Physiographic History

OF

LAND FORMATION IN WEST PAKISTAN

BY

* Syed N. A. Z. Hussaini

1. Introduction.

The Indo-Pakistan sub-continent can be divided into three well marked regions each having distinguishing characters of its own. The first is the *Peninsula* lying to the South of the plains of the Indus and Ganges river systems. The second division comprises the Indo-Gangetic alluvial plains stretching across Northern India from Assam and Bengal on the East to Punjab and Sind on the West. The third is the *Extra-Peninsula*, the mountaineous region formed of the mighty Himalayan ranges and their extension into Baluchistan. These three regions differ greatly in physical features, stratigraphy and structure.

The *Extra-Peninsula* region comprises of folded and overthrust mountains of geologically very recent origin. Its rivers are active in eroding their beds and carving out deep gorges. The plains owe their origin to a sag in the crust formed with the uplift of the Himalayas, which has got filled up in course of time by sediments derived from both sides and especially from the high Himalayan mountains which are under active erosive action of the rivers traversing them. The filling has taken place in layers of shingle, sand, and clay, etc., in varying depth and the river system of these plains as it exists today has a great hand in this formation. The rich soil and the river system has always been offering great opportunities to mankind for important developments. It is the study of the layers forming the depth of these plains that had not formed subject of interest while exploiting these resources.

This note is an effort to orientate the thought (a major part indeed) of our irrigation engineers to channels which upto now were not considered the avenues for an engineer to traverse as a pre-requisite for conceiving all major irrigation problems. In reality, from now on the solution of all our troubles caused by our old irrigation works and likely to be caused by new works lies in approaching the problems through the consideration of the pre-requisites not thought of before. In

* Additional Chief Engineer (Irrigation), Lahore.

new projects in hand or in conception we must consider these pre-requisities of testing the physical suitability of the plains to be developed and the soils therein for the proposed network of surface water irrigation channels fed by a diversion weir on a river which was a source of aggradation of that plain, either a complete source or a partial source.

Waterlogging (*sem*) is a serious menace to our subsistence or even our existence. Salinity (*thur*) is a pre-curser, a finger of ridicule or warning towards engineers who never thought of it as a consequence of their development efforts and were still oblivious of impending doom when remedies now thought of are still ignoring the pre-requisites then lost sight of.

2. Discovery of Indus Civilisation a Great Help to Understand Problems

The reader might be shocked further if I sling another unengineering heresy on him. I say that discovery of Indus Civilisation, an alluvial cradle of civilisation on the flood plains of the Indus and its tributaries, in West Pakistan area in third decade of the present century was in fact not a chance discovery, it was a link in a chain of divine programme of West Pakistan land development and thought development to progress side by side. It should have created interest in engineers, proud of land development done by them till then in the geographical history of that area. The plain of West Pakistan (Indus Plain) on which they were now pouring water had been cultivated about five thousand years ago and had been well cultivated as appeared from the relics of that old civilisation, a chain of mounds (sites of old cities) along different routes in deserts now being developed or already developed by their efforts. How and why and when did this area go barren ? Were the cities devastated by floods, several of them, or otherwise due to change in courses of Indus and its tributaries which beside irrigation also provided moving roads for transport of heavy goods and food stuffs. What lesson could an Irrigation Engineer take from probing into the history of this fluvial civilisation of antiquity. 50 centuries are an appreciable period in the history of formation of a flood plain in a river valley to furnish the geological and stratification history of the aggradation of that plain to an engineer. The level of the sub-soil has risen since pre-historic times 10 to 15' above ancient ground surface, the ground story of pre-historic Mohanjodero lies within the sub-soil though 'the relative level of the plain surface and river bed presumably have remained un-altered.'

3. Geographical History of an Arid Area Essential to Project Planning

Till now, the engineers considered only the command levels aud classification of surface soil and no more. What lay underneath and how the geology and stratification of that 'underneath' would respond to that seasonal or perennial water spreading for a certain crop pattern, was ignored. Let us start from there and see whether we can trace back the [illegible] of our present ills of salinity and water logging (earlier and later

stages of same phenomena) and link them to some more pre-requisite ignored when preparing our irrigation projects whose productivity is on the decline now. We may be able to retreive our losses or at least part of our losses. Thus, an engineer's first requisite to look into for project consideration is geographical history of the arid area—the desert where he is to bring the water and soil together once again to make a region become inhabited again. Did it support agricultural community before and why it became a desert. Like politicians, engineers can take lesson from history. The extent of an engineer's acquaintance with physiographic conditions of a region makes him well versed in the wise use of water, or I should say, keeping in view the necessary subsequent evil of salinity and water-logging makes him wise how to avoid the unwise use or method of use of water.

An Irrigation Engineer while considering the problems of bringing together man, soil and water again in arid areas must have lessons in humanism as well. Irrigation Engineers must be interested in physical geography and economic geography. They must study climatology and geomorphology part of the former specializing in hydrology and erosional processes. Economic geography must include geography of population, agricultural practices, (crop pattern for various soils and land formations), principles of division into various economic regions and the bases for planning. Above all, he must be a humanist. It is sad we have lost contact with the man and soil, maintaining only contact with water and its behaviour.

4. Survey of Old River Courses Essential for Study of Geology of a Plain

How to start the study of physiographic history of land formation? Old river courses marked or obliterated but traceable from contour surveys give indication not towards the general direction of surface drainage alone but stratification underneath as well, thus guiding us towards the alignment of water spreading chhnnels in the likely general direction of drainage of the ground water if planning a new irrigation project or towards the alignment of drainage channel in the likely general direction of drainage if planning drainage of an area already waterlogged due to neglecting the former pre-requisite of aligning the water spreading channels in the likely general direction of drainage of ground water.

If our surveyors come across any abandoned or still inhabited mounds and likely depressions nearby or marked old river courses let them be plotted in our surveys as special land features. We can, thus. deduce the general direction of abandoned river courses (on which these cities and small villages of the pre-historic or historic agricultural communities existed) and locate their isolated meander loops abandoned by them when they were active meandering rivers in that area as water logged swamps within a fertile irrigated area for obvious reasons. It would, thus, be possible to trace the physical causes of waterlogging and understand the direction and alignment of the best drainage system as an anti-water-logging measure. To consider a drainage channel as a mere reverse of

irrigation channel taking it to outfall in any direction to any river or nallah where levels permit without considering the stratification of the land formation underneath in that area is an utter fallacy.

5. Conjectures Regarding Courses of Chenab & Jhelum in Rechna & Chaj Doabs

To support my view and to provoke thought generally in this direction, I would state that my observations are that Lower Gugera Branch and Burala Branch of Gugera Branch of Lower Chenab Canal are running on the ridges, the natural levels of an old river bed, irrigating away from those old river levels and also into the dry bed of the old river course from each side. Jaranwala Mandi and Jaranwala area lie in that old bed of river into which the water is pouring through its natural stratification from both sides. Chuharkana and Feroze are part of that same river course. (Plan of Chaj and Rechna Doabs attached). I would fling another heresy and say that this old river was Chenab river which once flowed in pre-historic times in this direction past Harrapa which was perhaps gradually abandoned because of some catastrophe, thus gradually lowering the commercial economy of the city and agricultural economy of whole plain aronnd it. Has any one ever considered it strange that Jhang Branch and Rakh Branch almost go in the centre of the Rechna Doab far away from the river and Jhang Branch surprisingly enough irrigating towards river sometimes from a distance of 20 miles ? Can any one imagine that the area lying between Jhang Branch aud River Chenab on the west of Lyallpur could have been formed wholly by River Chenab itself ? Between Ravi and Sutlej, Chenab and Indus, it is always usual that canal systems go along the rivers on both sides of the Doab and irrigate towards the middle of the Doab which is always a drainage line. Same arguments hold in Chaj Doab where the alignments of main irrigation channels go towards the centre of the Doab. Why ? The search for solution to that question in my opinion can give us a lot of information and consequent guidance towards solving the problem of waterlogging in these two Doabs.

6. Conjectures Regarding the Geology of Waterlogged Areas in West Pakistan Other Than those in Rechna or Chaj Doabs.

So much for morphological part of my argument. Let us take now an example where geological aspect of the physiography of land formation was neglected. Khushab area along perennial Muhajir Branch and Jacobabad rice area fed from Kashmore inundation canals (now proposed to come under weir-controlled Guddu canals) and Larkana rice canal area fed from Sukkur Barrage are 3 such examples. Land in Larkana, Jacobabad and Khushab plains was formed over centuries, possibly century of centuries by erosion of soil from Kirthar Range, Suleman Range and Sakesar Hills and was composed of impervious strata having no drainage and remained so till covered over by spills of River Indus in former two cases and river Jhelum in latter case which approached the area from South towards North by weathering action. The upper shallow depth of river silt formation has been saturated and area waterlogged. Unfortunately, by

mistake or neglect approving rice crop pattern needing heavy delta in former two cases and perennial irrigation in latter case, was obviously a total disregard of the physiographic history of the land formation of area to be irrigated from the projects. Rice pattern for non-perennial irrigation in former two and perennial for the latter case, would have been out of question from physiographic reasons as described above.

7. Remedies Suggested. Replacement with New and Change of Crop Pattern in Present Waterlogged Area.

How can we retreive our losses caused by this neglect or disregard is to take drastic steps to go back to where we should have started if we had considered all these pre-requisites. We have to plan up an extension of irrigation of vast desert areas on the South of Indus and its tributaries, Ghara and Panjnad reaches (very significantly called بیرون پنجند in Moghal revenue system) whose physiography can assure us freedom from water-logging for a very very long period, their underground drainage being adequate, replacing the rice area in first two cases with food areas on new extensions and gradually changing rice crop pattern to low delta *kharif* crops (cash as well as food) and Rabi well irrigated food crops like wheat, thus further aiding and assuring the lowering of the water-table as well.

8. Steady Measures to be Adopted using our own Internal Resources in Man Power and Material.

As a nation, we have to do such long term revolutionary replanning. Dutch Drainage Engineers cannot help us in such matters except that their work for their own nation can inspire us and as a nation, face to face with a threat to our existance we can also resort to such revolutionary measures in Indus Delta as creation of polders in Rhine Delta lower than sea level and thus reclaiming land to maintain our standard of living.

Our problems are our own. We can do them in our own way, but it requires patience and hard work as well as Unity, Faith and Discipline.

9. Subject of 'River Courses of Indus Civilisation' can Facilitate Understanding of Flood Disposal and Protection works as well.

Many may be interested to know more about the heresy propounded by me that Chenab flowed in pre-historie times past Harappa against beliefs upto recent times, but that is a separate historical subject 'River Courses of Indus Civilisation'. My note giving brief outlines is a humble attempt to orientate and provoke thought in a new direction not attempted so far to solve our problems of salinity and waterlogging. To keep the interest on 'River Courses of Indus Civilisation', let me state another observation—Harappa was abandoned by Chenab which adopted a new course towards North between Shahkot and Sangla Hill where it existed when Alexander came to a city lying on its bank. Mohanjodero was flooded by Indus which abandoned its own course on the South of Rohri Gorge and Hills Range in Khairpur District and adopted a new course through the Rohri Gorge gradually approaching Mohanjodero flooding it continuously for a long period from a distance away from its present course as apparent from 4 storeys of town on same plinth plan one after the other (one underground

at present) and eventually causing its abandonment. The Hills Range across country on East of the cities in both the cases is an interesting similarity. I may also further stimulate thought in this direction by saying that the plain on which Mohanjodero existed before being flooded by Indus, was originally formed by a river and its tributaries draining Quetta and Kalat plateaus (then green ranges with heavier rainfall as proved by Mohanjodero's burnt bricks throughout the city) through Sibbi, Kachhi, and Larkana plains leaving Jacobabad plain on its North. There is nothing strange in the sudden changing of courses by rivers in famous deltas of the world either now or in pre-historic times. Hwang Ho (Yellow River) changed its course where it had been since 1280 A.D. suddenly in 1858 swinging towards North from a point 300 miles from sea and going 250 miles towards North on the opposite side of Shantung Penninsula (see Plan of Delta Courses of the Hwang Ho attached). Such a change on thickly populated plains is a major disaster. It is accompanied by appalling loss of human life. Harappa suffered from such a disaster.

10. Causes of Wrecking of West Pakistan Area in the Prehistoric Times of Indus Civilisation—danger it may be Repeated.

What wrecked Indus Civilisation? Man's invasions or Nature's ravages? General belief has been that Aryan invasions wrecked it. Engineers will face this fallacy of history with a question. Why was there no restoration till recent times when large scale river supply diversions by advanced engineering and methods of constrnction could take water to long distances to spread over the large plains? Thus, it is proved that this Civilisation was wrecked by Nature's ravges :—

(*i*) Floods (and possibly consequent waterlogging) in Southern part of this Commonwealth or Realm ; and

(*ii*) Abandonment of their courses by rivers in the Northern part thus depriving that area of irrigation source and communications.

I may also state another observation which will further facilitate the understanding of the agricultural and irrigation practices of that Civilisation that the concentration of those communities was always at the confluence of two or more rivers for two obvious reasons :—

(*i*) A junction for their lines of communication for carriage of heavy goods and foodstuffs.

(*ii*) Wider area available for agricultural practices and availability of irrigation supplies with minimum of variations in command levels and minimum of drought periods.

Let us gird our loins and see that West Pakistan (incidently, same area as of Indus Civilisation) is not wrecked again by our neglect and disregard of advanced knowledge of Geography. History and Engineering of which our forefathers in pre-historic times were perhaps ignorant. Let us consider these problems thinking deeply rather than indulging in high thinking and over-planning. As I have said above, our problems are special problems of our own and we can solve them cheaply and efficiently

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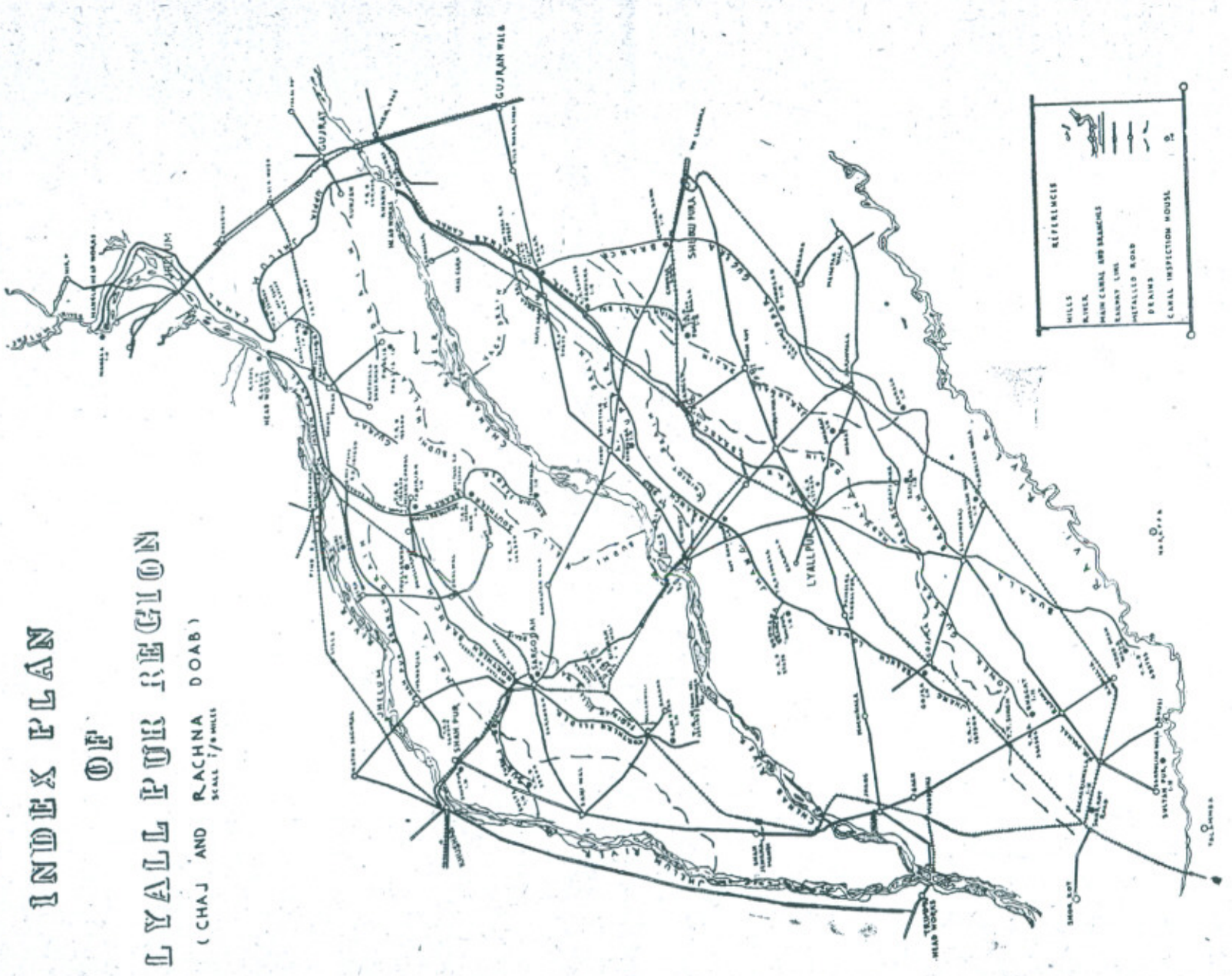
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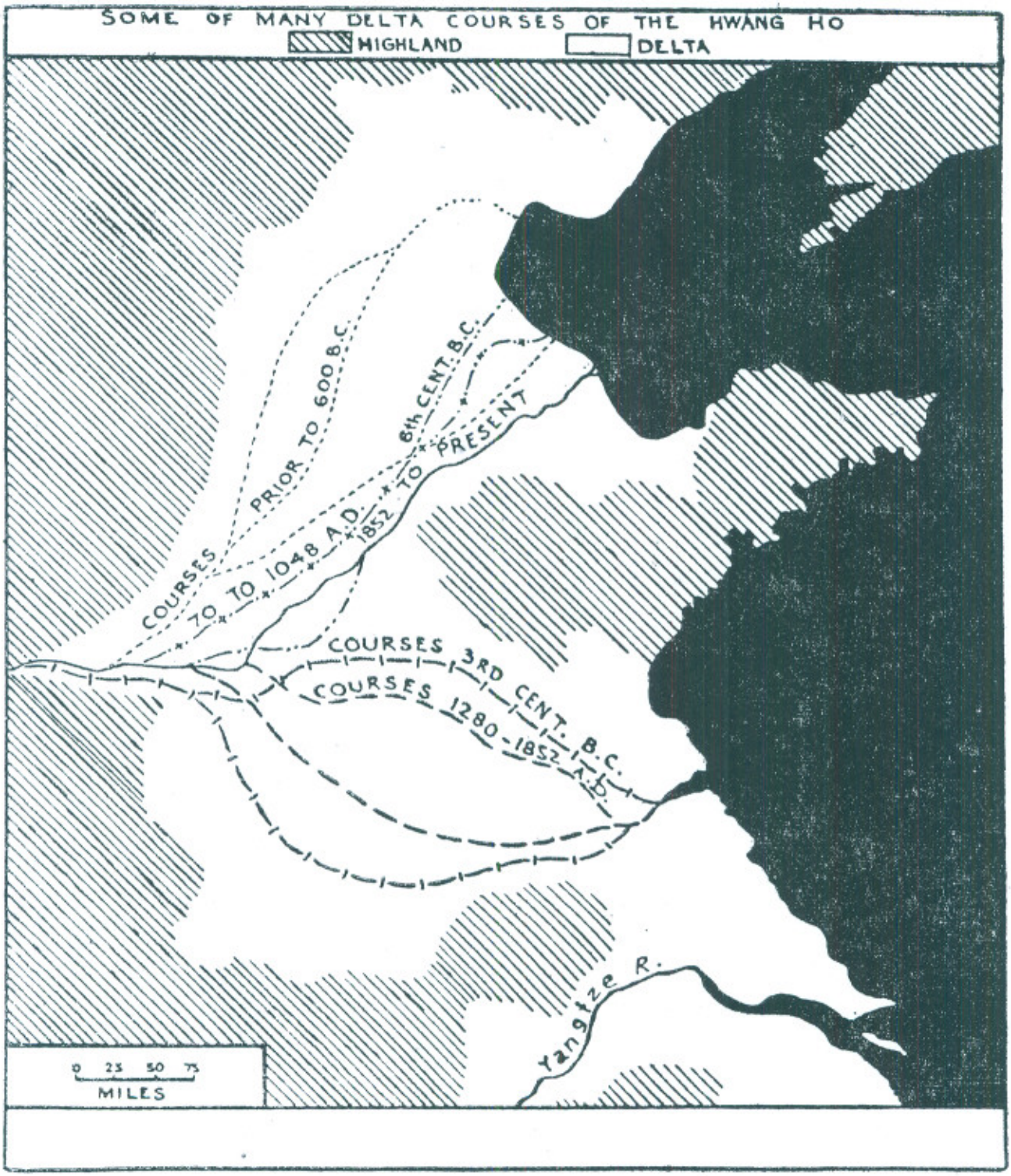
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HIGHLAND
DELTA
COURSES PRIOR TO 600 B.C.
6th CENT. B.C. TO 1048 A.D.
1852 TO PRESENT
COURSES 3RD CENT. B.C. TO 1128 A.D.
COURSES 1280 - 1852 A.D.
Yangtze R.
0 25 50 75
MILES