Part I: Technology: *the Non-Indo-European Contribution*

Abstract

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Chapter I

The Conquests of Environments

It is customary to view Western Man as the most inventive creature who ever lived, and other peoples as unimaginative and backward by comparison. For this reason it has never surprised those who write textbooks of History that our own civilization advanced so far ahead of all that preceded it.

Obviously we are more inventive and so we have naturally achieved a higher civilization. At one point in time, the stage was set for the logical development of Science and the proper extension of a certain innate superiority in controlling the forces of Nature for our own benefit. Science thus developed automatically. Very few people, until quite recently, were aware of the achievements of other ancient, and modern, Cultures which have not shared our tradition. Their arts and architecture were remarkable enough; but their mechanics and Technology were of little account except for an occasional odd device like the compass, etc. And our own uninventiveness as a whole completely escaped notice. When it was found that Eskimos could be trained to operate *and repair* sewing machines and watches as quickly as (if not more quickly than) we ourselves, some surprise was expressed.

In time the ingenuity of the Eskimo became increasingly apparent, and writers began to vie with one another in their search for superlatives to describe these otherwise 'backward' people. But it soon became evident that the Eskimos were not alone in this. Their conquest of the wilderness of ice and snow and inhospitable environment is similarly shared by other primitive people, whom it now turns out have proved themselves to be quite as ingenious in making the most of the immediately available resources of their environment. For example, there are the Indians of the Sonoran Desert in Southern Arizona. Considering their environment, it is quite amazing to find what they have succeeded in extracting out of it.

Throughout this discussion of primitive Culture, and in much of the treatment of more highly complex civilizations of non-Western tradition, it is necessary to bear in mind that the greatest displays of ingenuity frequently appear in the exploitation of the *immediate* resources of the environment rather than the secondary or less immediate resources.

This recognition, given somewhat belatedly, is now being accorded at high levels. Claude Levi-Strauss, speaking officially for UNESCO, made the following admission in attempting to establish who has made

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the greatest contribution to the world's wealth:'

> If the criterion chosen had been the degree of ability to overcome even the most inhospitable geographical

> conditions there can be scarcely any doubt that the Eskimo on the one hand and the Bedouin on the other, would
> carry off the palm.

He might equally well have used the Indians of the Sonoran Desert in place of the Bedouin. And one could have included another rather rugged environment, the high altitudes of the Peruvian Andes, where the Aymara have shown themselves well able to hold their own with the Eskimo, the Bedouin, and the Indians of Arizona. Let us examine very briefly some of the achievements of such people.

Ice and snow: the Eskimo

One of the best modern authorities on this aspect of Eskimo life is Erwin H. Ackernecht. He writes: [2]

> The Eskimo is one of the great triumphs of our species. He has succeeded in adapting himself
> to an environment which offers to man but the poorest chances of survival. . . .
> His technical solution of problems of the Arctic are so excellent that white settlers would have
> perished had they not adopted many elements of Eskimo technology.

Frederick R. Wulsin, an authority on clothing problems for cold climates, says candidly: "There seems to be no doubt that Eskimo clothing is the most efficient yet devised for extremely cold weather."[3] Of this we have had personal experience, and can affirm its truth without hesitation. Moreover, to the Eskimo must probably go the credit for developing the first 'tailored clothing' and, not unnaturally, the first thimbles.[4]

In addressing a Scientific Defense Research Symposium in Ottawa, in 1955, Dr. O. Solandt admitted

1. Levi-Strauss, Claude, "Race and History" in the series *The Race Question in Modern Science,* UNESCO, Paris, 1952, p.27.
2. Ackernecht, Erwin H, "The Eskimo's Fight Against Hunger and Cold," *Ciba Symposia,* vol.10, July-Aug., 1948, p.894.
3. Wulsin, Frederick, R, "Adaptations to Climate Among Non-European Peoples," in *The Physiology of Heat Regulation* and the *Science of Clothing*, edited by L.H.Newburgh, Saunders, Philadelphia, PA, 1949, p.26.
4. Jeffreys, Charles, W., *A Picture Gallery of Canadian History*, Toronto, ON, Ryerson, 1942, vol.1, p.113.

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frankly that

> . . . . the White Man has not introduced a single item of environmental protection in the Arctic which was not already being used by the natives, and his substitute products are not yet as effective as the native ones. Only in his means of production has he the edge.

Ackernecht continues subsequently:[5]

> A very short review of the Eskimo's hunting techniques has already revealed an extraordinary number of well conceived implements. Eskimos are described as very "gadget minded" and are able to use and repair machinery such as motors and sewing machines with almost no instruction. It is impossible to give here a complete list of aboriginal Eskimo instruments, the number of which and quality of which have been

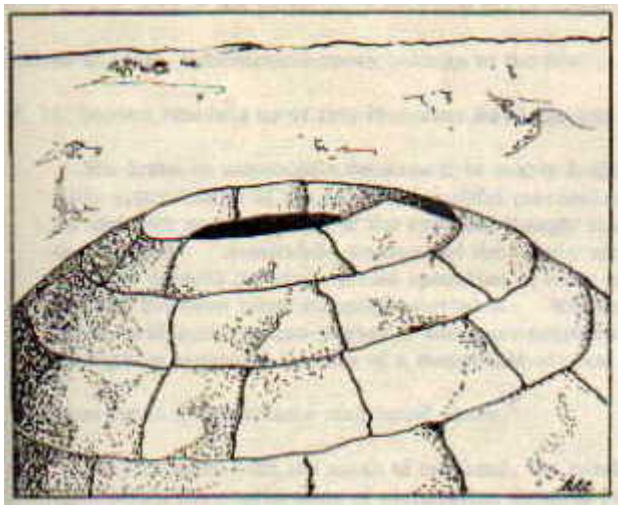
emphasized by all observers. . . .

The best known type of Eskimo house is undoubtedly the dome shaped snow-house with its ice window. With extraordinary ingenuity, the very products of the cold are used here as a protection against it.

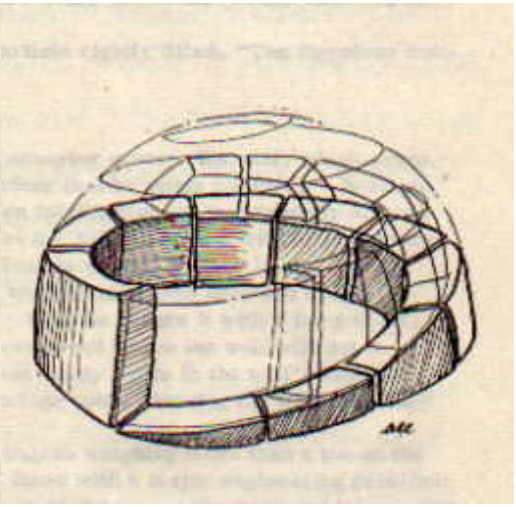
It might be thought that once the idea was conceived, the construction of such a house would be comparatively simple. Actually it is remarkably difficult to construct a dome without any means of supporting the arch while in the process of completing it. As the wall rises, it converges upon itself. Each new block overhangs more and more until near the top they rest almost in a horizontal plane. The problem is to hold each block in place until the next one ties it in, and then to hold that one until it, too, is tied in place.

Given enough hands the problem is not so difficult, but the Eskimos have overcome the problem so effectively that a single individual can, if he has to, erect his own igloo single-handed without too much difficulty.

The solution is to carry the rising layers of blocks in a spiral instead of in a series of horizontal levels. This is shown in Fig. 1. Thus as each block is added it not only rests on the lower level, but against the last block. One block would simply tend to fall in, and, by experience, so do two or even three, when a new layer is started if the tiers are horizontally laid. But the Eskimo method overcomes the problem entirely.



This is a drawing from a photograph of an Igloo at Baker Lake, taken by Mr. Lloyd Wilson of the Defence Research Board. The original structure measured 17 feet in diameter.



A schematic drawing to show how the spiral construction is initiated.

Figure 1.

5. Ackemecht, Erwin. H., "The Eskimo's Fight Against Hunger and Cold", *Ciba Symposia*, vol.10, July-Aug., 1948, p. 897.

The solution is, of course, amazingly simple -- once it is known. . . . Most solutions are, when someone has discovered them for us! The problem is to visualize the solution before it exists. We tend to assume we would discover the way quite quickly but experience shows that this is not true. As A. H. Sayce has put it so well, "one of the most significant lessons of Archaeology is that man is not essentially creative but destructive"

and among ourselves at least, "constructiveness belongs to the few." [6]

H. M. Davies reminds us of this fact when he eloquently pointed out:[7]

> We drive an automobile because it is nearly foolproof, with little appreciation of the hidden, beautiful mechanism that powers it, and with no conception of the creative thought that went into its development: meanwhile we demand the family airplane. We listen to a radio receiver whose operation is utter magic to us and demand the even more complex television. We are a race of lever-twiddlers, button-pushers, and knob-twisters, enjoying the prodigious technical labours of a comparatively few men.

As Sayce put it in the article mentioned above,[8]

> As compared with the mass of mankind, the number of those upon whom the continuance of civilization depends is but small; let them be destroyed or rendered powerless, and the culture they represent will disappear.

But to return for a moment to the Eskimo again: because his environment offers him little in the way of raw materials, his solutions must always seem simple in nature. It is all the more to his credit that he has achieved so much. Dr. Edward Weyer in an article rightly titled, "The Ingenious Eskimo," puts the matter this way;[9]

> Take the Eskimo's most annoying enemy, the wolf, which preys on the caribou and wild reindeer that he needs for food. Because of its sharp eyesight and keen intelligence, it is extremely difficult to approach in hunting. Yet the Eskimo kills it with nothing more formidable than a piece of flexible whalebone.
>
> He sharpens the strip of whalebone at both ends and doubles it back, tieing it with sinew. Then he covers it with a lump of fat, allows it to freeze, and throws it out where the wolf will get it. Swallowed at a gulp the frozen dainty melts in the wolf's stomach and the sharp whale bone springs open, piercing the wolf internally and killing it. . . .
>
> When the Eskimo gets a walrus weighing more than a ton on the end of a harpoon line, he is faced with a major engineering problem: how to get it from the water on to the ice. Mechanical contrivances belong to a world in whose development the Eskimo has had no part. No implement ever devised by him had a wheel in it. Yet this does not prevent him from improvising a block and tackle that works without a pulley. He cuts slits in the hide of the walrus,

6. Sayce Archibald, H., "Archaeology and Its Lessons," in *Wonders of the Past,* edited by Sir John Hammerton, Putnam's, London, 1924, vol.1, p.10.
7. Davies, H.M., "Liberal Education and the Physical Sciences,' *Scientific Monthly,* vol.66, no.5, May, 1948, p.422.
8. Sayce, A.H., ″Archaeology and Its Lessons" in *Wonders of the Past,* edited by Sir John Hammerton, Putnam's, London, 1924, vol.1, p.11.
9. Weyer, Edward, "The Ingenious Eskimo," in *Natural History,* published by Natural History Museum, New York, May 1939, p.278, 279.

> and a U-shaped hole in the ice some distance away. Through these he threads a slippery rawhide line, once over and once again. He does not know the mechanical theory of the double pulley, but he does know that if he hauls at one end of the line, he will drag the walrus out of the water onto the ice. [For illustration see Fig. 2]

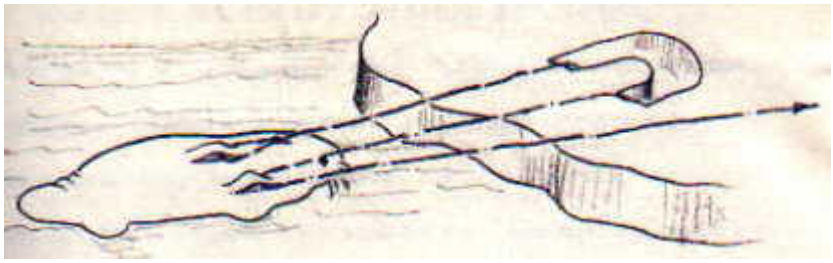


Figure 2.

The deceiving thing about his ingenuity is in its very simplicity! He makes hunting devices of all kinds, that are effective, inexpensive in time, easily repaired, and uses only raw materials immediately available. His harpoon lines have floats of blown-up skins attached, so that the speared animal is forced to come to the surface if he dives. To prevent such aquatic animals from tearing off at high speed dragging the hunter and his kayak, he attaches baffles to the line which are like small parachutes that drag in the water. A bone hoop and a skin diaphragm stretched over it, and some thongs, are all that he needs.

To locate the seal's movements under the ice he has devised a stethoscope which owes nothing to its modern Western counterpart working on the same principle.[10] And recently a native 'telephone' was discovered in use, made entirely from locally available materials, linking two igloos with a system of intercommunication the effectiveness of which was demonstrated on the spot to the Hudson's Bay Agent, a Mr. D. B. Marsh who discovered it. Marsh adds at the end of his report, this statement:[11]

> The most amazing thing of all was that no one in that camp had ever seen a telephone, though doubtless they had heard of them from their friends who from time to time visit Churchill.

Nevertheless, it is exceedingly unlikely that any such friends who had seen a telephone, would have seen the kind of arrangement this Eskimo had developed which of course used no batteries. We used to make a similar kind of thing as children with string and ordinary cans, but they were never very much use, and in any case we got the idea from someone else. In this case the Eskimo had used fur around the diaphragm to cushion it, and the sound came through remarkably well.

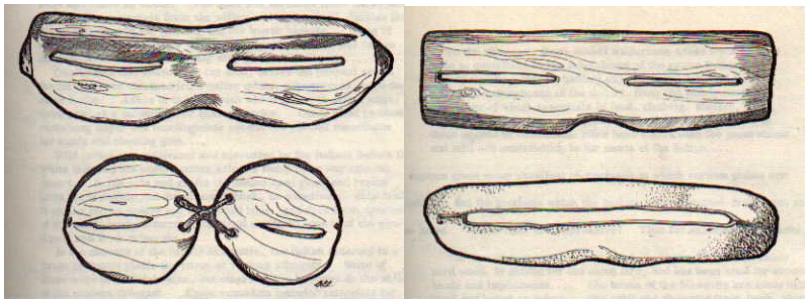


Figure 3.

And finally, a word about Eskimo snow goggles. A plate of illustrations of these protective devices is given in Fig.3. These are well known to Arctic explorers, and no one will travel in the Arctic without them -- or something to replace them -- if he wishes to escape the very unpleasant ailment of snow blindness.

10. An illustration of such an instrument is given by Alexander Goldenweiser, *Anthropology*, Crofts, New York, 1937, p.85, fig.23.
11. Marsh, D. B., "Inventions Unlimited", *The Beaver*, published by The Hudson's Bay Co., Dec., 1943, p.40

Like everything else the Eskimo makes, they are very effective, and often so designed that he does not need to turn his head to see to either side of him. This is important, since the game he usually hunts would catch the movement.

Deserts: Indians of the Sonoran

Turning now to the Indians of the Sonoran Desert, Macy H. Lapham has written illuminatingly of their genius for making much of little. He writes:[12]

> To the stranger, these desert wilderness areas seem to have little to contribute to the subsistence of the native Indian . . . . Notwithstanding this forbidding aspect, to the initiated there is a veritable storehouse of the desert, from the widely scattered resources of which essentials in food, clothing, shelter, tools, cooking utensils, fuel, medicine, and articles of adornment or those sacred in ceremonial rites have contributed for generations and still are contributing to the needs of the Indian. . . .

Lapham gives many excellent photographs in which various plants are identified -- and the products which the Indians have extracted from them are also listed. These lists are impressive! Thus for example he remarks:

> The desert ironwood, a small tree, is known for its extremely hard wood, is prized for the camp fire, and has been used for arrow heads and implements. . . . The beans of the Mesquite are made into meal and baked as cakes. The split and shredded inner bark, along with similar materials from the willow and cotton wood, furnish the fibres and strands for building and for woven baskets. Some of these baskets are so finely woven that coated with gum and resins obtained from the desert plants they may be used for liquids. . . .
>
> Condiments and seasonings for food, before the present era of the tin can were obtained from native mints, pepper grass, sage and other herbs. Ashes of the salt bush which grows in saline soils, were used as a substitute for baking powder. Other plant products containing sugar and mucilaginous substances yielded substitutes for candy and chewing gum. . . .
>
> Wild cotton was cultivated and harvested by the Indians before the White Man and his wool-bearing animals found their way into the desert. In his arts and crafts the Indian used gums and resins from the Mesquite and the creosote bush, as adhesives; awls made from the cactus spines and sharpened bone; and dyes from species of the indigo bush, mesquite, the fetid marigold, seeds of the sunflower, and from minerals.
>
> In the absence of the family drugstore, the Indian resorted to a range of desert plants for cures of various ailments. Some of these were of doubtful value, but others are to be found on the shelf of the modern druggist. These remedies included materials for poultices and infusions, and decoctions of the manzanita, creosote bush catnip, canaigre or wild rhubarb, verba santa or mountain balm, verba mansa, the inner bark of the cotton wood, winter fat,

12. Lapham, Macy H., "The Desert Storehouse," *Scientific Monthly,* vol.66, no.6, June, 1948, p.451ff.

> golden aster, goldenrod, yarrow, horsebrush, and species of the sunflower. They were used for sore throats, coughs, respiratory diseases, boils, toothaches, fevers, sore eyes, headaches, and as tonics and emetics. Mullein leaves were smoked and used for medicinal purposes, while roots of the yucca, winter fat, and four o'clock, and leaves of the seepweed, were used as laxatives and for burns and stomach ache. There was even an insecticide -- a sweetened infusion of the leaves of the *Haplophyton* or cockroach plant which was used as a poison for mosquitoes, cockroaches, flies and other pests.

Even such random excerpts from Lapham's article might be sufficient indication of the 'inventiveness' of these so-called primitive people. But there is much more to wonder at.

A photograph of a Mesquite thicket in a river bed is accompanied by this observation:

> Mesquite thickets supply fuel, poles, timbers for buildings and fences, and fibres and strands for baskets and binding materials. From the mesquite's bark, seed pods, and bean-like seeds come food, browse for livestock, medicine, gums, dyes, and an alcoholic beverage.

The roots of the Yucca trees supply drugs and a 'soap substitute.' Like the pioneer farmers, it seems that they use everything but the noise! Lapham concludes:

> Thus, as the Indian made his rounds of this self-help commissary in an apparently empty wasteland, be found an impressive stock to be harvested and added to his market basket. We can only marvel at the wisdom and vast store of knowledge accumulated by these primitive people as they made the desert feed, clothe and shelter them.

This is a long quotation. But it serves to indicate what ingenuity can do with an otherwise unpromising environment. It is difficult indeed to conceive of a more complete exploitation of the primary resources of the desert in which they have been content to live.

Ingenuity

One wonders if Lapham's use of the word 'found' is really just. They seem virtually to have exhausted their environment, extracting from it wisely, ingeniously, and effectively all it could possibly afford. Would we have 'found' much of this I wonder. . . .

The point I should like to emphasize particularly here is that such people, for so long supposedly unimaginative and dull, have demonstrated a remarkable genius for this kind of thing. Their ingenuity has been

overlooked so often because those who surveyed their work were themselves unaware of the effort required to invent *anything.* It all seems so obvious. Their solutions to mechanical problems in particular are always characterized by a peculiar simplicity that is completely deceiving.

To digress for a moment, we may use as an illustration of this aspect of primitive technology, a method used by Polynesians to build the plank walls of their canoes.

Anyone who has ever tried to bind two planks together edgewise, so that they will be tight and rigid -- and will remain so -- will have quickly discovered how difficult it is. It is, in fact, *almost* impossible. Yet the Polynesian canoe builders do it easily. Figure 4 shows how it was done. In a sense, it really takes an engineer to see the genius of this. By using gums and resins in the joint, a perfectly rigid, strong, and watertight union is effected. The solution seems obvious enough. Such ingenuity was exercised wherever their comparatively simple needs were not completely satisfied because of some mechanical obstacle.

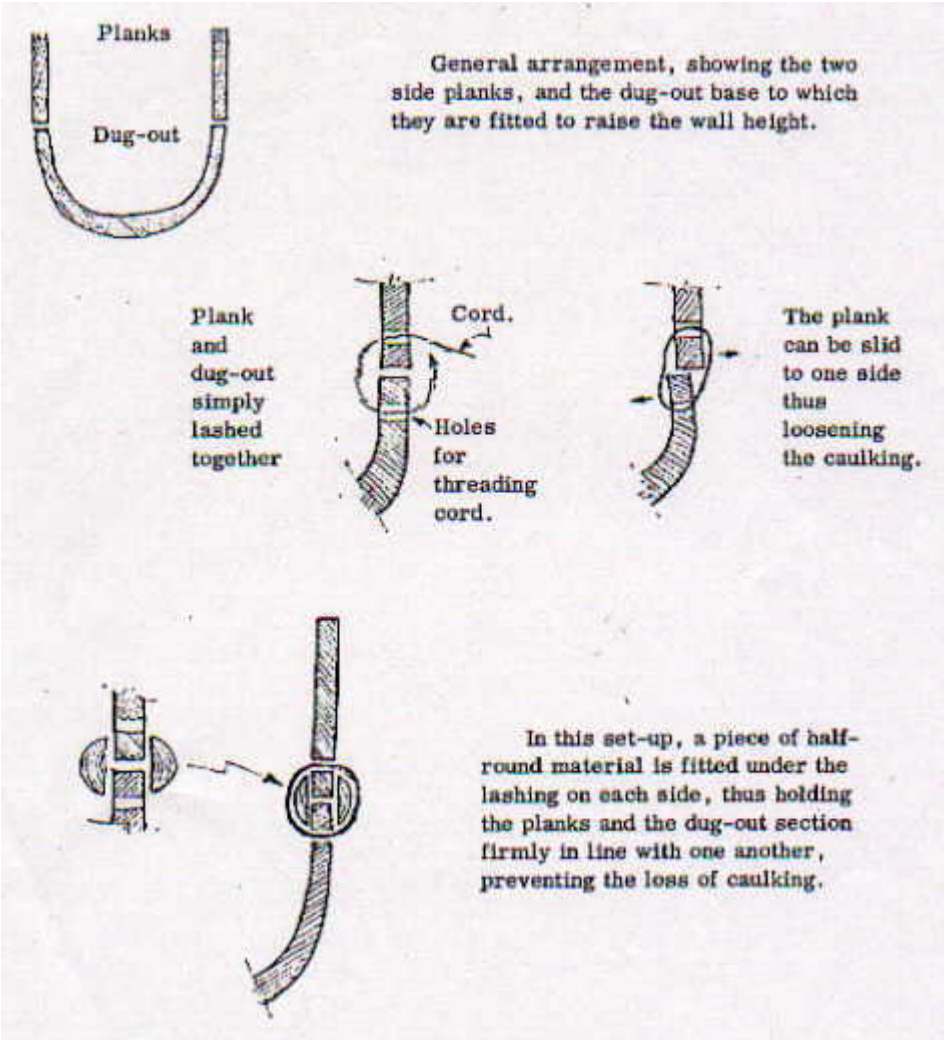
Perhaps one more such 'simple' solution may be in order here. The Indians of North America used leather for clothing -- the familiar buckskin. However, one problem of all such materials is that after a while the edge begins to curl up or to roll in such a way as to be both unsightly and ill-fitting, and of course colder in winter. This was overcome by making a series of cuts into the edge and at right angles to it, each cut being about two inches long, and spaced about one-sixteenth of an inch to one-eight of an inch apart. This imparted to the edges the familiar 'frill' effect, which is both decorative and fundamentally useful. It required virtually nothing to do it -- except ingenuity in the first place. It prevents edge-curling entirely.

Deserts: ancient Nabateaens of the Transjordan

Desert areas always seem to hold so little promise of survival to the sophisticated European. The very appearance of barrenness seems to hinder the processes of thought which would otherwise find how to render it more habitable. But it seems to have been no great problem to non-Indo-European people, whether ancient or modem.

Recent archaeological exploration in the desert area of Transjordan has revealed a remarkable triumph of early irrigation engineering. Michael Evenari and Dov Koller reported recently on the results of their work in the Negev.[13]

13. Evenari, Michael, and Dov Koller, "Ancient Masters of the Desert," *Scientific American,* April, 1956, p.36ff.



Anyone who will try this experiment for themselves will find that it is impossible to secure two pieces of planking together securely so that they will not move out of line. This method is completely effective.

Figure 4.

The idea that anyone could have farmed a desert as arid as this is today, seemed so incredible that many authorities concluded the climate of the region must have been more lush in the time of the Nabataeans. Nelson Glueck went to Palestine in the 1930's and to Transjordan, to re-explore the Nabataean Culture, and what he found led him to acclaim the Nabataeans as "one of the most remarkable people that ever crossed the stage of history." Their cities did indeed bloom in the midst of a seemingly hopeless desert. Nowhere in all their houses was there a stick of wood to show that any trees had ever grown in the region.

The authors then explain how these ancient people achieved a greater mastery of the desert than any other people since, and they underline the fact that the Nabataeans "avoided the mistake" of trying methods which are the universally accepted Indo-European ones, namely the use of dams. Their method was cheaper, more effective,

more readily controlled, and brought a greater area of desert land under successful cultivation. They so prospered in fact, as to be able to build and support the very famous city of Petra. The authors then describe the method of irrigation these people employed. And in summing up, they remark -- to quote their own words:

> The more one examines the Nabataeans' elaborate system, the more impressed one must be with the precision and scope of their work. Engineers today find it difficult enough to measure and control the flow of water in a constantly flowing river, but the Nabataean engineers had to make accurate flow estimates and devise control measures for torrents which rushed over the land only briefly for a few hours each year. They anticipated and solved every problem in a manner which we can hardly improve upon today. Some of their structures still baffle investigators.

Records tell that the yield was often seven or eight times the sowing. As the authors conclude:

> The Nabataeans' conquest of the desert remains a major challenge to our civilization. With all the technological and scientific advances at our disposal we must still turn to them for some lessons . . . the best we can do today is no more than a modification of the astute and truly scientific methods worked out more than 2000 years ago by the Nabataean masters of the desert.

Snowy waste, or sandy desert, bitter cold or stifling heat -- we have little to contribute in the conquest of such environments.

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