places.

Mr. I. Lopatin, who has devoted many years of his life to investigations of the native tribes of eastern and northeastern Siberia,

kindly informs me that in his experience clay-eating is not practised by any of these, but that some Tungusian tribes, such as the Oroche, Udekhe, and Olcha make use of clay as a medicine. He did not observe this practice, however, among the Golde with whom he is particularly familiar and to whom he has devoted a very interesting monograph. "Many times during my expeditions into the countries of these peoples," Mr. Lopatin writes me, "I saw small pieces of clay fashioned into cakes, about one and a half inch square and a quarter of an inch thick, and suspended from the roofs of their huts. On two occasions I watched the preparation of these clay cakes. An Udekhe woman made a sort of dough of the clay, and after having kneaded it well, she turned out two or three dozens of cakes somewhat resembling American crackers. When these clay crackers were sufficiently dried, she perforated each piece in the center and on both sides made four rows of cavities by pressing, about four or five in a row, whereupon she strung the cakes through the perforations in the center and suspended them under the roof of the hut. On another occasion I saw a man of the same tribe make such cakes which were of the same size and shape as previously. He said that a particular kind of clay, which is yellowish gray in color, must be used for this purpose. The clay cakes must be thoroughly dried before being consumed. They are kept under the roof for at least five or six months and in fact for two or three years before they are ready for use. Udekhe, Oroche, and Olcha believe that these cakes are very helpful in stomachic troubles and diarrhoea. In the event of such complaint these cakes are taken internally for a period of six or seven days. I wish to stress the point that these clay cakes are but seldom eaten by these people and exclusively as a remedy in case of illness."

It is certainly possible that this remedy is apt to stop diarrhoea; it is so employed elsewhere, for instance, in Sumatra (Heringa, p. 186), and as has been stated, by the natives of Queensland in Australia (above, p. 139). In our own time powdered clay has been recommended as a remedy for cholera (*Berliner Klinische Wochenschrift*, 1905, p. 750), and clay pills have been used for hemorrhoids (Hahneman, Chronic Diseases, II; Hooper and Mann, p. 269).

During his excavations conducted in Kamchatka in 1910-11 W. Jochelson (Archaeological Investigations in Kamchatka, p. 66, Carnegie Institution, 1928) found pieces of white clay in some of the excavations of dwellings, which he is inclined to think was eaten by the inhabitants. He refers to Krasheninnikow's "Description of Kamchatka" as mentioning white clay as a remedy for diarrhoea.

The edition consulted by him is the third in Russian, published at St. Petersburg, 1818. I have a German edition of this work (Lemgo, 1766) in which this passage is not contained, neither in the chapter on Diseases and Remedies nor in the chapter on Food and Drinks of the Kamchadal; in discussing the different kinds of earth found in Kamchatka (p. 97) no reference is made either to clay-eating. Of course I do not doubt that in the edition consulted by Jochelson the passage in question is contained, but what I venture to call into doubt is that the clay pieces found by him in the deserted dwellings were really intended for internal medicinal use. Unfortunately, Jochelson has neglected to state the essential point, and this is, of what shape these clay pieces were, whether they were shaped into a certain form by human hand or just odd pieces in their natural state. If, for instance, they were like the clay cakes described by Lopatin, this would constitute sufficient evidence for his conclusion; but if not artificially fashioned in some way or other, the hypothesis is not convincing, or the case remains at least doubtful.

According to W. Bogoras (The Chukchee, p. 200, Jesup North Pacific Expedition, VII, 1904), "the Reindeer Chukchee as well as the Lamut and the Koryak in Kamchatka occasionally use as food a kind of white clay, which is called 'earth fat' (*nute-echen*). This, of course, is eaten only in moderate quantities, mixed with broth or with reindeer-milk." If this be true, the clay consumed cannot, of course, be designated as a food, but is rather a condiment added to articles of food.

L. J. Sternberg (The Gilyak, *Ethnograficheskie Obozränie*, 1905, p. 17) mentions a dish of the Gilyak consisting of the gluey broth of fish-skins, seal's fat, berries, rice, and sometimes of minced dried fish, being mixed with dissolved white clay; this dish is favorite for treating guests.

H. von Siebold (Ethnol. Studien über die Ainos, 1881, p. 37, Suppl. Z. Ethn.) was told that the Ainu occasionally eat a clay mixed with herbs and roots; he had no occasion to see this himself. Hooper and Mann (p. 251), without citing any source, assert, "Among the Ainu, the aborigines of Japan, there is a kind of clay which is eaten to a considerable extent, mixed with fragments of the leaves of a plant and used as an ingredient in the preparation of soup. The clay occurs in a bed in the valley of Tsie-tonai ('eat-earth valley') on the north of the coast of Yezo. It is of light-gray color and fine consistency, and is consumed, not as a matter of necessity, but because it is believed to contain some beneficial ingredient." The above name should be written Chi-e-tonai; *chi* means "earth," *e* "to

eat"; but a word *tonai* is not given in the Ainu Dictionaries of Batchelor and Dobrotvorski. In the works of J. Batchelor, the best informed authority on the Yezo Ainu, no reference is made to consumption of earth in a pure state, nor have I learned anything to this effect among the Saghalin Ainu. This, of course, does not mean that the habit does not exist, or might not formerly have existed. There is, however, an Ainu practice recorded by Batchelor which offers a striking parallel with what is found among the Pomo and Hopi, as well as among the natives of western Australia (above, p. 138).

The bulbs of *Corydalis ambigua* (Ainu *toma*, Japanese *engosaku*) are extensively eaten by the Ainu, especially those in the Ishikari valley of Saghalin Island and in the southern Kuriles. The bulb has a slightly bitter taste which is removed by repeated boilings in water. In Etorup, the Ainu boil the bulbs with a certain kind of earth to remove its bitterness. They are eaten either simply boiled or mixed with rice. In Saghalin, it is said, they are cooked generally with the fat of seals (J. Batchelor and K. Miyabe, Ainu Economic Plants, No. 48, *Transactions of the Asiatic Society of Japan*, XXI, 1893, p. 215). The Ainu also feed on acorns (*ibid.*, No. 108) which are usually boiled and occasionally roasted, but earth is not applied to these as by the Pomo and the peasants of Sardinia.

The Ainu have traditions of famines in early times when people were dying from want of food, and this seems to be one of their typical forms of legend two of which are recorded by J. Batchelor (Specimens of Ainu Folk-lore, *Transactions of the Asiatic Society of Japan*, XVI, 1888, pp. 112-122). In these no allusion is made to earth-eating; in fact, no famine food is mentioned. It is known, however, that the ancient Ainu subsisted a great deal upon the stem and leaves of the mugwort (*Artemisia vulgaris*) which has been the means of keeping them alive throughout more than one famine (J. Batchelor and K. Miyabe, Ainu Economic Plants, No. 78).

In mixing earth with certain foodstuffs there is agreement between the Ainu, Gilyak, and Chukchi; and this perhaps may be regarded as an ancient feature of the culture of the Palaeo-Asiatic tribes. Considering the further fact that earth is still eaten by Tungusian tribes and that a certain kind was consumed by the ancient Kamchadal, there is a continuous area in northeastern Siberia for the practice of earth-eating. It will be seen that this continues in points of the far north of North America.

PERSIANS AND ARABS

One of the infernal punishments of the Parsis was that a man, who used false measure and weight and who adulterated his merchandize, was compelled to eat dust and earth meted out to him on a scale (M. Haug, Über das Ardâi Vîrâf nâmeh, 1870, p. 25).

Ibn al-Baiṭār (1197-1248), an Arabic scholar born at Malaga, Spain, and author of a famous work on pharmacology, discusses eight kinds of medicinal earth (L. Leclerc, Traité des simples, II, 1881, pp. 421-427; for a general appreciation of this work see Baron Carra de Vaux, Les penseurs de l'Islam, II, 1921, pp. 289-296). The eight kinds are the terra sigillata, Egyptian earth, Samian earth, earth of Chios, Cimolean earth or pure clay (cimolite), earth of vines called *ampelītis* (Pliny XXXV, 56) or *pharmakītis* from Seleucia in Syria, Armenian earth, and earth of Nishapur. A great deal of the information given by the Arabic scholar is derived from Dioscorides and Galen. Earths used in medicine were but rarely taken internally, but usually applied locally; these cases, therefore, do not come within the subject of this monograph. Reference is made here only to Ibn al-Baiṭār's notes as far as they relate to earths administered internally. It appears that the sigillated earth, which will be more fully discussed under the heading "Europe," was regarded by Avicenna as an antidote and having the tendency to eject poisons from the system when taken before or after the act of poisoning. Under Cimolean Earth, Ali Ibn Mohammed is quoted as saying that this soft earth, called *al-hurr*, green in color like verdigris, is smoked together with almond bark to serve as food when it will turn red and assume a good flavor and that it is but rarely eaten without being smoked. The Cimolean earth is named for Cimolus (Greek Kimolos), one of the Cyclades, also called Argentiera (cf. Dioscorides V, 175; Pliny XXXV, 57; E. Seidel, Mechithar, 1908, No. 204).

The Armenian earth (bole armenic), according to Ishak Ibn Amrān, was salutary in cases of bubonic plague, being administered both externally and internally. The same is affirmed by Leo Africanus (in Ramusio, 4th ed., 1588, fol. 10b; French ed. by Schefer, I, p. 114) with reference to Barbary, save that there the Armenian earth was applied externally to the bubos. At present no longer used, this article (Latin *bolus armena*) was renowned in ancient times and extensively traded from Armenia, where it is abundant. It was introduced into medical practice by Galen (Seidel, Mechithar,

No. 132). It is a soft earth, greasy to the touch, strongly adhering to the tongue, very fragile, generally of a yellowish brown color, sometimes of a fine flesh red. According to J. Chardin (Travels in Persia, ed. Sykes, p. 164), it also occurred abundantly in Persia, where it was especially used by women in washing their heads. According to W. Ainslie (Materia Indica, I, 1826, p. 43), it was brought from the Persian Gulf to India, where the Tamul practitioners prescribed it as an astringent in fluxes of long standing and supposed it to have considerable efficacy in correcting the state of the humors in cases of malignant fever. Its constituent parts, according to Ainslie, are silica 47 per cent, alumina 19 per cent, magnesia 6.20 per cent, lime 5.40 per cent, iron 5.40 per cent, water 7.50 per cent.

The most celebrated of all edible clays was that found near Nishapur in Persia. The Arabic historian al-Ta'alibī (A.D. 961-1038), who calls it *al-naql*, writes that it occurred exclusively at Nishapur and was exported from Zauzan into all quarters of the globe to places near and distant; a raṭl of this clay was sometimes valued at a dinar in Egypt and in the Maghreb (E. Wiedemann, Zur Mineralogie im Islam, *Sitzber. phys.-med. Soz. Erlangen*, 1912, p. 242). According to Edrīsī (Jaubert, Géographie, I, pp. 452, 454), there was two days' journey from Caneīn, or Caïn, on the road leading to Nishapur, a kind of brilliant white clay, called *ṭīn el-mehāji* and exported for purposes of consumption to distant regions. The same fact is mentioned by Ibn Haukal (W. Ouseley, Oriental Geography of Ebn Haukal, 1800, p. 223).

Ibn al-Baiṭār devotes much space to the clay of Nishapur, chiefly relying upon Ali Ibn Mohammed and the celebrated physician Mohammed Ibn Zakkariyā al-Rāzī (i.e. born at Rei, the ancient Rhages), known as Razes, of the tenth century. This clay is described as being white, of an agreeable taste, taken either in its natural state or roasted. It is sweet to the taste, and soils the lips on account of its great softness; on the other hand, it is said that its flavor is somewhat saline, but that exposed to a fire it will lose this saline property and grow sweet. There are people who pound it and soften it with rose-water and a little camphor and who then shape this compound into bread loaves, tablets, or other forms. Others scent the clay with musk, camphor, or some other aromatic, and thus take it after having indulged in wine to perfume their breath and to assuage the heat of the stomach.

According to Razes, the clay of Nishapur fortifies the heart and combats nausea. It stops vomiting (or is used as an anti-emetic)

and especially counteracts nausea provoked by sugared and greasy foods. Razes holds that the Nishapur clay is not apt to cause obstructions in the reins and bladder, as it happens with other clays. In his "Treatise on Clays" Razes tells an interesting story of how he cured an individual seized by a very grave choleric affection accentuated by violent fits of vomiting and cramps. The usual remedies were of no avail; he administered to the patient powdered Nishapur clay in doses of thirty drams, three times, twice in a decoction of sweet apples and once in a decoction of sweet rush (*Andropogon schoenanthus*), and his nausea and indigestion were immediately relieved. What was still more marvelous was that the patient found himself stronger and merrier than before as though the medicine had nourished him.

Razes further maintains that he employed Nishapur clay in treating affections of the stomach, as well as in cases of nausea and indigestion caused immediately after a meal. This convinced him that it was necessary to administer a small dose of clay after a meal, which relieved the indigestion, chills in the abdomen, and the tendency to vomit. He considers Nishapur clay as a capital remedy for the treatment of affections of the stomach especially with patients who apparently have no obstruction of the liver or contraction of the bowels. In these cases this remedy is rarely harmful; on the contrary, it seems that the body gains weight. He administered this clay also to individuals who suffered from a considerable secretion of saliva and to all patients seized by a ravenous appetite—all these were radically cured.

The modest and unadorned report of Razes inspires confidence and merits full credence.

At present, the habit of clay-eating is widely diffused over Persia. It has developed into a passion among those people who have taken to it, and these swallow considerable quantities of clay. The habit extends to both sexes, notably to women, and is said to be restricted to common people, while it is rare among the better classes. The reasons advanced by the people are that "it tastes well" and "satiates their hunger." The clay fiends are characterized by leanness and sallow, earth-like complexion. Edible clays form a not unimportant article of trade, and are sold in the bazars of most cities. Two edible clays are especially reputed—one traded from Kirman and called *ghel-i-giveh*, and another from Kum under the name *ghel-mahallat*. The two sorts have been analyzed and described by Goebel (see also Ehrenberg I p. 184; II p. 36). According to Goebel, these clays contain no nutritive substances, but some agents which have

an effect on the nervous system. Their action is mechanical, not chemical. They leave the organism without exerting a disturbing influence on the composition of the blood in case indulgence has not been excessive. Tietze (Die Mineralreichtümer Persiens, Jahrbuch der k.k. geol. Reichsanstalt Wien, 1879, p. 654) gives an analysis of three kinds of earth from Persia.

J. L. Schlimmer (Terminologie médico-pharmaceutique français-persane, p. 299, Teheran, 1874) writes that "geophagy is a general habit among the women of Persia, even when they are not pregnant. The Persian physicians attribute this 'idiosyncrasy' to the presence of intestinal worms, which for the rest is far from being proved. Among young children, however, this particular habit is often connected with the existence of intestinal worms, and in this case vermifuges administered in small doses continued for a long time and the simultaneous use of wine will overcome this 'depraved appetite'; but a cure becomes difficult in cases where geophagy is the concomitant symptom of scrophulous diathesis when the young patients assume a cachectic appearance, which is quite characteristic of their condition."

Polak (Persien, II, p. 273) observes that the Persians have trained their taste to such an extent that they discriminate between various kinds of clay without hesitation.

An earthy, soap-like substance that the natives term *chunniah* is obtained from lakes not far from Halla. It is largely eaten by the women of Sind (J. Wood, Journey to the Source of the River Oxus, 1872, p. 19). In Lasch's article (p. 220) this *chunniah* has been transformed into *tschamiah.*

Hajaj, a military officer, who served under the Caliph Abdul Malik (A.D. 685-705), was in the habit of eating clay. Determined to wean himself from this habit, he consulted Theodocus (Theodunus or Tiaduq), a renowned physician, as to the proper remedy. "The will of a man of your mold," Theodocus responded. Hajaj then ceased to eat clay (L. Leclerc, Histoire de la médecine arabe, I, 1876, p. 83).

As in China, earth-eating was also connected with religious beliefs among the Arabs and the Mohammedans of India. Hooper and Mann (p. 259) inform us that dust from the tomb of the prophet is an auspicious article, said to be a cure for every disease. According to E. W. Lane (Manners and Customs of the Modern Egyptians, 5th ed., I, p. 323), who received such specimens from a Mecca pilgrim, they come in oblong, flat cakes of a grayish earth, each about

an inch in length and stamped with an Arabic inscription, "In the name of Allah! Dust of our land [mixed] with the saliva of some of us." They are alleged to be composed of earth obtained from the surface of the grave of the Prophet and to be a cure for every disease, and are sold at Mecca. A cake of this kind is sometimes worn as an amulet in a leather case. It is also formed into lumps of the size and shape of a pear, and is suspended from the railing which surrounds the monument erected over the grave of a saint.

Sir Richard Burton (Pilgrimage to Al-Madineh and Mecca, I, p. 415) found in Arabia a yellow loam or bole being eaten by anaemic women. It was used as a soap in some parts of the East, and was supposed to have some miraculous properties owing to the Prophet having employed it with success as a medical agent.

In 1612 William Lithgow visited the cave near Bethlehem in which the Virgin Mary, at the time of the persecution of Herodes, took refuge, and gives this account (Totall Discourse of the Rare Adventures and Painefull Peregrinations, p. 247 of the edition reprinted at Glasgow, 1906): "The earth of the cave is white as snow, and hath this miraculous operation, that a little of it drunke in any liquor, to a woman, that after her childbirth is barren of milke, shall forthwith give abundance: which is not onely availeable to Christians, but likewise to Turkish, Moorish, and Arabianish women, who will come from farre countries, to fetch of this earth. I have seene the nature of this dust practised, wherefore I may boldly affirme it, to have the force of a strange vertue: Of the which earth I brought with me a pound weight, and presented the halfe of it to our sometimes Gracious Queene Anne of blessed memory, with divers other rare relicts also, as a girdle, and a paire of garters of the Holy Grave, all richly wrought in silke and gold, having this inscription at every end of them in golden letters, Sancto Sepulchro, and the word Jerusalem, etc."

The legend goes that the milk of the Virgin when she took refuge in that grotto spurted against the rock, and ever since this earth has been capable of increasing the milk of both women and animals. In the first place, of course, the question is here of earth-eating (cf. the analogous custom in Australia of using earth externally as a means of promoting lactation, above, p. 139).

The Italian designation for diatomaceous earth, *latte di luna* ("lunar milk"), may be connected with this belief (other Italian terms for it are *agarico minerale* and *farina fossile*).

In an interesting study entitled "Mohammedan Saints and Sanctuaries in Palestine" (*Journal of the Palestine Oriental Society,*

V, 1925, p. 188), T. Canaan writes, "Christians as well as Mohammedans use the soft whitish stones of the milk-grotto in Bethlehem to increase mothers' milk. The stones are rubbed in water and given to the nursing women. It is supposed that the holy family took refuge in this cave where a drop of Mary's milk fell to the floor."

The same author reports that plaster, stones, and sweepings of many shrines are used medicinally. Some of the earth of a certain locality made with oil into a paste cures sores of the head. Earth gathered from another holy place is dissolved in water, and given to cattle will guard them against disease. Everything that belongs to or comes in contact with a saint or his shrine is believed to receive some of his power which may be transmitted to others. Thus the earth of a saint's tomb (likewise stones, water, grass and trees) is believed to possess supernatural power.

AFRICA

T. F. Ehrmann (Geschichte der merkwürdigsten Reisen, VII, 1793, p. 70; after J. Matthew's Journey to Sierra Leone 1785-87) speaks of a white, soap-like earth found here and there in Sierra Leone and so fat that the Negroes frequently eat it with rice, because it melts like butter; it is also used for white-washing their houses. Ehrmann adds, "A curiosity which merits a closer investigation." The same clay was also reported by Golberry (1785-87) from Senegambia and described by him as a white, soap-like earth as soft as butter and so fat that the Negroes add it to their rice and other foods which thus become very savory. This clay is said not to injure the stomach (Lasch, p. 216).

In the third edition of his "Ansichten der Natur" (1849, I, p. 167), A. von Humboldt writes, "In Guinea the Negroes eat a yellowish earth which they call *caouac*. When carried as slaves to the West Indies, they try to procure there a similar earth. They affirm that earth-eating is quite harmless in their home country. The *caouac* of the American islands, however, makes the slaves sick. Therefore, earth-eating was forbidden there, though in 1751 earth was secretly sold in the markets of Martinique. The Negroes of Guinea assert that in their country they eat habitually a certain clay whose flavor gratifies them without being harmed by it. Those addicted to eating *caouac* are so fond of it that no punishment can prevent them from swallowing earth." Humboldt's information is derived from Thibault de Chanvallon (Voyage à la Martinique, p. 85).

Ehrenberg (II pp. 15, 53) has refuted the idea propounded by Thibault de Chanvallon that the Guinea Negroes generally and habitually eat a red earth, without endangering their health. Ehrenberg's conclusions are based on the observations of many missionaries stationed at many points of the Gold and Slave Coasts during more than thirty years. On the whole, earth-eating occurs there but seldom, chiefly on the part of children and thoughtless persons. Ehrenberg (p. 19) has also analyzed a clay specimen from Cuba and arrived at the conclusion that the *caouac* substitute of the West Indies alleged to be so harmful does not appear to be more harmful than the earth of Guinea.

In regard to the Congo region we are well informed by Catholic missionaries who have paid special attention to this subject. It is noteworthy that geophagy prevails among some tribes of the Congo

and is absent among others. F. Gaud (Les Mandja, p. 151, Brussels, 1911) writes, "At the present time it is only during famines that the Mandja (in the French Congo) gather the earth of termites'-nests and consume it mixed with water and powdered tree-bark. This compound is said to assuage the tortures of hunger in a singular manner. We think that this effect must be attributed not only to the physical action resulting from the filling of the stomach, but also to the absorption of organic products existing in the clay. It is in fact known that the walls of the termites'-nests are built by the female workers with tiny clay balls kneaded by them by means of their saliva. It would not be surprising that this saliva contains formic acid."

The buildings of the great ants (*Termes bellicosus*) are constructed from red ferruginous clays in the shape of mushrooms (see illustration in G. Schweinfurth, The Heart of Africa, I, p. 349).

C. van Overbergh (Les Basonge, p. 151) gives the following information: "The Baluba frequently eat *pembe* or white earth. Result: appalling leanness and swelling of the abdomen. Pregnant women do not eat white earth. In general women eat earth; I have never seen men eat it, but I do not guarantee that men will not eat it. Another observer, Michaud, states that he saw men and women alike eat earth. It appears that a person who has once tasted this earth becomes infatuated with it, but dies in consequence."

Another missionary among the Baluba, R. P. Colle (Les Baluba, Congo belge, I, p. 131), states, "A certain number of children display a very lively desire to eat the embers of the hearth and clay. It is that firm, fat, white and unctuous clay which serves for the manufacture of pottery. Perhaps they are driven to this by the need of salt. The embers in fact contain potash; and the clay in question, a slight quantity of magnesia. The result of this habit is the disease called *le carreau.*"

While among the Baluba, as stated, pregnant women do not consume earth, it is eaten by pregnant women of the Mayombe (C. van Overbergh, Les Mayombe, p. 121).

"At Nouvelle-Anvers in the Belgian Congo, it is reported by eye-witnesses, can be procured for five Centimes the kilo a sort of clay of which the natives are very fond. This is a yellow earth of agreeable odor which contains silicic acid, oxid of aluminum, sodium, and a little iron" (C. van Oberbergh, Les Bangala, état indigène du Congo, p. 123).

R. Schmitz (Les Baholoholo, Congo belge, p. 65) writes, "Earth is not alimentary. Once in a while one encounters a case of geo-

mania, a sick person who has a passion for the wall of a hut or an ants'-nest and who eats of it till he dies."

On the other hand we read, "Not the slightest indication of geophagy among the Mangbetu, Mangbellet, and Mobadi" to which another observer adds, "Save among a few sick" (C. van Overbergh, Les Mangbetu, p. 181).

"The Ababua does not eat any species of earth" (J. Halkin, Les Ababua, Congo belge, p. 151). "No case of geophagy exists among the Warega" (Delhaise, Les Warega, Congo belge, p. 87).

According to Winwood Reade, the famous author of "The Martyrdom of Man," a white clay is frequently chewed or drunk in solution on the Gold Coast, the young people taking it as a sweetmeat, and the old people as a medicine (*Journal Anthrop. Institute*, X, 1881, p. 467).

The following interesting account of geophagy with reference to the people of Batanga is given by W. L. Distant (*Journal Anthrop. Institute*, X, 1881, p. 467):—

"A somewhat curious instance of this custom came before me at Batanga in May, 1880; and subsequent inquiry has enabled me to throw some light upon it. From what I could gather while at Small Batanga, the custom seems to prevail all along the coast as far as the island of Corisco, where I believe it is also known, and perhaps it extends farther south. I met with it first at Babani, where there occurs a deposit of yellowish red clay, containing about 15 per cent of iron and a considerable quantity of mica and some quartz particles, but there is evidently a large quantity of organic matter in it. This clay is made up into balls of about five inches in diameter, and baked over a slow fire. When quite dry and ready for use, a small portion is broken off, and placed in the hollow of any smooth leaf and reduced to powder between the finger and thumb. The leaf is then gently shaken in order to cause the harder and more gritty particles to fall aside. These are carefully removed, and the residue, consisting of a fine powder, is transferred to the mouth, masticated, and swallowed. I was informed that the men use it while on a long journey, when they do not wish to stop in order to cook food. As, however, they travel far without carrying something in the way of provisions that can be eaten readily, this scarcely accounts adequately for the origin of the custom. Some inquiries made at Camaroons elicited the following additional information. The custom is known there, but does not exist to the same extent, or in the same manner as at Batanga. The material used is a very dirty

earthy clay, with but little iron and no mica, and is derived from a deposit on the banks of the rivers. When baked in the sun, it becomes very hard; and, indeed, is sometimes used in the construction of houses. The men sometimes, but seldom, eat it; but I am told the women, during the time of pregnancy, when they are supposed to be assailed by very unnatural appetites, use it largely. Is it the result of inheritance, or merely from the force of imitation, that the custom is almost universal among the Camaroons children? I am told that all of them eat it, even those belonging to the mission, who are well fed, and are strangers to the sensation of hunger. By way of test, I showed some of them a small piece of the Batanga earth. They looked at it for a moment as if to make sure of it, then eagerly besought me to give them some. I gave them what I had in my hand, and they greedily swallowed it, afterwards expressing a desire that, as the kind I had given them was so nice, they would like some more. These children had just supped, and their evident appreciation of the clay could, therefore, hardly be connected with hunger, and would seem to indicate an appetite, or at least a liking, however unnatural, not much related to the desire for food. One of those children, I was informed, usually took a piece of the clay to bed with her, but this child, though well-fed, was always hungry."

The Negro slaves imported from West Africa to America continued the habit of earth-eating, especially in the West Indies. P. Browne (Civil and Natural History of Jamaica, 1756, p. 64), who estimated the number of Negroes living in the island at that time at 120,000 (p. 24), describes a peculiar sort of earth that runs in veins, and is chiefly found in marly beds. "It is of different colors," he writes, "but these generally answer to that of the layer wherein it is found; it is apparently smooth, and greasy, and somewhat cohesive in its nature; but dissolves easily in the mouth. The Negroes, who make frequent use of this substance, say, that it is sweetish; and many get a habit of eating it to such excess, that it often proves fatal to them. It is the most certain poison I have known, when used for any length of time; and often enters so abundantly into the course of the circulation, as to obstruct all the minute capillaries of the body; nay, has been often found concreted in the glands, and smaller vessels of the lungs, so far as to become sensibly perceptible to the touch. It breaks the texture of the blood entirely; and for many months before they die, a general languor affects the machine, and all the internal parts, lips, gums, and tongue, are quite pale, insomuch, that the whole mass of their juices seems to be no better than a waterish lymph. It is probable they are first induced to the

use of this substance (which is generally well known among them) to allay some sharp cravings of the stomach; either from hunger, worms, or an unnatural habit of body."

It is even suggested that Negro and Indian slaves took to earth in despair as a means of slow suicide and that the Carib slaves ate earth whenever they were punished or mistreated (Ehrenberg II p. 16, after W. Irving, Columbus). What is more interesting to us is the ceremonial use of earth on the part of American Negroes.

G. Hughes (Natural History of Barbados, 1750, p. 15), speaking of the ordeals of the Negroes of Barbados, writes, "They take a piece of earth from the grave of their nearest relations, or parents, if it can be had; if not, from any other grave. This being mingled with water, they drink it, imprecating the divine vengeance to inflict an immediate punishment upon them; but in particular, that the water and mingled grave-dust which they have drunk (if they are guilty of the crime) may cause them to swell, and burst their bellies. Most of them are so firmly persuaded that it will have this effect upon the guilty, that few, if any (provided they are conscious of the imputed crime), will put the proof of their innocency upon the experiment."

In the disease known as cachexia africana (*mal d'estomac* of the French), common among the Negroes of the West Indies and Guiana, an essential symptom is a generally depraved appetite and an ungovernable determination to the eating of dirt. According to Cragin (p. 358), "the only appreciable signs of mental activity during the course of this disease are the crafty and cunning plans which the patient most subtly matures and as stealthily executes to procure his desired repast. This consists usually of charcoal, chalk, dried mortar, mud, clay, sand, shells, rotten wood, shreds of cloth or paper, hair, or occasionally some other unnatural substance. The patient, when accused of dirt-eating, which is too often urged as a voluntary crime rather than an irresistible disease, invariably denies the charge. As curative means, neither promises nor threats (even when put in execution), nor yet the confinement of the legs and hands in stocks and manacles exert the least influence and their preventive effect is as temporary as their employment; so great is the depravity of the appetite, and so strongly are the unfortunate sufferers under this complaint subjected to its irresistible dominion. A metallic mask or mouthpiece secured by a lock is the principal means of security for providing against their indulging in dirt-eating, if left for a moment to themselves, nor does this effect a cure or save the life of the patient."

Cragin quotes from a work "Practical Rules for the management and medical treatment of Negro slaves in the sugar colonies, by a professional planter" (London, 1811) the statement, "We find that Negroes laboring under any great depression of mind, from the rigorous treatment of their masters, or from any other cause, addict themselves singularly to the eating of dirt."

Cragin is inclined to think that the disposition to eat chalk, clay, and earth arises from a purely physiological cause, an acidity of the stomach, not from a melancholic or any other affection of the mind. He concludes that the effect has been mistaken for the cause. As one of the facts to prove his position he cites the following: persons living on the same plantation, perhaps on the identical section of the same plantation, on which they were born and reared, with all their friends around them, and by indulgent masters and owners, who are themselves the real slaves, while the owned are only nominally so, provided with ample food, raiment, and if necessary, medical aid, are also subject to this malady.

Dr. Melville J. Herskovits of Northwestern University informs me that the Bush Negroes and the Negroes of the coastal region of Surinam eat earth only on ceremonial occasions. Many times he saw women who were possessed by the spirit rolling lumps of a white sacred clay (*pemba doti*) in their hands during the time of possession and repeatedly licking their hands or the clay.

According to Major J. O. Browne (The Vanishing Tribes of Kenya, 1925, p. 104), "instances occur from time to time of earth-eating, but they are always associated with an outbreak of ankylostomiasis, of which, of course, it is a well-known symptom."

F. Fülleborn (Das deutsche Njassa- und Ruwuma-Gebiet, 1906, p. 115) has the following notice: "In the south of German East Africa earth is eaten, although not so generally as it is reported with reference to Asiatic and American peoples. The fact that pregnant women among the Wakissi are said to eat earth once in a while would mean nothing, since the pregnant often have desires for strange things. I was witness of how at Wiedhafen on the Nyassa relatives brought to a prisoner together with his daily ration a piece of loam (not a special kind, but a quite common one apparently detached from the wall of a hut) of which he ate with seeming enjoyment. This, it is true, was the only case observed by myself, but Elton reports in regard to the Wassangu that he saw there young children and women emaciated into skeletons who had contracted a disease from earth-eating, and Johnston reports similar cases from British Central Africa."

Ehrenberg (II p. 19) received also a clay from Abyssinia with the remark that it was eagerly eaten by women.

In Morocco the earth from the tombs of saints is used in the healing of disease. It is called the *hanna* or *henne* of the saint. It is made into plasters to be applied to the skin or into amulets. It is also moistened with the water of the sanctuary, and then becomes a potion which will cure the most obstinate evils. It is known that the objects concealed in a sanctuary are never stolen, thanks to the protection of the saint who would blind, paralyze or instantly slay thievish intruders. By making a bag containing earth from a saint's tomb and suspending it in a tree, on the walls surrounding a garden, in the flour-chest, or in a shop which remains unguarded at night, the saint is obliged to protect these places; he is transformed into a veritable guardian and is compelled to punish the thief as though his own sanctuary had been violated (Legey, Essai de folklore marocain, 1926, p. 10).

During her stay in Taourirth Abdallah, which is one of the Kabyl towns in the foothills of the Atlas, in Algeria, in 1928, Miss Georgiana B. Such, as she kindly informs me, noticed numerous cases of clay-eating and always in individuals obviously suffering from some more or less obvious polyglandular disturbance or insufficiency—many had goiter; all those examined by her were suffering from intestinal parasites, many had tapeworms, and all were undernourished.

L. Rauwolf (Beschreibung der Raiss inn die Morgenländer, 1583, p. 32) writes that in Tripoli an ash-colored earth called *malun* was used for washing the head and that another earth called *iusabor* was frequently eaten by women as among us the pregnant eat coal and other things.

R. F. Burton (Lake Regions of Central Africa, II, p. 28) writes that clay of ant-hills, called "sweet earth," is commonly eaten on both coasts of Africa. According to Major Tremearne (The Ban of the Bori, p. 80), the women of Nigeria eat white earth during the first three months of pregnancy to insure a successful delivery, but earth is not used as food during a famine.

EUROPE

In his *Naturalis Historia* (XVIII, 29) Pliny discusses *alica*, a preparation or a kind of porridge made from peeled spelt for which Italy was famed. It was manufactured in several localities, for instance, in the territories of Verona and Pisae, but the product of Campania was most renowned. Pliny describes in detail how the grain was dealt with in Campania for this purpose and that three kinds of alica, the finest, the seconds, and the coarse were distinguished; none of these, however, had as yet the white gloss for which they were reputed. For this purpose, Pliny continues—and expresses his surprise by adding a *mirum dictu* ("strange to relate") —a white marl or chalk (*creta*) is mixed with the grain, and this chalk well embodied in the mass lends it color and tenderness (postea, mirum dictu, admiscetur creta, quae transit in corpus coloremque et teneritatem adfert). This chalk, he writes, is found between Puteoli and Neapolis upon a hill called Leucogaeum (a Greek name meaning "white earth"). He refers to a decree, then still in existence, of the emperor Augustus, in which the latter ordered an annual allotment of twenty thousand sesterces to be paid from his exchequer to the Neapolitans for the lease of this hill. The reason for this contribution, the emperor stated, was that the people of Campania alleged that their alica could not be made without this mineral.

It must be emphasized that what Pliny reports with reference to the alica of Campania was not a regular, but an exceptional practice at which Pliny himself marvels as a very singular fact. In other places of Italy as well as in Egypt the alica was prepared without the addition of creta. Accordingly we face here a purely local custom whose principal object was to whiten the meal or to intensify its whiteness. Nothing like improving its flavor or pleasure in eating a clayish substance is mentioned by Pliny. This passage is not conclusive in attributing to the ancients the habit of earth-eating, as has rashly been done by Ehrenberg (II p. 2).

Pliny further mentions an adulterated kind of alica produced in Africa, over which gypsum, in the proportion of one fourth, is sprinkled. No reason therefor is given. Fée, one of Pliny's commentators, wonders how the African mixture accommodated itself to the stomachs of those who ate it. I believe, very well, and that Fée himself with millions of others has numerous times consumed flour adulterated with gypsum and perhaps worse ingredients.

I know of no passage in Greek or Roman literature to warrant the opinion that earth, clay, or chalk was occasionally or habitually consumed, either for pleasure or as a necessity. Various renowned clays like those of Samos, Chios, and Selinos were only employed medicinally or for industrial purposes (Pliny XXXV, 16, 53-56).

Galen (A.D. 129-199) has left an interesting account of his journeying back and forth between Rome and Pergamum in order to stop at Lemnos and procure a supply of the famous terra sigillata, a reddish clay stamped into pellets with the sacred seal of Diana. He describes the solemn procedure by which the priestess from the neighboring city gathered the red earth from the hill where it was found, sacrificing no animals, but wheat and barley to the earth. He brought away with him some twenty thousand of the little disks or seals which were supposed to cure even lethal poisons and the bite of mad dogs. Berthelot believed that this earth was an oxid of iron more or less hydrated and impure. During the middle ages and later Greek monks replaced the priestess of Diana, and the religious ceremony was performed in the presence of Turkish officials (L. Thorndike, I, p. 130).

The learned Dr. Covel, in his Diary (1670-79), gives us an interesting account of what he saw in connection with the terra sigillata of Lemnos, the sacred earth with supposed curative properties:

"On the side hills, on the contrary side of the valley, directly over against the middle point betwixt this hill and Panagiá kotzinátz is the place where they dig the terra sigillata. At the foot of a hard rock of gray hard freestone enclining to marble is a little clear spring of most excellent water, which, falling down a little lower, looseth its water in a kind of milky bogge; on the East side of this spring, within a foot or my hand's breadth of it, they every year take out the earth on the 6th of August, about three hours after the sun. Several papas, as well as others, would fain have persuaded me that, at the time of our Saviour's transfiguration, this place was sanctifyed to have his virtuous earth, and that it is never to be found soft and unctuous, but always perfect rock, unlesse only that day, which they keep holy in remembrance of the Metamorphosis, and at that time when the priest hath said his liturgy; but I believe they take it onely that day, and set the greater price upon it by its scarcenesse. Either it was the Venetian, or perhaps Turkish policy for the Grand Signor to engrosse it all to himself, unless some little, which the Greeks steal; and they prefer no poor Greek to take any for his own occasions, for they count it an infallible cure of all agues taken in the beginning of the fit with water, and drank so two or three times.

Their women drink it to hasten childbirth, and to stop the fluxes that are extraordinary; and they count it an excellent counter-poyson, and have got a story that no vessel made of it will hold poison, but immediately splinter in a thousand pieces. I have seen several finganes (Turkish cups) made of it in Stamboul; we had a good store of it presented to us by Agathone and others, all incomparably good. We had some such as it is naturally dig'd out and not wash'd . . . Thus they take it out: before day they begin and digge a well about 1 ½ yards wide, and a little above a man's height deep; and then the earth is taken out soft and loomy, some of it like butter, which the Greeks say, and the Turks believe, is turned out of rocky stone into soft clay by virtues of their mass. When they have taken out some 20 or 30 kintals for the Greeks' use, they fill it up again, and so leave it stop't without any guard in the world . . .

"We came down to a town called Hagiapate, where there is a great large fountain, where they wash and prepare the hagion choma (sacred earth) for the Turkish seal. They first dissolve it in water, well working it with their hands; then let the water pass through a sive, and what remains they throw away. They let the water stand till settled, then take of the clear, and, when dry enough, they mould in their hands; and most of this we have is shaped from thence. It is all here white, yet I had some given me flesh-coloured. I enquired diligently about it, and they all told me it came out of the same pit; but I expect some of these fellows have found some other place which they conceal. We had some little quantity given us of several people, but very privately, for fear of the *Avaniás*. Agathone, being the Pasha's favourite, feared nothing, but gave us at least 20 okes before 20 people. They tell a story that the earth is hollow from the holy well, when dig'd, to the fountain, where they wash it; and that a duck once dived in the water there and was taken up here; but it seemed an impossible thing to me, there being not water enough in the first place to cover a duck, and the water in the bogge so very shallow, and the earth not sinuous."

J. T. Bent, editor of Covel's Diary (Early Voyages in the Levant, 1913, p. 285), adds the following comments: "Dr. Covel's remarks on the sacred earth of Lemnos are particularly valuable, as this is one of the clearest instances of a pagan superstition being carried on through the influence of Christianity down to our own times. Pliny mentions it (XXIX, 5); also Dioscorides (V, 113); and Galen made an expedition to Lemnos on purpose to see it, and gives us an account of it (De simpl. med., IX, 2). He mentions the disorders

for which it was considered beneficial; he also gives us the ceremonies and mode of operation; on certain occasions a priestess of Artemis came, and after certain rites carried off a cartload to the city; she mixed it with water, kneaded it, and strained off both the moisture and gritty particles, and when it was like wax, she impressed it with the seal of Artemis. During the middle ages, the reputed virtues of this earth remained unimpaired as a remedy for the plague."

Pierre Belon witnessed the ceremony on August 6, 1533. When Tozer visited Lemnos in 1890, the ceremony was still performed annually on August 6, and was to be completed before sunrise, or the earth would lose its efficacy. Mohammedan Khojas then shared in the religious ceremony, sacrificing a lamb. In the twentieth century the entire ceremony was abandoned. In western Europe the terra sigillata continued to be held in high esteem, and was included in pharmacopoeias as late as 1833 and 1848. C. J. S. Thompson has given a chemical analysis of a sixteenth-century tablet of the Lemnian earth, with the result that no evidence therein of its possessing any medicinal property could be found (L. Thorndike, II, p. 131).

Hegiage Ben Josef al-Thakefi, governor of Arabia at the time of the Caliphs, is said to have died of phthisis caused by overeating of terra sigillata, called by the Arabs *ṭin makhtum*, *lutum* and *lutum sigillatum* (D'Herbelot, Bibliothèque orientale, II, 1777, p. 229). This earth is also mentioned in the pharmacological literature of the Arabs, for instance, in Serapion's Liber de semplici medicina (P. Guigues, Les noms arabes dans Sérapion, *Journal asiatique*, 1905, p. 85) and by Ibn al-Baiṭār (L. Leclerc, Traité des simples, II, p. 421).

Peter of Abano, in his Treatise on Poisons (*Tractatus de venenis*, about 1316), mentions the terra sigillata which, he says, causes vomiting if there is any poison in the stomach. Kings and princes in the west take it with their meals as a safeguard, and it is called terra sigillata because stamped with the king's seal. Now, however, the seals are no longer trustworthy, and Peter cautions the Pope against what may be offered him as terra sigillata (Thorndike, II, p. 909).

Earth dug from a grotto in Malta, where St. Paul spent a night, was formerly used for the cure of many ailments, being esteemed a cordial, a sudorific, and a certain remedy for the bites and stings of venomous animals. In the eighteenth century this earth was dis-

tributed from Malta, made up in small round cakes and stamped with the impression of a winged cherub and the words *terra sigillata* (Hill, History of the Materia Medica, p. 206).

In a few wretched villages of Sardinia bread is still prepared from the meal of acorns, which is mixed with a ferruginous argillaceous earth, in order to counteract the tannic acid of the acorns. This earth is called *trokko;* and the bread, *pan' ispeli* (M. L. Wagner, Das ländliche Leben Sardiniens, p. 60, Heidelberg, 1921). This practice corresponds exactly with the acorn bread of the Pomo of California (below, p. 173).

Altheer (p. 93) writes that at Ogliastra in Sardinia a porridge of acorn meal is mixed with a fat clay and that this compound is made into cakes which are sprinkled with ashes or smeared with a little grease and taken as daily food.

The women of Spain and Portugal take pleasure in munching a pottery clay styled bucaro from which vases of a yellow reddish color are made; when dissolved in water or wine, it imparts to these a very agreeable flavor and odor. The bucaro clay is found near Estremoz in the province of Alemtejo, Portugal, and in the province of Estremadura. The almagro, a very fine clay which occurs near Cartagena in the province of Murcia, Spain, is mixed with powdered tobacco in order to render it less volatile and to give it that sweet flavor which is the characteristic of the tobacco of Seville (Camilli, p. 187). Mixed with powdered chili pepper, the same clay is frequently eaten in southern Spain (Altheer, p. 93). The word *almagro* (also *almagra* or *almagre*) is derived from the Arabic *al-maghra* ("red ochre"); this clay is still employed in painting and known in France as *rouge indien* ("Indian red") or *rouge de Perse* ("Persian red").

Deniker states that it is asserted by women that the eating of earth gives a delicate complexion to the face and that the same custom has also been pointed out among women in several countries of Europe, more especially in Spain, where the sandy clay which is used for making the alcarrazas is especially in vogue as an edible earth. The Spanish word *alcarraza*, derived from the Arabic *al-kurrāz* ("earthenware vessel, pitcher"), denotes a porous, unglazed earthenware jar for cooling the water; in the southwestern United States such a jar is commonly called *olla*.

It is said that the ladies of the Spanish aristocracy in the seventeenth century had such a passion for geophagy that the ecclesiastic

and secular authorities took steps to combat the evil (Morel-Fatio, Comer Barro. Mélanges de philologie romane dédiés à Carl Wahlund, p. 41, Macon, 1896).

In Macedonia magnesia was sold in the markets and baked in the bread. Another sort of earth was so much in use there that some Ulemas from Anatolia once offered the Grand Vizier various specimens of it as a cheap means of nutrition for the Turkish troops (Altheer, p. 93).

Saint Hildegard of Bingen (1098-1179) describes a complicated cure of leprosy by use of the earth from an ant-hill (L. Thorndike, II, p. 147).

A fossil flour was used in Saxony in times of famine, and its consumption had fatal results. A similar substance was found in Italy, notably in the territory near Magognano in the beginning of the nineteenth century, but it is not on record that this substance styled in Italy "mineral agaric" and "lunar milk" (above, p. 154) was actually consumed (Camilli, p. 188).

The miners in the sandstone mines of the Kyffhäuser ate fine clay placed like butter on bread (known as "stone butter"). The same is reported for miners near Kelbre in Thuringia who used to eat a lithomarge called "stone marrow" (steinmark), a fine clay made liquid or spongy by a small quantity of water (Camilli, p. 187). "Mountain meal" (bergmehl) was resorted to in Germany during the Thirty Years' War for feeding man and cattle (see Hopffe and Zaunick in Bibliography).

"In Finland a kind of earth is occasionally mixed with bread. It consists of empty shells of animalculae, so small and soft that they do not crunch perceptibly between the teeth; it fills the stomach, but gives no real nourishment. In periods of war, chronicles and documents preserved in archives often give intimation of earths containing infusoria having been eaten; speaking of them under the vague and general name of 'mountain meal.' It was thus during the Thirty Years' War in Pomerania (at Kamin or Cammin); in the Lausitz (at Muskau); and in the territory of Dessau (at Klieken); and subsequently in 1719 and 1733 in the fortress of Wittenberg" (A. v. Humboldt, Aspects of Nature, I, p. 196). Ehrenberg (II p. 5) adds Mühlhausen and Oberburgbernheim in Alsace according to the Chronicle of Basle, where earth was baked into bread, and says that the earth-cakes of Klieken served as bread in the fortress Wittenberg, so that the government then found it profitable to sell this treasure of the earth as fiscal property.

During a famine in 1832, the foodstuffs used in the parish Degernä on the frontier of Lapponia contained a meal-like silicious earth mixed with real flour and tree-bark, according to analyses of Bercelius, Retzius, and Ehrenberg. For a long time it has been customary at Umeå, Sweden, to add such earth to wheat flour, and this is said to have no injurious effect on health. Hundreds of car-loads of such earth, especially from Lillhaggsjön Lake in Umeå, mixed with foodstuffs, are said to have served as a nourishment to the Lapps about the same time. Such earth is likewise utilized in Finland; near Laihela, in the region of Vasa in Oesterbotten, Finland, a powder-like white clayish earth (according to Retzius, inorganic) is used as an addition to flour (Ehrenberg II p. 5; and *Bericht über die Verhandlungen der Berliner Akademie*, 1837, pp. 41-43; 1838, p. 7).

NORTH AMERICA

It is commonly believed (and science also has its conventional traditions sometimes half true, sometimes untrue or unproven) that Alexander von Humboldt was the first who drew attention to geophagy among American tribes or even to the subject at all; and when geophagy is spoken of, it is usually Humboldt's illustrious name which is remembered. Humboldt made the subject of geophagy fashionable; his account certainly retains its value, and is still entitled to the interest which it at first aroused, but he was neither the first who discussed the subject (many European writers of the eighteenth century were quite familiar with it as far as Africa, Siberia and Europe are concerned), nor was he the first to point it out with reference to American tribes.

As early as 1527 earth-eating was mentioned by Alvar Nuñez Cabeza de Vaca. Speaking of a tribe called by him Iguaces, who live on wild roots and are much exposed to starvation, he relates that "now and then they kill deer and at times get a fish, but this is so little and their hunger so great that they eat spiders and ant-eggs [the pupas], worms, lizards, salamanders, and serpents, also vipers the bite of which is deadly. They swallow *earth* and wood, and all they can get, the dung of deer and more things I do not mention; and I verily believe, from what I saw, that if there were any stones in the country, they would eat them also." In another passage the same explorer states that the fruit of the mesquite tree (*Prosopis juliflora*) was eaten with *earth*, and then became sweet and very palatable (F. Bandelier, Journey of Cabeza de Vaca, 1905, pp. 89, 127).

Sir Samuel Argoll, in a letter on his voyage to Virginia in 1613, speaks of "the discovery of a strange kind of earth, the virtue of which he did not know; but the Indians eate it for physicke, alleaging that it cureth the sicknesse and paine of the belly" (Purchas, XIX, p. 92).

In reference to clay-eating among the present-day Virginia Indians Dr. Frank G. Speck, professor of anthropology at the University of Pennsylvania, has been good enough to send me the following information: "I recall from my notes that the Pamunkey and the Catawba would confess to eating a little clay at times when they are engaged in making pottery. This they do not as a practice nor, as I recall, for medicinal purposes, but because it tastes agree-

ably to them; but they do not make a regular practice of it. They say that it is commenced when they are children, playing about in the clay which has been gathered and cleaned for pot-making by their mothers. Both sexes eat clay. It does not seem to have become a habit among the Indians as among the whites. And I believe there is a connection between it and pot-making, as a theory in its history in the southeast. The Pamunkey mix powdered mussel-shells (Unio) with their pot-clay, and the Catawba sometimes blood, which may be worth considering in the development of the taste." A similar example of women potters enjoying clay while at work is given below (p. 190) for Colombia.

At a later date Dr. Speck communicated to me the following personal observation: "The Catawba women who still make clay pots are given to eating clay in small quantities, because they like the taste of it. This is done when building pots. They say it is good for the health in small measure, acting as a laxative. I found it so too upon trial. Their children also eat it and would be apt to eat too much of it if not controlled by their mothers."

The Zuñi eat the tuber of *Solanum fendleri* (so-called native potato) raw, and after every mouthful a bite of white clay is taken to counteract the unpleasant astringent effect of the potato in the mouth (M. C. Stevenson, Ethnobotany of the Zuñi Indians, Bureau Am. Ethn., 30th Annual Rep., p. 71).

It seems, however, that this procedure was not general among the Zuñi. At least F. H. Cushing (Zuñi Breadstuff, p. 226, repr. in Indian Notes and Monographs of the Museum of the American Indian, VIII), in speaking of the preparation of a diminutive wild potato, which is poisonous in the raw state or whole, but rendered harmless by the removal of the skin, writes that such potatoes were stewed and eaten usually with the addition of wild onions as a relish. He does not refer to clay in this connection, nor to any kind of clay used by the Zuñi in reference to any other food.

The Oraibi of Arizona use a kind of clay which is mixed with potatoes and eaten, hence known as potato-clay (specimen in Field Museum).

J. G. Bourke (The Snake-dance of the Moquis of Arizona, 1884, pp. 70, 252) refers to the Moqui's eating of clay with wild potatoes as a condiment. He adds that the Navaho to a very marked extent and the Apache, Moqui and Zuñi to a smaller degree may be classed among clay-eaters.

Mr. C. Daryll Forde has kindly sent me the following information on the edible clay used by the Hopi: "The edible clay known and used by the Hopi is a white compact material as hard as chalk, but more 'greasy' to the touch and taste. Two sources were known to my informants: (1) the larger supply is obtained from Navaho who bring it in from the Chinlee District, (2) a small local supply also exists in a low hill of sand and shale debris on the west side of Second Mesa near the Mishongnovi spring, Toreva (tojiva). My informants thought that the Navaho themselves did not use it (I was unable to corroborate this with Navaho informants). The Hopi name is *tomöntcöka*. It is always used in association with wild vegetables or berries. The following are two standard recipes:

(1) Kevepsi (berries of a low bush, *keptcoki*, not yet identified) are boiled, the clay is mixed in with them as they cook, and the whole mashed into a paste.

(2) Tumna, the tubers of a wild bush collected in April and May, are boiled and eaten with powdered clay (*au gratin*, so to speak), or the tubers and the clay are mashed together after cooking, or, again, one nibbles at a lump of the clay while eating the main dish."

Mr. E. Simpson and others of the Department of Geology, University of California, have made a physical examination of this clay, with the following report communicated to me by Mr. Forde:—

"The Hopi edible clay is a cream-colored, very fine material with a speckled appearance due to the presence of small, whiter-colored mud ovules. The latter appear to be clay pellets which may have been formed by coagulation in a saline solution, such as would obtain in a saline lake.

"On treating the specimen with water it immediately began to 'dissolve' and rapidly colored all the water in the beaker. In a few hours it had swelled to more than twice its original volume, and had the consistency of soft jelly. The colloidal clay was decanted off and the residue, of which there was extremely little, examined under the microscope. A few very angular grains of quartz, none over a tenth of a millimeter in diameter, were observed together with a few weathered grains of medium plagioclase felspar. Most of the residue, however, was a fibrous chlorite apparently pseudomorphic after biotite.

"The clay was undoubtedly deposited in a lake which was probably saline. It is possibly 'bentonite' or altered volcanic ash, but this cannot be proved by physical examination.

"The property of swelling by taking up considerable quantity of water when immersed suggests that perhaps this clay was of value in giving a sense of repletion to a relatively empty stomach."

W. Hough (in Handbook of American Indians, I, p. 467) writes that "in some localities (among the Pueblos) clay was eaten, either alone or mixed with food or taken in connection with wild potatoes to mitigate the griping effect of this acrid tuber." In this case, accordingly, the clay serves as a soothing medium as among the Ainu in combination with the bulb of a *Corydalis* (above, p. 149).

In acute indigestion the Papago boil for a little while some of the red earth taken from beneath the fire; after being strained a little salt is added, and the mixture is then given to the patient to drink. He has to take this remedy three times, always at mealtime, and he gets nothing or at most very little to eat (A. Hrdlicka, Physiological and Medical Observations among the Indians, 1908, p. 241).

The Pomo of California, in making bread, mix red earth with acorn meal. Dr. S. A. Barrett has been good enough to give me the following information on this point: "The fact of the matter is that they make white bread, as it is called, without a mixture of earth, but this is not esteemed as highly as the black bread, which is as a matter of fact a very dark brown and heavy bread. The two are made, as I recall it, in exactly the same manner, except for this mixture of a very small quantity of a reddish earth, which the Indians say serves as our yeast does. There is nothing, however, in the way of 'raising' of the dough, but the red earth is simply mixed, and the dough is placed in the oven to bake at once. The oven, of course, is nothing more or less than a hole in the ground, which is lined with leaves and filled with layers of this dough and hot stones, the latter being separated from the dough by layers of leaves. It bakes slowly, but is really a very palatable food. I am not sure how this earth actually affects the dough, as I have never had an opportunity to look up the actual chemical composition of this red earth. I cannot state definitely the geographical distribution of this particular custom in California, but as I recall it now, it is not found among the Miwok with whom I have worked to a considerable extent, though not as fully as among the Pomo. The Miwok method of handling acorn meal and bread is quite different from that of the Pomo in several respects. I might add that there is a certain whitish or bluish white clay which was to a certain extent used by the Pomo, though this was not used with anything else and is said by them to be a food of itself. I do not now recall having encountered the use of

this whitish or bluish white clay among any of the other Californian tribes with which I came more or less in contact, though it may be that it is such a slight part of their food supply that unless one was specifically hunting for it, it would be very easily overlooked."

In a creation myth of the Cahuilla of California an incidental allusion to earth-eating on the part of the first people is made. Mūkat, in a dispute with Temaīyauit, says, "There will not be enough food for all of them." "They can eat earth," said Temaīyauit. "But they will then eat up all the earth," answered Mūkat, and Temaīyauit replied, "No, for by our power it will be swelling again" (W. D. Strong, Aboriginal Society in Southern California, p. 135, University of California Press, 1929). Of course, it is rather the possibility of eating earth than the fact itself, which is here alluded to; but if eating earth was regarded as possible, actual tests apparently must have been made.

Sir John Richardson (Arctic Searching Expedition, 1852, p. 118) writes, "A pipe-clay is very generally associated with the coal beds, and is frequently found in contact with the lignite. It exists in beds varying in thickness from six inches to a foot, and is generally of a yellowish-white color, but in some places has a light lake-red tint. It is smooth, without grittiness, and when masticated has a flavor somewhat like the kernel of a hazel-nut. The natives eat this earth in times of scarcity and suppose that thereby they prolong their lives."

With reference to this passage, Frank Russell (Explorations in the Far North, p. 133, publ. by University of Iowa) remarks, "I found the bed of edible clay, mentioned by Richardson, near the base of the cliff. It is used for whitewashing at Norman, and is said to have been used as a substitute for soap by the Indians before the introduction of that article by the traders. Norman stands at the mouth of the Bear River near the Bear Rock, a solitary butte over four thousand feet in height." The Indians here in question are Athabascans of northwestern Canada.

V. Stefánsson (Arctic Expedition of the American Museum, Anthr. Papers Am. Mus. Nat. Hist., XIV, 1914, p. 395) has the following entry in his diary under the heading "Edible Earth":—

"Bought to-night a tin full of 'edible clay' from a cutbank on the Kañianirk part of the Colville (S. bank) between the Killirk and Ninñolik branches. The specimen is in flakes and powder. Seller considered the clay a true food, but says it is eaten in large quantities

only at times of scarcity or when travelers run out of food. Many eat a little now and then, seller (Kañianirmiut woman) says she puts a little on her tongue almost every day and lets it soak up there till soft. She gets presents every year now of similar stuff up the coast, but the sample sold me has been treasured for years. When clay is to be used in earnest as food, it should be let soak in water over night or longer; it then disintegrates and swells into a thick paste, seems to increase in bulk rather more than rice does in boiling. When about to be eaten, this paste is mixed up in a little more water to make it thinner, and then it is poured into hot water in a pot and cooked 'like flour soup,' i.e., brought to a boil. 'This is good food if one has oil with it; otherwise it constipates you.' The seller, however, considers the clay to be rich in a tasteless and smellless oil which she says the old men say is old whale-oil that soaked down the cutbank from whales whose bones (lower upper jaws, shoulder-blades, ribs, backbone, etc.) are seen near the top of the cutbank far above."

The Iglulik Eskimo have a tradition relating to the early history of mankind when men had only earth for food. "In earliest times it was very difficult for men to hunt. They were not such skilful hunters as those who live now. They had not so many hunting implements, and did not enjoy an abundance and variety of food such as we have now. In my childhood I heard old people say that once long long ago men ate of the earth. Our forefathers ate of the earth; when halting on a journey and camping, they worked the soil with picks of caribou-horn, breaking up the earth and searching for food. This happened in the days when it was very difficult to kill a caribou, and it is said that they had to make a single animal last all summer and autumn. Therefore they were obliged to seek other food. . . . In those days earth was the principal food of man" (K. Rasmussen, Intellectual Culture of the Iglulik Eskimos, p. 253, Copenhagen, 1929).

A certain outward resemblance of this tradition to the Indic one in the *Vinayavastu* (above, p. 144) is obvious, as is also the diversity of the two stories. In the Indic one earth is considered a superior food of the golden age, in the Eskimoan one it is an inferior food resorted to for lack of better staples in the beginning of life. Of course, such a stage of living, as visualized in the Eskimo tradition, has never existed; it is an afterthought reconstruction, but maybe at the same time a vague reminiscence of earth having formerly been consumed on a larger scale than at the present time.

Lieutenant G. T. Emmons, who has had a thirty-five years' experience with the tribes of the Northwest Coast, assures me that he has never seen or heard of a single case of clay-eating among any of these. Clay or earth is not mentioned either by Harlan I. Smith in his article "Materia Medica of the Bella Coola and Neighboring Tribes of British Columbia" (Annual Report for 1927 of National Museum of Canada, Ottawa, 1929).

It would be erroneous to believe that earth-eating is a privilege of the Indians. It is found among the whites as well, especially in Georgia and Carolina. In 1709 T. Lawson (History of Carolina, p. 206, London, 1714) recorded this observation: "The children [of the Indians] are much addicted to eat dirt, and so are some of the Christians, but roast a bat on a skeiver and make the child that eats dirt eat the roasted rearmouse (bat), and he will never eat dirt again." In 1857 J. R. Cotting published the analysis of a species of clay found in Richmond County, Georgia, which, as announced in the title of his article, "is eagerly sought after and eaten by many people, particularly children." This substance, in its external characters, he writes, resembles lithomarge, or rock marrow; its colors are dark red, yellow, yellowish red, yellowish white, purple and reddish white. He found it associated with other minerals in many parts of the survey, in both the counties of Burke and Richmond, but the purest and most abundant was on land of David F. Dickinson near M'Bean Creek, Richmond County, on the east side of the great road leading from Augusta to Savannah, about fourteen miles from the former place. Here large excavations had been made to obtain this clay, indicating that the demand for it must have been heavy. It has a slight sweetish taste, not unlike calcined magnesia. Its action on the stomach is mechanical, as it contains nothing capable of being decomposed and nothing on which the gastric juice can act. It is composed of silex, oxid of iron, alumina, magnesia, and water.

A boy about fifteen years of age, who was taking his favorite repast at that locality, informed Cotting that he was in the habit of eating daily of that substance, "as much as he could hold in his hand." Cotting asked the boy whether his parents did not inform him better. He replied that he had only a mother and that she ate it too when she was well, but that she was almost always sick. Cotting was informed by people living in the vicinity of the localities where this clay occurs that many deaths have resulted there from no other perceptible cause than from persisting in the use of this

clay as a luxury. Cotting adds that this peculiar species of clay is said not to be found north of the Potomac and that a species in some respects similar is found at Bare-hills, Maryland, which, however, is deficient in the proportion of iron and magnesia.

The Redbones (see Handbook of American Indians, I, p. 365) of Carolina are reputed to be clay-eaters.

MEXICO AND CENTRAL AMERICA

The use of earth in ancient Mexico is particularly interesting, especially in its relation to religious ceremonies.

"A peculiar food of the ancient Mexicans seen by the conquerors consisted of cakes made from a sort of ooze which they get out of the great lake, which curdles, and from this they make a bread having a flavor something like cheese" (T. A. Joyce, Mexican Archaeology, p. 155). The source is not quoted by Joyce. Ehrenberg (II p. 3) writes, "Earth-eating was reported in Mexico as early as 1494 and in 1519 by Bernal de Diaz as the relish *tecuitlatl* from the Lake of Mexico, which was confirmed by Hernandez in 1580."

The following documents have reference to this matter. Sahagun (book XI, chap. 3, at end of §5) informs us that "on the Lake of Mexico is found a substance (*urronas*) called *tecuitlatl*, clear blue in color; when it forms a thick layer, it is gathered, spread out on ashes, and formed into cakes which are baked and then eaten."

Bernal Diaz refers to the same matter in two passages (chaps. 92 and 153; translation of A. P. Maudslay, II, p. 73; IV, p. 160). In the former he speaks of fisherwomen and others who sell small loaves made from a sort of ooze gathered on the Lake of Mexico; this ooze curdles or coagulates, and can be cut up into slices the taste of which reminds one a little of our cheese. In the other chapter he writes, "They gathered on the Lake a sort of ooze which when dried had a flavor like cheese." D. Jourdanet (in his French translation of Diaz' work, p. 517) comments that "the Indians of the present time still collect on the banks of the lagoon a mass said to consist of the eggs of gnats mixed with a gelatinous substance which comes from the swarms of these insects (called *agua-utle*); it has indeed a strong flavor like bad cheese."

F. Lopez de Gomara (Historia de Mexico, p. 118, Antwerp, 1554), describing the market, relates, "They eat everything, even earth. At a certain time of the year they sweep up with nets of a fine mesh a fine substance which grows on the water of the lakes of Mexico and coagulates. It is not a plant or earth, but is like mire. There is a lot of it, and they collect much of it, and spreading it out in the way salt is prepared, they empty it out, and there it coagulates and dries. They make of it cakes like bricks. Not only do they sell it in the market, but also they take it to other markets

outside the city far away. They eat it as we eat cheese, and it has a slightly saltish taste; with *chilmolli* it is savory. They say, too, that so many birds crave this article on the lake that during the winter they cover many parts of its surface." *Chilmolli* is a ragout or soup in which chili dominates.

F. Juan de Torquemada (Monarchia indiana, 1723, book XIV, chap. 14; II, p. 557), evidently depending on Gomara, has this account: "On the surface of the water of this lake grow some things like finely ground slime, and at a certain time of the year when they are more solidified the Indians gather them with fine meshed nets. They take them out of the water onto the earth or sand of the shore and spread them out till they dry, and then make cakes of them two fingers thick, which subsequently dry out to one finger-breadth when they are ripe. When they are well dry, the people cut them like small bricks, and eat them as though they were of cheese. The Indians think they have a very fine flavor, but they are rather salty. Of this they send a goodly quantity to the markets, and of another food which they call *tecuitlatl*, although at present these two kinds are lost and no longer appear, and I do not know whether the reason is that the Indians have taken to our food and no longer care for their own." The word *tecuitlatl* is listed in the "Dictionnaire de la langue nahuatl ou mexicaine" (p. 404) of R. Siméon with the following definition: "A viscous substance (lit. 'excrement of stones') gathered amidst of the plants of Lake Tezcuco; this substance is dried at the sun, and is preserved to be eaten like cheese. The Indians consume it at present and confer upon it the name *cuculito del agua*."

Cf. also the notes of D. Jourdanet in his translation of Sahagun (p. 854).

Midwives give to pregnant women the advice that they must abstain from eating earth and *tiçatl* ("a sort of white earth"), for fear that the infant when born might be sick or disfigured by a bodily defect (Sahagun, book VI, chap. 27). This rule seems to imply that pregnant women in ancient Mexico were in the habit of longing for earth.

Joseph de Acosta (Historia natural y moral de las Indias, p. 382, book V, chap. 28, Madrid, 1608) describes a ceremony in ancient Mexico in honor of Tezcatlipoca, god of the night and particularly night winds. During the ceremony the priest blew a pottery flute, and after playing it toward the four points of the compass whereby he meant to indicate that both those present and absent heard him,

he placed his finger in the soil, and seizing earth, shoved it into his mouth and ate it as a sign of adoration; the same was done by all who were present (Y aviendo tañido hàzia las quatro partes del mundo, denotando que los presentes y ausentes le oian, ponia el dedo en el suelo, y cogiendo tierra con el metia en la boca, y la comia en señal de adoracion, y lo mismo hazian todos los presentes, etc.). This ceremony was performed ten days before the feast, for the purpose that all might attend this worship in eating earth and demand from the god whatever they pleased. Torquemada (Monarchia indiana, 1723, book X, chap. 14, II, p. 256) describes the same ceremony as follows: "Ten days before the big feast to Tezcatlipoca, in the month Toxcatl, the priest came out of the temple with a flute with a shrill note, and facing in turn all four directions, played it. This was to call all men's attention to the coming feast. Then there was silence, and putting his finger on the ground, he used to take earth, and used to put it in his mouth and eat it as a sign of humility and adoration. Every one did the same, weeping bitterly, throwing himself prostrate on the ground, invoking the obscurity of the night and the wind and asking them with fervor not to leave them shelterless or forget them."

F. Lopez de Gomara (Historia de Mexico, p. 100, Antwerp, 1554) reports that when three thousand nobles came out from Mexico to meet Cortes, "each one as he reached Cortes touched his right hand to the ground, kissed it, bowed down, and passed forward in the order in which they came" (Cada uno, como a Cortes llegaba, tocaba su mano derecha en tierra, besabala, humillabase, y passaba adelante por la orden que venian). The Spanish text is somewhat ambiguous: it is not clear whether they kissed their own hands or the ground, but more probably the latter as a sign of humiliation and adoration as in the ceremony previously described. Gomara (p. 305) relates also that during the ceremonies accompanying the induction of a new ruler in Mexico, nobles as they approached the image of Huitzilopochtli (Vitzilopuchtli), god of war, touched the ground with one of their fingers and then kissed this finger.

Juan Suarez de Cepeda, in 1581, reports that the Tarascans on the west coast of Mexico, on the occasion of an eclipse ("when the mother goddess playing with sun or moon puts her hands over them so that the light is shut off") make noises and eat earth and stones till the eclipse is over ("till the mother goddess returns home"). He further relates, "As soon as the people see the stars which are known as the Pleiades and which in their due course according to

the movements of the heavens appear on the horizon, they run to eat, and do eat stones and clods of earth, just as if they were *turrones* [a kind of candy like nougat, very popular in Spain] and honey cakes, and they say they do this so that their teeth may be strengthened, and kept firmly in position so that they do not fall out. And thus they expect will happen to them, feeling like beasts, the opposite effect of what they try for and would wish" (De Cepeda, Relacion de los Indios Colimas de la Nueva Granada. Anales del Museo Nacional, IV, México, 1912, pp. 516, 517). This last sentence would appear to be corrupt; it would seem to suggest that if their teeth do become loosened they are very put out about it.

It was customary among the Aztec that in a certain form of sworn treaty the person rendering the oath put his finger on the soil and then lifted his finger to his mouth as though he was eating earth. In the same manner witnesses also rendered an oath (J. Kohler, Recht der Azteken, pp. 71, 109; and A. H. Post, Grundriss der ethnologischen Jurisprudenz, I, p. 483).

The passages quoted have not been revealed by any previous writer on geophagy, but they are important in showing that the custom is of ancient date in Mexico and roots deeply in religious rites and practices. Lasch (p. 217) states merely that earth-eating is frequent in Mexico, notably among women and children, and that in Guadalajara, San Luis, Puebla, and other places are sold on the markets pastils made of white, lightly baked clay and said to be of good flavor. In regard to the Maya of southern British Honduras Mr. J. Eric Thompson informs me that "they are fond of eating a kind of white chalk which they find in the 'fill' of pyramids. In reply to a question as to why they eat this substance they state that it tastes good and is good for them. Personally I considered it absolutely tasteless. Children in the Maya villages are fond of eating earth. Constant earth-eaters are said to suffer badly from hookworm. Medical authorities with whom I discussed this question differed as to whether hookworm was the cause or the effect of this earth-eating."

The fact that geophagy is still prevalent in Mexico may be gleaned from the following very interesting information kindly sent me by Professor Marshall H. Saville of the Museum of the American Indian, New York:—

"Thirty years ago I visited the town of Etla in the state of Oaxaca, in a valley running west from the Oaxaca valley, and some eighteen miles from the city of Oaxaca. This town is now, and so

far as the archaeology is concerned, has always been occupied by the Zapotec Indians.

"I made this visit in order to collect from the various groups of Indians from different parts of the state, who assembled here during the time of the fiestas celebrated annually in honor of the patron saint of Etla.

"The church in which the saint is preserved was built in early colonial times on the pyramidal base of an ancient temple, which, in turn, had been erected on rising ground from which in places the bedrock projected. The ancient Mexicans often took advantages of such eminences, and the Christian priests often razed these old temples to replace them with churches. The fame of the Virgin of Etla is widespread throughout the Indian country of the state of Oaxaca.

"Nearing the town I saw many Indians in family groups returning to their own villages, as this was the last day of the fiesta. Many of them had their faces covered with dust or powder; in fact, they were very dirty. Others were busily engaged in eating powder from a gourd held in their hands. Even the little children were thus engaged. On getting closer to the church I heard the noise of hammering, and saw many Indians industriously hammering off pieces of the rock in the pyramid upon which the church stood. A considerable section of this base looked like a miniature quarry. The rock was obtained by means of stone hammers, and the pieces ground into powder by means of the said stone hammers. I am sorry that I did not get a sample of the rock, nor do I know to what class it belongs. However, it was quite soft and easily reduced to dust.

"I afterwards learned that the Indians not only considered it efficacious for liver troubles, but that coming from this hallowed spot, probably having reference to olden times, taking this powder which was endowed with magical powers, insured their welfare for months to come.

"Father Mayer has just told me that an Indian boy who recently went with him on a collecting trip for us up the Tapajoz River, from Santarem, Amazonia, picked up a clay ball from a site where pottery had been fabricated, and proceeded to eat it, saying that it was 'good to eat.'

"I have seen in the materia medica of native Indian villages in Mexico and Ecuador pieces of soft stone among the herbs, insects, etc., which are sold by the primitive Indian woman for medicine."

According to O. Stoll (Guatemala, 1886, p. 133), the custom of eating certain kinds of earth is generally practised among the Indians of Guatemala, and they do not keep it secret. The earth principally used by them is a light yellowish gray, strongly odorous substance which is a volcanic product weathered away into a powder. It is perfectly insipid and tastes somewhat like chalk. The Indians prize it as a spice of excellent quality and call it "white sweetness" (*sak cab*). Certain it is that this earth is a substitute for tooth-powder and contributes to preserve their white teeth. The quantity eaten at a time is small, as it is merely scattered over the food. Another way of consuming clayish materials is connected with religious ideas. The people who travel to the famous place of pilgrimage, Esquipulas, will take along from there blessed figures of saints made from a powdered earth by the clergy. These figures (*benditos*) are eaten by the devout, or are given away by them to friends and relatives, being credited with the power of relieving existing diseases and preventing sickness.

Stoll affirms that geophagy is a genuine Indian custom which is very ancient; for in the *Popol Vuh* the two magicians, Hunahpu and Xbalanque, rub earth into the roasted birds with which they poison Cabrakan. The fact itself is correct, yet I do not believe that the story of the *Popol Vuh* can be invoked as an example of earth-eating in ancient times. In the text under consideration (translation of Brasseur de Bourbourg, p. 65, Paris, 1861; Villacorta and Rodas, Manuscrito de Chichicastenango, p. 206, Guatemala, 1927), Hunahpu and Xbalanque employ the earth as a ruse to overcome Cabrakan. "This bird," they say, "will be the means of his defeat; in the same manner as white earth will envelop this bird all over through our care, we shall knock him down on the earth, and in the earth we shall bury him." Cabrakan, after eating the bird, staggers and has no more strength on account of the earth rubbed into the bird. Moreover, it was only this one bird which was treated in this manner for the purpose of bringing about Cabrakan's downfall, not, however, the other birds which were plainly roasted at the fire without application of earth. It cannot even be inferred from this passage that birds were generally baked in earth at that time; it was merely a single specific case, a trick devised for the purpose of capturing Cabrakan. The body of the bird was rubbed in with *tizate*, and then white dust was sprinkled around it. The word *tizate* is explained by De Bourbourg as being derived from Nahuatl *tiçatl*, "a whitish earth, very friable, of which they avail themselves to polish metal,

make cement, etc." (see above, p. 179). The Spanish translation runs, "Y a uno de ellos (pájaros) le pusieron tizate encima, que es una tierra blanca, que fué lo que le pusieron." Nevertheless I am convinced with Stoll that geophagy is very old in Guatemala and certainly goes back to pre-Columbian times.

With reference to the treatment of the bird in the preceding legend it may be called to mind that according to A. Skinner (Material Culture of the Menomini, 1921, p. 194) meat was often roasted on coals by the Menomini and that small animals were sometimes rolled up in clay and baked in the hot ashes; this was a favorite method of dealing with porcupines; when the clay shell was split open, the quills and hide of the animal adhered to the mold, and the roast came out clean.

Stoll also mentions the morbid geophagy of children and adults who devour indiscriminately all kinds of earthy substances. Popular opinion ascribes to this habit a number of pathological symptoms, which is called into doubt by Stoll; he is convinced that many children indulge in this habit without risking disease and that others who acquire the complex of diseases in question do not really eat earth.

The Guatuso Indians of Costa Rica do not use salt, but are said by Bishop B. Thiel of San José to enjoy a clayish earth in lieu of it (K. Sapper, Mittelamerikanische Reisen und Studien, 1902, p. 232).

W. Sheldon (Brief Account of the Caraibs who inhabited the Antilles, *Transactions Am. Antiquarian Soc.*, I, 1820, p. 412) has the following note: "The Caraibs as well as the Negroes, when in a state of melancholy, sometimes hanged themselves; or they would eat earth and filth until they brought on dropsies or other fatal disorders, which occasioned their death. The pernicious habit of eating earth appears to be endemical in the Westindia islands. The white Creoles are not free from a propension to this depraved appetite; and I have heard it much spoken of as prevailing among the people of Georgia and the Carolinas. The Caraib slaves would eat earth whenever they were punished or thwarted."

T. Young (Narrative of a Residence on the Mosquito Shore during the Years 1839–41, p. 76, London, 1842) writes, "The Sambo girls have a custom of eating charcoal and sand to obtain it fresh and moist, and they have appeared to enjoy it with great gusto." The Sambo are descendants of Indians and Negroes who escaped from a wrecked slave ship, and live on the Mosquito Coast, Nicaragua.

Regarding geophagy of the Negroes in the West Indies, see above, p. 159.

Mention has been made of earth-eating as a means of committing suicide among Negro slaves. The same is reported with reference to the Tupinamba of Brazil by Gabriel Soares de Sousa in his interesting "Noticia do Brazil" (chap. 161, Noticias ultramarinas, III, pt. 1, p. 289), written in 1587. This is one of the earliest accounts of earth-eating in America and certainly the earliest relative to South America; it has thus far been overlooked by every one who has written on the subject. "This people," Soares writes, "has another very great barbarity: when they are seized by disgust or when they are grieved to such a degree that they are determined to die, they begin to eat earth, every day a little, until they emaciate and their face and eyes will swell, and they will finally die; no one can help them or is able to dissuade them from committing suicide, as they affirm that the devil has taught it to them and that he appears to them whenever they are determined to eat earth."

Alexander von Humboldt's observations were made on June 6, 1800, when traveling down the Orinoco he spent a day in the village called La Concepcion de Uruana. His account is as follows:—

"In the midst of this grand and savage nature live many tribes of men, isolated from each other by the extraordinary diversity of their languages: some are nomadic, wholly unacquainted with agriculture, and using ants, gums, and earth as food; these, as the Otomac and Jarure, seem a kind of outcasts from humanity.

"It was a very prevalent report on the coasts of Cumana, New Barcelona, and Caracas, visited by the Franciscan monks of Guiana on their return from the missions, that there were men on the banks of the Orinoco who ate earth. . . . The earth which the Otomac eat is a soft unctuous clay; a true potter's clay, of a yellowish-gray color due to a little oxid of iron. They seek for it in particular spots on the banks of the Orinoco and the Meta, and select it with care. They distinguish the taste of one kind of earth from that of another, and do not consider all clays as equally agreeable to eat. They knead the earth into balls of about five or six inches diameter, which they burn or roast by a weak fire until the outside assumes a reddish tint. The balls are remoistened when about to be eaten. . . . During the periodical swelling of the rivers, which is of two or three months' duration, the Otomac swallow great quantities of earth.

We found considerable stores of it in their huts, the clay balls being piled together in pyramidal heaps. The very intelligent monk, Fray Ramon Bueno, a native of Madrid (who lived twelve years among these Indians), assured us that one of them would eat from three quarters of a pound to a pound and a quarter in a day. According to the accounts which the Otomac themselves give, this earth forms their principal subsistence during the rainy season, though they eat at the same time occasionally, when they can obtain it, a lizard, a small fish, or a fern root. They have such a predilection for the clay, that even in the dry season, when they can obtain plenty of fish, they eat a little earth after their meals every day as a kind of dainty. . . . The Franciscan monk assured me that he could perceive no alteration in their health during the earth-eating season.

"The simple facts are therefore as follows: The Indians eat large quantities of earth without injury to their health; and they themselves regard the earth so eaten as an alimentary substance, i.e., they feel themselves satisfied by eating it, and that for a considerable time; and they attribute this to the earth or clay, and not to the other scanty articles of subsistence which they now and then obtain in addition. . . . The earth which we brought back with us, and which Vauquelin analyzed, is thoroughly pure and unmixed. . . . That the health of the Otomac should not suffer from eating so much earth appears to me particularly remarkable. Have they become accustomed to it in the course of several generations?

"In all tropical countries, human beings show an extraordinary and almost irresistible desire to swallow earth; and not alkaline earths, which they might be supposed to crave to neutralize acid, but unctuous and strong-smelling clays. . . . With the exception of the Otomac, individuals of all other races who indulge for any length of time in the strange desire of earth-eating have their health injured by it. Why is it that in the temperate and cold zones this morbid craving for earth is so much more rare, and is almost entirely confined, when it is met with, to children and pregnant women; while in the tropics it would appear to be indigenous in all quarters of the globe?"

It must be emphasized that Humboldt himself has not had any personal experience of the effect of geophagy on the Otomac. As to this point, he has depended entirely on the opinion of the Franciscan friar, Ramon Bueno, and the lay brother, Juan Gonzalez, in whose station he spent the day. The conclusion that the Otomac

are the only people whose health is not impaired by earth-eating (subsequently repeated by many authors) does not seem very plausible; no ill effects are reported, for instance, from Java, Sumatra, Borneo, or Melanesia. Cortambert's observations given below contradict Humboldt's opinion. The conclusion that geophagy is more prevalent in the tropics than in the temperate and cold zones holds good no longer, and is plainly refuted by the facts recorded in this article.

J. Gumilla (Historia del Rio Orinoco, 1791, I, p. 179), said to be credulous and uncritical, denies that the Otomac ever eat pure earth, and states that their clay balls are mixed with maize flour and crocodile's fat; but the two informants of Humboldt affirmed unanimously that the Otomac never added crocodile's fat to their clay balls, and as to maize, they had never heard of it at Uruana.

E. Cortambert (p. 218) gives the following account of the earth-eating habit among the tribes of the upper Orinoco: "This edible earth is a clay blended with iron oxid, reddish yellow in color. It is kneaded into balls or cakes allowed to dry and cooked when to be eaten, rather a ballast for the stomach than a food and commonly used only in times of famine. Although this clay does not contain any nutritive properties, it acts on the principal organ of digestion to such a degree that Indians can subsist on it for several months without any other resources. They sometimes fry it in *seje* oil, and then it offers some really substantial parts. This article of food, in general, does not affect injuriously the health of those who are accustomed to it; but the stomachs unaccustomed to it bear it with difficulty. Obstructions of the viscera and absorption of the chyle are the consequences most to be dreaded by those who want to partake of this strange dish. The Indians who lacking in moderation have a passion for earth considerably fall off in weight, and their reddish color will grow sallow. The taste for clay becomes so intense in some individuals that from houses made of ferruginous clay they will break off pieces and take them into their mouth with avidity. They are discriminating connoisseurs of clay, for not all kinds have the same pleasant taste to their palate; widely varying qualities are distinguished. A few whites in Venezuela have imitated the savages and do not despise cakes of fat earth."

W. E. Roth, in his comprehensive study of the Guiana Indians (Bureau Am. Ethn., 38th Annual Report, p. 225), gives no observations of his own, but quotes J. Gumilla, Humboldt, and J. Crévaux. Among the Otomac, children are given earth to lick and suck by

their mothers. Their bread made with alligator fat consists, at least half of it, of chalky earth which, however, does not injure them.

According to J. Crévaux, all the Cayenne Carib are earth-eaters. In each house are found clay balls which the Indians smoke, dry, and eat pulverized. An hour after each meal they will take one of these balls, remove the outer layer that has been blackened, scrape the inside with a knife, and thus obtain a fine powder of which they swallow five or six grams in two doses. In an account of Crévaux's second expedition to South America in 1878-79, given in *Globus* (XL, 1881, p. 262), these observations are made in reference to the Rucuyennes of Guiana. Roth adds that very many children on the upper parts of the Amazon have this strange habit of eating earth, baked clay, pitch wax, and other similar substances; not only Indians, but also Negroes and whites. No conclusion, however, is drawn from this observation, which goes to show that the habit roots in a physiological cause.

In his "Additional Studies of the Arts, Crafts and Customs of the Guiana Indians" (Bureau Am. Ethn., Bull. 91, 1929, p. 18) W. E. Roth adds the following: "In Surinam De Goeje speaks of a hungry Trio widow eating clay."

"Near the Orinoco there is a tribe of savages who feed upon a species of unctuous clay, a practice which, though probably the outgrowth of necessity, is not extremely rare throughout the Amazonian region. This clay, which is said to have a milky and not disagreeable taste, is a species of *marga*, or marl-*subpinguis tenax*, as it is called—which is found in veins of varying color. It is smooth and greasy, dissolving readily in the mouth, and is absorbed into the circulation" (W. G. Mortimer, History of Coca, p. 288, New York, 1901).

T. Whiffen (The North-West Amazons, 1915, p. 124), who stamps clay-eating as a "vice," says that geophagy is very common among all the tribes of the Northwest Amazon, especially with the non-cocainists, the women and children. "As a rule it occurs among the very poorest—the slave clan, those who are least able to obtain such a luxury as salt, and it is found among the female children most of all . . . I never came across any man who ate clay, though I know of a boy who suffered from this neurotic [?] appetite. The clay, if it cannot be otherwise obtained, will be scraped from under the fireplace, and it is always eaten secretly. The Indians look upon geophagy as injurious, but it appears to be ineradicable. I cannot help thinking it must be due to some great 'want' in Indian diet,

a physical craving that the ordinary food of the tribes does not satisfy. It is instinctive. In the manufacture of coca they add clay. This suggests that if taken in small quantities it may have a neutralizing and therefore a beneficial effect on some more or less injurious article of daily food. But it rapidly and invariably degenerates into a vice; and the habit appears to have a weakening and wasting effect on the whole body. In some parts of the Amazons, though not with these tribes, the clay is regularly prepared for use, and the vice is shared by other races than the Indian. Children who suffer from this extraordinary craving will swallow anything of a similar character, earth, wax, and Bates even mentions pitch, but they prefer the clay that is scraped from under the spot where the fire has been burning, probably because the chemical processes induced by the heat render it more soluble, easily pulverized, and hence more actually digestive in its action. It has been suggested that this disease was introduced into America by Negro slaves, and is not indigenous. This is a question for the bacteriological expert [?] rather than the traveler to decide, but as it indubitably exists among tribes that have not come in any contact with Negroes or Negro-influenced natives, it would seem to argue on the face of things that the similarity of vicious tastes was due to similarity of causation, rather than to contamination by evil example, unless the ubiquitous microbe is to be held responsible for this ill also."

Geophagy occurs not rarely, especially among younger individuals on the Amazon (P. Ehrenreich, Beiträge zur Völkerkunde Brasiliens, p. 62).

In regard to the Botocudo P. Ehrenreich (*Zeitschrift für Ethnologie*, XIX, 1887, p. 29) states merely that geophagy is widely diffused among them, and quotes St. Hilaire as saying that saline earths which are not rare in the province of Minas and saline plants serve them for salt the use of which is unknown to them (cf. above, p. 107).

The Bakaïri make dolls of a red loam which is licked by children. This loam, it is said by the natives, was eaten by their forebears before they became acquainted with mandioca. The Bororó drink water mixed with loam as an invigorating beverage, but do not eat loam (K. von den Steinen, Unter den Naturvölkern Zentral-Brasiliens, 1894, pp. 282, 481).

According to T. Koch-Grünberg (Zwei Jahre unter den Indianern, 1910, II, p. 291), edible clay is regarded as quite a delicacy. In his work "Von Roroima zum Orinoco" (III, pp. 298, 311, 337) Koch-

Grünberg mentions balls of dried clay and a fat white clay (probably kaolin, he adds) in form of balls and wrapped up with leaves, used as a relish.

The Juan-Avo or Caripuna who live in the proximity of the cataracts of the Madeira are described by Acunna as devouring earth (C. F. P. von Martius, Beiträge zur Ethnographie und Sprachenkunde Amerika's, I, 1867, p. 415).

The habit is not confined to the Indians; for Negroes and whites have the same propensity. At Pebas, in Peru, Mr. Hauxwell found it impossible to restrain his own children. On the Marañon the half-breeds are mostly addicted to the practice of dirt-eating. Even strangers, English, or the white Peruvians, who have intermarried with Mestizos and have had children by them, find its presence among their little ones the plague of their life. Children commence from the age of four or less, and frequently die from the results in two or three years. Officers there, who have the Indian or half-breed children as servants in their employ, sometimes have to use wire masks to keep them from putting the clay in their mouth; and women, as they lie in bed sleepless and restless, will pull out pieces of mud from the adjoining walls of their room to gratify their strange appetite, or will soothe a squalling brat by tempting it with a lump of the same material (W. L. Distant, *Journal Anthrop. Inst.*, X, 1881, p. 468).

Gilij (Saggio di storia americana, II, p. 311) writes that the Indian women of the village Ranco on the Magdalena River while engaged in making pottery shove large pieces of clay into their mouth.

According to Saffray (*Globus*, XXIII, 1873, p. 8), geophagy occurs rather frequently in some regions on the lower Magdalena River in Colombia, but is not endemic as on the Orinoco. The edible earth consists of a very fatty clay of yellowish or reddish color.

Earth-eating is also reported from southern Brazil, Paraguay, Peru, and Bolivia. In Bolivia a light white clay (called *pasa*) is sold in the markets with victuals, and is also consumed by whites, particularly women. The clay is eaten either in its natural state as it is dug near Oruro, or is purified and fashioned into jars or images of saints. Odoriferous resins are sometimes blended with the clay to improve its taste. J. J. von Tschudi (Reisen durch Südamerika, V, 1869) mentions a lady who daily enjoyed the clay figure of a saint for years.

G. I. Molina (Saggio sulla storia naturale del Chili, p. 50, Bologna, 1810) speaks of a potter's clay, called by him Argilla buccherina and found in the province Santiago, Chile, fine, light in weight, odorous, brown with yellow dots, dissolving in the mouth and sticking to the tongue. The nuns of the capital made delicate pottery from this clay large quantities of which were exported to Peru and Spain under the name "bucchero (bucaro) ware of South America." Water kept in these vessels assumes a pleasant flavor. Peruvian women were in the habit of eating fragments of this pottery (le donne peruane costumano di mangiarne i frammenti como le Mogolesi mangiano il vasellame di Patna); they were presumably attracted to it by its aromatic properties. Compare above, p. 140.

F. Gautier (see Bibliography) found a white clay used in the province of Potosí of Bolivia, but did not hear of any disease accompanied by clay-eating.

Dr. A. Rengger (Reise nach Paraguay in den Jahren 1812 bis 1826, p. 326, Aarau, 1835) writes, "Mr. de St. Hilaire met men who ate earth at Paranagua, Guaratuba, and in other parts of the Province Santa Catharina (in Brazil). He regards it as a degenerate taste. I do not share this opinion, but rather look upon the devouring of earth as a disease, cases of which frequently occurred to me in Paraguay and of which I cured a number of persons. In this country the matter was also looked upon as an evil habit. I have seen several pregnant women addicted to earth, who after delivery lost again this unnatural propensity."

A. N. Schuster (Paraguay, 1929, p. 65), discussing geophagy in Paraguay, regards it as a disease caused by intestinal worms.

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In the Catalogue of the Surgeon General's Library this article is erroneously credited to O. Brummer whose name appears merely in the preface as one who sent several specimens of edible clay to Batavia. These were examined and analyzed by Altheer whose name as that of the author is printed at the end of the article on p. 812.

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