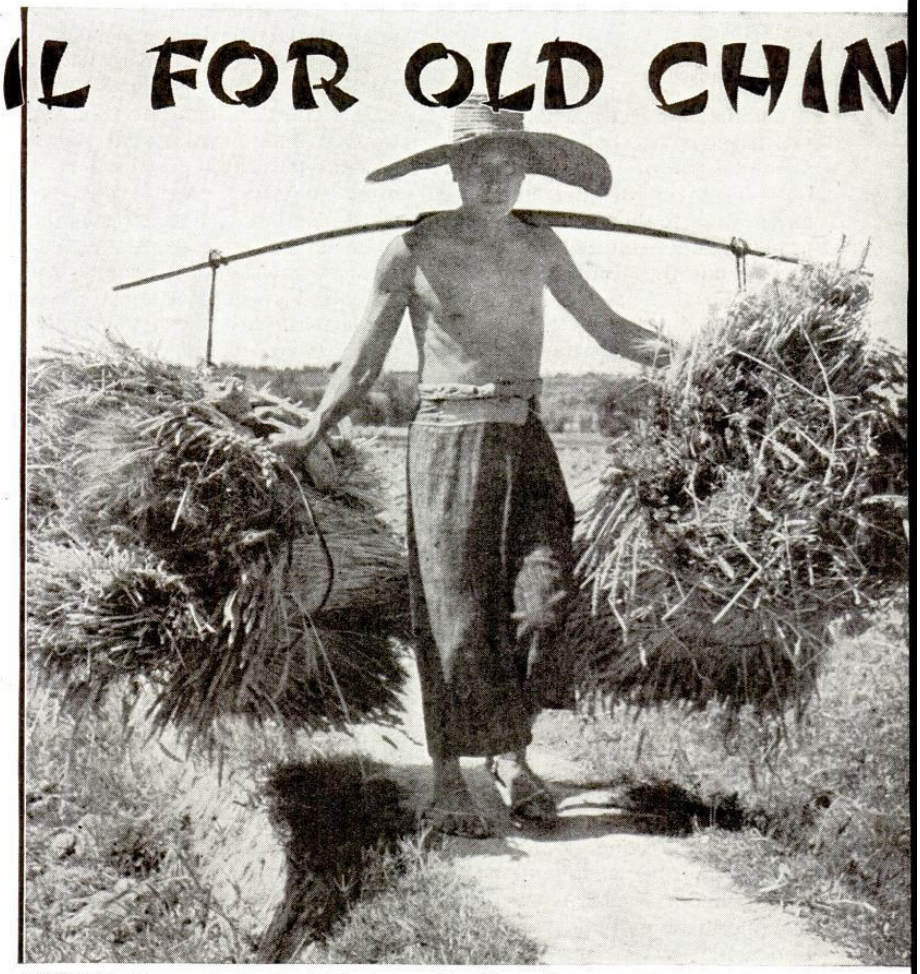
NEW SOIL FOR OLD CHIN



HIS MODE of transport may be old—but not so his wheat. A new strain grown plump in chemically treated soil at an experimental farm, it holds promise of a healthier China.

JUST HOW GOOD IS "the Good Earth" of China? How well does it feed the 500 million people who live upon it today? Can it be made to sustain the still greater numbers which will swarm it tomorrow?

To help the Chinese Government answer these questions, I have spent six years in Free China. Afoot, on ricksha, in carrying chair, in charcoal-burning automobile, on train and plane, and on horseback and bicycle (called "ocean horse" in West China), I have covered 25,000 miles of this ancient land.

As a result I have come to know Wang Shih Hung very well. Mr. Wang, I should explain, is the John Jones of China—the ordinary, everyday, average man-in-the-street. Working with him, learning from him, and teaching him what I could, I have come to see that China's problems are but a complex of his problems. I have come to believe, further, that, in an age when my adopted city of Chengtu in West China is only 60 flying hours from the Municipal Airport in Chicago, the problems of the world are but a complex of such problems as China's.

Let's look, then, at Mr. Wang as the smallest unit to which the vast problem of feeding China can be broken down. Wang Shih Hung is, first of all, a farmer; four out of five Chinese are. His farm consists of about 3½ acres. The average size of his fields—and Texas farmers will do well to suppress their amusement for a moment—is one-half acre. On this small checkerboard of land, an area roughly equivalent to that of an average city block, he grows enough food to sustain his family of five or six. Varying, of course, with the region in which he lives, his daily board is likely to consist of rice, wheat in noodle form, bean curd, beans and peas, perhaps some cabbage or other leafy vegetable, a few peaches or persimmons, now and then some eggs or chicken, occasionally a bit of pork, but almost never any beef or milk. If Wang Shih Hung has any cattle, they serve as his beasts of burden, not as producers of food. The Wangs are largely vegetarians, not by choice but by circumstance.

Note that I said Wang grows enough to *sustain* his family. I used the word advisedly. Only with the greatest efforts and with the best luck can he do much more than keep his family going on what, by Occidental standards, would be a subsistence diet. As each new small mouth comes along crying out for food, he must work his land that much the harder. And there, in microcosm, is China's whole problem of feeding itself. In the last century China's population has increased two- or three-fold, and, despite wars, famines, floods, and plagues, the accelerated birth rate continues. Will added millions push China over the brink of subsistence living into the abyss of perpetual hunger?

To answer that we must go back to our friend Wang. Is he, first of all, a good farmer? He is. Realize that the soil he tills has been in constant use for more than 4,000 years, much of it producing two crops annually, and one marvels that he is able to take as much from it as he does. His personal attention to almost every individual stalk of grain and his careful use of fertilizers are what see him through. The bean cakes left after he has expressed the oil from his soybeans, the ashes from every bit of straw and scrub wood which he burns, the stable manures and the night soil (human feces)—all go back upon the land. At two or three points along the paths that run past Wang's farm, stand large earthen pots, each enclosed by a bamboo lattice or

Enrich and water the good but weary earth of this ancient land and, says this farm expert, it will feed not only its present 500 million people, but 250 million more.

By H. L. Richardson

Recently Agricultural Advisor to Chinese Government; Rotarian at Chengtu

screen of willows. These are public comfort stations which passers-by may use, and Wang frankly hopes they will use them often. He needs the fertilizer they will yield for his ancient soil. Nothing in America or New Zealand would shock Wang more than the practice of dumping city sewage in lakes and rivers. It is less the pollution of these waters he would decry than the wanton destruction of rich plant nutrients.

The arts of irrigation, terracing, and benching are as familiar to Wang Shih Hung as the teachings of Confucius—and as old. On the Min River in Szechwan Province, which, because of its lushness, has been called the original Garden of Eden, is a system of irrigation 2,200 years old. Imprisoning the swelling Spring waters of the Min behind an ingenious cofferdam made of wood and bamboo and stones, the system cleaves the river, sending flood waters safely down one channel and irrigation waters down another.

Some 500 lateral channels branching off from the latter and some 2,000 sublaterals stemming from these laterals carry seven and a half feet of water gradually, and as needed, over 500,000 acres of rich alluvial soil. Here, on the Chengtu Plain in China's famed Red Basin, live an average of 2,000 people to the square mile—one of the densest concentrations of humanity on the globe.

And Wang Shih Hung knows, too, about a variety of crops and about crop rotation. Wheat, not rice, is the most ubiquitous of Chinese cereals—the nation producing more of it than any other nation save Russia. In his book *Land Utilization in China,* J. Lossing Buck estimates that three-quarters of the families of China include wheat products in their diet while not more than one-half eat rice. Even so, China grows more rice (1½ billion bushels a year) than any other country. His Winter wheat harvested, the farmer of Central and South China plows and floods the field and converts it into his rice paddy.

Then there is the soybean, "the cow of China"; the millet and kaoliang of the North, the latter a kind of sorghum used for everything from food to liquor to fences. Barley and bamboo, beans and peas, oranges and melons, sugar cane and walnuts, cotton and tobacco, Irish potatoes and sweet potatoes, tea and tung trees—Wang Shih Hung grows as many as his climate and space allow.

Near Kiangtsing on the Yangtze River I saw a temple raised to honor a magistrate and his wife who, some 200 years ago, had introduced the sweet potato to the region. Today this mealy tuber is the mainstay in the diet of the poor throughout China, the nation leading all the world in sweet-potato production. And if a platter of roastin' ears and a sack of "goobers" make Americans feel at home, they would feel at home in China, for Indian corn and peanuts, both of which are believed to have come from America by way of The Philippines centuries ago,

PROLIFIC Br'er Rabbit is being groomed for a leading rôle in the feeding of China. A light eater and yet a prodigious producer of meat and fur, he is well suited to small farming. This is a Government rabbit station.

Photos: Alexanderson (CNS) from Guillumette

are flourishing crops in old Cathay.

If Farmer Wang knows so much about crops and their fertilization, irrigation, and rotation, how, then, can he do better? How can he hope to raise the level of his family's diet; how can he supply the nation with the food-energy it will need to build the railroads and highways, the factories and hospitals, the new schools and better cities it envisages?

IT WAS my privilege to work with agricultural scientists of China, America, Britain, and other nations in an effort to obtain the answers to just such questions. Each of us had, of course, his own special field of inquiry—and mine was fertilizers—but together we were trying to discover China's agricultural potential. While I cannot properly speak for my colleagues, a composite conclusion of all our separate findings would doubtless be this: China *can* feed herself; on the whole she is doing so now. Given peace, she can develop an agriculture capable not only of banishing starvation (it is said that at least 100 million Chinese continuously live below subsistence standard), but of feeding a total population of 750 millions —250 million more than she has today.

That is a bold prophecy. What basis have I for it? I shall come to that in a moment. First let us grasp the overall picture. Here is China, a land about one-third larger than the Continental United States (with almost four times as many people), lying almost exactly in the same latitudes, and possessing thus a climate which similarly ranges from a semi-tropical South to a coolly temperate North.

If, before the war, all you saw of China was Shanghai and its environs in Kiangsu Province, which is the most densely populated political unit in the world—or if now, during the Japanese occupation, all you have seen are Chungking and Chengtu with their half million or more each, then you will indeed conclude that China is already hopelessly overcrowded. But your eyes have deceived you. If from some stratospheric height you were able to look down upon all China, you would see its 500 millions as a dense dark fringe bordering the seacoast, or thick on the alluvial plains of the four great rivers and the countless lesser rivers. In the vast reaches between these dense fringes of humanity you would observe more vacant yet usable land than exists in almost any other comparable part of the world.

Some of it is loess land, light earth blown about by the winds for centuries and piled, in some places, to a depth of hundreds of feet. Most of it is land once forested, then cleared and farmed, but now gullied or eroded and idle.

Can it be tilled? Much of it can —and therein lies one great hope for China's agricultural future. Pipe China's abundant water to it; terrace it where necessary; open it to the world with highways, railroads, and airports; and teach the individual settler the best of domestic or imported farming practices, and these vast desolate areas can be made to flower richly. If China comes up out of its valleys, to which it is now bound by water and ancestral attachment, then its agricultural future is virtually unlimited.

And if it doesn't? Even so, even if it should farm only the area now under cultivation, its future is quite bright. It was my job in China to go about studying the soil, to determine by laboratory and field experiment work its deficiencies and potentialities. On thousands of small test plots which we staked out on actual farm land throughout agricultural China, we found, first of all, that most Chinese soils are deficient in plant foods—over 80 percent were deficient, in fact. How short they would be without Farmer Wang's constant application of natural fertilizers is obvious. The difficulty is that Wang can't get enough of them—even though he goes to the village, as he often does, to bargain for the public offal.

What, then, is the answer? Chemical fertilizers! On our test plots we showed agricultural experts and interested farmers—and no farmer in the world has a greater love for his land than the Chinese—what these could mean to him. Starting with a batch of, say, wheat seed, we would plant some of it in a patch treated with nitrates, some more of it in one receiving phosphates, some more in a square to which potash had been added, and still more in soil containing various combinations of two or three of these chemicals. In yet another square which had been prepared only as a typical local farmer would prepare it we would plant more of the same seed.

THE whole group of plots would be repeated several times in one experiment, to make the results absolutely clear. The results rarely failed to be striking, and while we were scientists seeking information on the need for fertilizers, and not salesmen selling minerals, over and over we heard the Farmer Wangs of China say: "If it can be done here, cannot it also be done on my land? When can we get some of these wonderful fertilizers?"

From our experiments on thousands of such test plots—and bear in mind that it was the National Government of China that initiated and sponsored the huge project—we deduced (1) that by the use of chemical fertilizers added to present manures, the rice region of Central and South China can increase its crop yield by 50 percent; (2) that by the same process the wheat region of North China can step up its present yield by 20 percent; and (3) that by the use of chemical fertilizers wherever [*Continued on page 53*]

THE AUTHOR

New Zealand-born, Dr. Richardson learned organic chemistry, then began an 11-year period of agricultural research at Rothamsted Experimental Station in Hertsfordshire, England. Reaching China in 1938, he served as advisor to the National Agricultural Research Bureau for almost six years. Headquartering in Chengtu, a city of one-half million some 200 miles northwest of Chungking, he joined the local Rotary Club and served as its Vice-President in 1940-41. Half the members of the Chengtu Club, he says, are Chinese and half are Westerners, and both Chinese and English are spoken at meetings. The President and the menu, however, are always Chinese. Dr. Richardson (he holds master of science and doctor of philosophy degrees and is a Fellow of the Institute of Chemistry) is now back at the Rothamsted Station.

New Soil for Old China

[*Continued from page 22*]

they will repay their cost, China as a whole can boost its total agricultural yield by 25 percent.

Some say that last figure is conservative, and I am inclined to agree. If, along with chemical fertilizers, Chinese farmers use improved strains and institute better pest control, disease control, and crop rotation, then China can expect a total increase in yield of 50 percent! That would mean that it could feed, on its present area of cultivated land, half again as many people as it now sustains—or 250 million. Add that to its present 500 million and you see how I arrived some paragraphs back at the figure of 750 million—the number I ventured to say China can someday feed.

But that doesn't answer Wang Shih Hung's question. Where *is* he going to get these wonderful fertilizers? In our laboratory work back there in the hinterlands of China we faced precisely the same problem—and solved it crudely with materials at hand.

We needed an electric furnace, I recall, for treating phosphate rock, and built it of local limestone, equipping it with carbons from dry batteries. To make superphosphate we treated bone ash placed in iron pans with sulphuric acid. But methods as primitive as that yield but a dribble. China needs millions of tons of chemical fertilizers. This the Government knows full well—and is encouraging both the importation and domestic manufacture of as much as it can get. Potash is no great problem. Farmer Wang's wood and straw ashes supply enough of that.

In South China are deposits of rock phosphate which, when processed, will fill another part of the gap. But what will truly plug it are a number of great nitrogen-fixing plants for the production of nitrate and sulphate fertilizers. China has the coal and the lime and, potentially, an abundance of the hydroelectric power needed for this process which captures the free nitrogen of the air and imprisons it in a compound the farmer can spread on his fields. These projected plants wait but upon more settled postwar conditions, some engineering genius, and some foreign capital.

New tools will help Wang Shih Hung somewhat, but think first in terms of small seeders and plows, not combines and tractors, when you think of his implement needs—for he is and perhaps always will be relatively a small operator. A greater stress on livestock, which is part of the Government program, will profit him also. But what he

needs most, I think it can be said, is an abundance of the wonder-working inorganic salts that will flow from these nitrogen-fixing plants.

Industrialization is coming to China, and as its 100,000 farm villages grow into manufacturing towns, Wang Shih Hung may acquire more room, may install electric heaters in his unheated home and electric lights over his dining table, and may be able to buy canned milk for his young brood, and perhaps someday even a truck for his hard trips to market. More immediately, he and his millions of fellow Chinese will constitute one of the largest markets for the goods of the world.

But as I see him now sitting there in his bamboo chair on the dirt floor of his stucco home, I hear him saying, between pulls on his long-stemmed pipe, "If I take care of my land, my land will take care of me." And in his eye is a twinkle which I interpret as a sign that he cannily intends to use all that the professors and factory people have to offer that will really help him take care of it.

Extended Reading on Page 6:

《The Ice Age in West China》by H. L. Richardson (1943)

Glossary

(1) Dr. H. L. Richardson, PhD, MSc

One of the 35 charter members of Chengtu Rotary Club (成都扶輪社) which was admitted to Rotary International on 9 January 1939, Charter No.4916, but was terminated on 21 December 1950. Richardson's classification was "*Agriculture – Soil Fertilization*" and was a British Boxer Indemnity Fund Research Specialist in the Nanking University (金陵大學). He was the author of this book:《Soil and Man in West China》.

A New Zealand born Briton, Richardson learned organic chemistry and received his training at Victoria University College, New Zealand, and the University of London. He then began an 11-year period of agriculture research at Rothamsted Experimental Station in Hertfordshire, England. Reaching the Republic of China in 1938, he served as advisor to the Government's National Agricultural Research Bureau for almost 6 years. Headquartering in Chengtu (*Chengdu*) (成都), a city of one-half million some 200 miles northwest of Chungking (*Chongqing*) (重慶), he joined the local Rotary Club and served as its Vice President in 1940-1941. Chengtu Rotary Club's membership of Chinese and the Westerners was in 50/50, and the meeting languages were both in Mandarin and English.

(2) Min River of Szechwan = Min River, Sichuan = 四川省岷江

(3) Kiangtsing, Yangtze River = Jiangjin, Yangtze River = 揚子江(長江), 江津

(4) Kiangsu Province = Jiangsu Province = 江蘇省

This article was edited by Herbert K. Lau (劉敬恒) (Rotary China Historian) on 1 January 2014 in observing the Rotary Month of "Vocational Service".

REVIEW

THE ICE AGE IN WEST CHINA. By H. L. RICHARDSON. *Journal of the West China Border Research Society* (*Chengtu*), vol. xiv, Series B, pp. 1–27, 1943.

GLACIATION

Very clear evidence of a considerable extension of glaciation in rather recent times at high levels in Western China is reported by Dr. Richardson in agreement with various other observers; but suggestions regarding glaciation of portions of Eastern China are treated with some scepticism, being based apparently on inconclusive evidence. If this actually took place, however, it may have been contemporaneous with relatively ancient glaciation in the western provinces.

There is evidence in the shape of "cols, cwms, or corries, U-shaped valleys, hanging valleys, screes, and old lateral and terminal moraines consisting of angular, almost unweathered, blocks" that a very modern glacial extension took place over large portions of Western China and Eastern Tibet where the elevation is more than 4,000 metres. On Minya Konka and the Tatsienlu Mountains the glaciers extended down the valleys so as to approach the 3,000-metre line.

In addition to this the author has found in the same region deposits at somewhat lower levels which he tentatively ascribes to a glacial origin. These are much older, however, and it seems that corroborative evidence from landforms is absent because such forms have failed to survive to the present day. Even the supposedly glacial deposits have been found in very few localities.

The younger (and undoubted) glacial extension, which the author proposes to call the Minya glaciation (from Minya Konka), is tentatively ascribed to the Würm epoch; the older (suspected) glaciation, which he terms Omei, may be of Mindelian age. The principal item of evidence of the older glaciation which is described has been found in the vicinity of Mount Omei, in Western Szechwan, which reaches up but little above the 3,000-metre contour and was thus unaffected by Minya glaciation. Here, however, in a valley below the 1,000-metre line, there is a deposit resembling, and under suspicion of being, till. It consists of clay of basaltic origin containing large and small transported basalt blocks. "The whole is extremely mixed and unstratified, with no signs of orderliness or bedding in the arrangement of the boulders. . . . The whole deposit looked more like a true boulder clay than anything else the writer has seen in West China." A possibly glaciated trough through which this debris may have come from a source in the vicinity of Mount Omei has almost entirely lost its U-form, having been cut to pieces by river gorges. On such slender evidence does the "Omei" glaciation depend for its proof or its claim to existence. The author seems, however, to feel confident of the glacial origin of the till-like deposit.

This till or till-like deposit is relatively ancient, for it has suffered considerable erosion and has afterwards been covered unconformably by a very large alluvial fan of limestone debris, on which part of the town of Lungchih is built. There are reasons for correlating this fan with

terrace deposits widespread in Western China which were formed not later than the Minya epoch.

Though the author touches upon fantastic theories of polar wandering which have been given some credence in China as providing an explanation for supposed low-level, low-latitude glaciation, he appears to be but little attracted by them. Apart from mechanical and other difficulties one of the obstacles to practical application of such theories in the form in which they have been proposed is that they push back the date or dates of glaciation far into the Tertiary era, and what is known of the rapidity of erosion in mountainous regions makes ages of several million years when attributed to landscape forms seem utterly absurd. The suggestion of Mindelian age (or about 400,000 years) seems more plausible for the Omei glaciation, however meagre may be the surviving traces of it, than the several, perhaps ten or more, million years required for a Mio-Pliocene age.

River Terraces and Palaeoclimatology

Apart from suggestions as to correlation with the reported glaciations, the author has made an important contribution to geomorphology and palaeoclimatology in the account he has given of the river terraces of Szechwan. At various heights above present day low-water river levels he has noted the presence of terraces and associated alluvial terrace deposits of gravel, sand, and clay. The lowest terrace is generally but little above flood-plain level ; and the highest is a very extensive valley-plain terrace and plateau-gravel level 60 to 100 metres above the present valley floors. Between the lowest and highest are flights of terraces, especially on slip-off slopes, among which it may be possible eventually to pick out more than one which are vestiges of valley plains that may be correlated from valley to valley and in different parts of the same valley. One, at least, in the opinion of the author, is thus recognizable. " The usual height above river level of this middle terrace would be about 30 metres where the high terrace is at a height of about 50 metres, and elsewhere in proportion."

It is recognized that in this far inland region such terraces are unlikely to have any direct relation to changes in relative levels of land and sea. The theory of their more obvious relation to climatic changes is accepted.

In a part of the region loess (the Chengtu clay) covers the alluvial deposits of the high and middle terraces. " It was deposited during a period of dry climatic conditions ; and the loess has been broken down into clay, and the concretions are now being dissolved away, by the present warm, moist climate." The loess deposit is not present on the low terrace (nor on its correlatives at higher levels in the mountains) ; and with the unburied and unweathered lower-terrace alluvia the moraines and glaciation of the Minya epoch may be correlated. In the Tatsienlu and Minya Konka glaciated areas also " loess-like deposits . . . seem to be earlier than the relatively recent extension of the glaciers ".

A suggestion is made that the high-terrace deposits date from the Omei glaciation. Near Mount Omei high-terrace deposits contain " large water-worn boulders of various rocks and some angular basalt boulders. These deposits are rather similar in colour and degree of weathering to

the basaltic clay [till ?] of Lungchih, and it is not unreasonable to suggest that they are of about the same age. One might then propose that the time of formation of the very extensive high-terrace and plateau deposits in Western Szechwan . . . was a time of heavy precipitation coinciding with a great extension of glacial action ".

The widespread plateau and high-terrace gravels are attributed to an early Pleistocene epoch of heavy precipitation which gave the rivers emerging from the mountains a heavy load of boulders and gravel. " Along the foot of the western mountains a piedmont alluvial plain was formed, the fan deposits of the various rivers coalescing. . . . It may have been, and probably was, interrupted in various places by local ridges of hills. Similar deposits were formed also up and down the river valleys leading to and from the great plain.

" Subsequently the precipitation decreased ; the load of gravel in the rivers was lessened, and its place was taken by sand and clay ; then the rivers slowly cut downward during a long period of years, and the old deposits were left as a river terrace or plateau. The climate, while still fairly moist, became much hotter, and subtropical red earths were formed.

" At intervals minor increases in precipitation may have led to a renewal of gravel deposition, especially at a period roughly half-way between the first great deposition and the present day. Then precipitation decreased again, and slow down-cutting continued, leaving the middle-terrace formations.

" After this precipitation decreased still further, giving semi-arid conditions with intense dust storms. In the north-west centre of the province [Szechwan] loess was deposited on the terraces so far formed, with calcareous concretions . . . a metre or so below the surface.

" Again, after further down-cutting by the rivers, there came a moister climate—increased precipitation—and renewed gravel deposition, giving the lower terraces along the rivers and building up the Chengtu Plain as we now know it. The loess previously deposited slowly decomposed : its calcareous silty texture broke down into clay, and the concretions began to dissolve away. . . .

" Then the climate became a little less moist—precipitation decreased—and the rivers began once more their long process of cutting down to grade, leaving the edges of the low terraces as we now see them. At the present time the rivers, even those of the Chengtu Plain, are slightly entrenched."

In the foregoing it is assumed without question that wetter climatic episodes result in aggradation and that degradation follows diminished precipitation. Discussing with the reviewer the question whether alluviation along the lower course of a river is more likely to mark oscillation towards drier or moister conditions, Dr. Richardson has expressed his belief that when (in Western China) precipitation has increased beyond a certain point accelerated erosion has swelled the output of waste to an extent out of proportion to the accompanying increase in the off-flow of water, thus causing aggradation on the floors even of valleys that have received no gravel of fluvio-glacial origin.

C. A. C.