

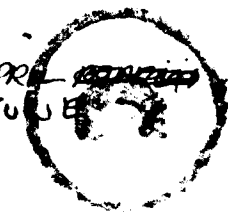
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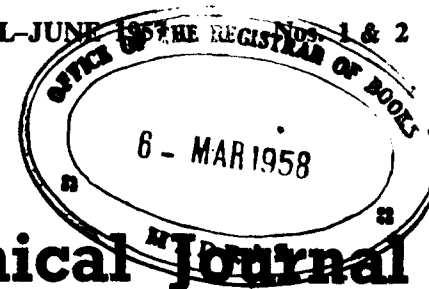
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A CONTRIBUTION TO THE STUDY OF THE ALLIKKULI CAVES

PROF. J. DUPUIS,
French College of Pondicherry.

One recent trip to the Allikkuli Caves, conducted by the French Institute of Pondicherry has enabled us to conceive a new idea about the so long debated problem of their origin.

Known from the country people by the name of Mannasi Amman Koil, these caves are situated on the Eastern slope of the Allikkuli Hills. On the map—scale one inch to one mile, No. 57-0/15—their position can be located by following the foot-path from the village of Gunipalaiyam leading westwards; the caves are situated at the point where that path crosses the 750 feet contour.

The site is one amphitheatre, 200 to 300 metres wide (700 to 1,000 feet) bounded by vertical cliffs of Jurassic conglomerates, about 30 metres high. On the map, this amphitheatre is shown as E-W ravine, and closed on the Western side. At the foot of the Southern cliff, the most important cave opens, with two smaller adjacent ones.

WHY THE THESIS OF A MARINE ORIGIN IS TO BE REJECTED.

1. If we examine the general topography in the area of the Allikkuli caves, small scarps are frequently observed in the Jurassic conglomerates. Those scarps, which range from one to several metres in height, appear as a general feature of the landscape: they are to be found on the slopes, at all levels and

A CONTRIBUTION TO THE STUDY OF THE ALLIKKULI CAVES	—By Prof. J. Dupuis		1
THERMAL SPRINGS IN SATPURA FORESTS OF KHANDESH— BOMBAY STATE	—By C. R. Karnik		5
THERMO-NUCLEAR FISSION AND THE WORLD CLIMATES	—By Inder Nath Chawla		9
JAT SETTLEMENTS AND HABITATIONS	—By A. B. Mukerji		

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even on the crests, towards the elevation of 300 metres (1,000 feet). It can be clearly stated that they have no connection with a coastline, the traces of which should be observed at a uniform level.

The cliffs, of 30 metres (100 feet) height, which bound the ravine of Mannasi Amman Koil, are but an amplified instance of that general topographic feature; besides, it is to be observed that, in the considered area, the scarps trend eastwards in a parallel direction. This fact suggests that this topographic feature is connected with the structure of the ground. The underlying gneisses which frequently show faults in the same trend (E-W) may account for that topography: the movements of the underlying gneisses along the planes of fracture, would have generated faults in the jurassic cover, which would have given a direction to the erosion and given rise to the small scarps and cliffs.

2. The Allikkuli Hills are constituted by conglomerates of the Jurassic age; and if a coast-line was to be observed on those hills, this would have been naturally due to a post-Jurassic transgression. The question which arises then is to know *which level* the post-Jurassic marine transgressions have reached in that area.

The problem is the same as to determine the level reached by the most important transgression of the tertiary sea. Dr. G. Kuriyan has stated that the marine level—in Kerala—was located at about 180 metres (600 feet) above the present level.

In one separate study¹ we have tried to determine the corresponding level in Tamil Nad; and we have found out that it was *slightly underneath* that of Kerala: the sea has not reached above 150 metres (500 feet contour). There is no trace whatever of a coast-line above that level. Consequently, the Allikkuli Caves, situated at about 225 metres, cannot possibly have been excavated by the sea.

HOW THE ALLIKKULI CAVES HAVE BEEN FORMED

The thesis of a marine origin being set aside, we must examine if the site of the cliffs does not reveal any other origin. The ravine, bound by the cliffs, has been carved out by one of the torrents which flow eastwards on the Eastern slope of the hills; the erosion, acting according to the E-W trend of the faults, has determined the formation of the cliffs (this phenomenon is not at all exceptional: in the Satyavedu area, similar valleys, framed by cliffs, occur). The stream, indicated on the map, is intermittent; but it certainly was more important in the rainy times of the Pleistocene.

The ravine of Allikkuli is one amphitheatre closed by cliffs on the Northern, Southern and Western sides; it only opens eastwards. It so appears that the stream coming from the West would enter the ravine by means of a fall. The

¹ That study has not been yet issued; it must be published in the "Travaux de la Section Scientifique, Institut Francais de Pondichery".

topography equally reveals that, just above the waterfall, the stream bifurcated, divided by a rocky island (this median rock is still obvious on photographs). The water was then pouring into the amphitheatre by means of a double waterfall; the effects of the corrosion are particularly evident in the Southern branch of the stream—above the waterfall, the curved track of the sapping water on the left bank; along the fall, the vertical grooves cut out by the water.

The amphitheatre is distinctly divided into two parts:

(1) The upper part, on the West, where the water, flowing down from the ridges, has cut out two channels, dissecting deeply the upper part of the cliff; the channels are separated by the median rock. The Southern channel, the wider of the two, must have had the most important flow. The Northern channel appears as a narrow gorge, slightly curved.

(2) The lower part, on the East, where there is no median rock: there, the waters of the two falls joined again into a whirl. The caves are carved out at the foot of the Southern cliff.

From these observations, we conclude that the whirling water at the foot of the falls constituted a giant's kettle. Moreover, the outlet of water from the **Northern fall**, confined more closely in a narrower and slightly curved channel, would deflect the water of the Southern fall towards the right bank. The caves have therefore been excavated by the water, whirling inside the giant's kettle, carrying away, in its motion, a great number of pebbles which caused a more vigorous sapping on the Southern cliff.

The undermining action of the water accounts perfectly for the shape of the principal cave. It is the shape of a crescent, not deeply incurved: roughly, a segment of a circle, the chord of which (the opening of the cave) is about 70 metres, while the depth, at its utmost, does not exceed 20 metres. The vault appears as an arch: its height, at the entrance, may be 9 metres; but it decreases gradually towards the bottom of the cave up to 1m, 50. That shape of a crescent, widely opened, is perfectly corresponding to the whirling motion of waters sapping the basement of the cliff.

The torrent would have more power than to-day, not only owing to a more rainy climate, but to a different arrangement of the drainage-pattern. At present nearly all the waters of the Allikkuli Hills are gathered in the central basin of Place Palaiyam, where they form the torrent of Allikkuli. But this is the result of the evolution of the drainage-pattern, due to the dissection of the hills and to a number of captures. Before that state of things, the drainage was subdivided to a greater extent; and the tiny streams, mostly dried up, which we observe to-day on the Western slope of the hills, must have drained, at that time, a catchment area of greater extent. Especially the stream that was flowing into the amphitheatre of Mannasi Amman Koil must have gathered a larger amount of the waters that are now flowing towards Hadsanpuram and Place Palaiyam.

As to the process of erosion of the conglomerate, it clearly appears in the country around. The pebbles, sealed up in the ferruginous cement, get loose easily with the action of water and the variations in temperatures: the surface of the hills bears a great number of cells, the cavities formerly occupied by pebbles that have been disengaged.

The vault and walls of the caves are covered with the same cells. There is no difficulty in conceiving that the pebbles—which are so easily disengaged from their cells on the slopes of the hills—could have been *a fortiori* set free at the foot of the cliffs under the repeated shocks of the whirling pebbles.

We therefore come to the conclusion that the Allikkuli Caves owe their existence to the power of water in a giant's kettle, which sapped the basement of the cliffs.

THERMAL SPRINGS IN SATPURA FORESTS OF KHANDESH—BOMBAY STATE

C. R. KARNIK,

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SUMMARY.

In this paper two hot-water gysers of Khandesh Forests are described.

The total solids present in parts per 10,000 c.c. of gyser-water varies from season to season and it is partially attributed to the chemical changes brought about by the increase in temperature.

Presence of diatoms are noticed in cold season.

INTRODUCTION

Blanford¹ examined Khandesh from geological view point as far south as the river Taptee. He points out that the northern portion of the district consists of a strip of variable width between the river and the Satpura hills, chiefly covered by alluvium.

The hills consist of trap which also appears here and there in deeper ravines cutting through the alluvium.

“North of Adavad at Unabdev a hot spring breaks out at the foot of the hills, just at the point where the trap crops out from beneath the alluvium”.

The above-mentioned observation is the only reference about Thermal Springs of Khandesh. The author during ecological studies of forest flora of Satpura ranges, came across five thermal springs in the ranges. An attempt is made in this paper to describe two gysers which were easily accessible throughout the year.

I. UNABDEV GYSER

There is a hot-water spring at Unabdev, about 6 miles from Chopda, situated Longitude 75° 15' E. Latitude 21° 3' N (c/f Survey Map No. 46 0/7—District East Khandesh). It is two furlongs from village Vardi, about 25 miles from Jalgaon, and 2 miles from Adavad.

Method :

The Chemical Analysis of the water of the gyser was determined according to the method outlined by Cuning and Hibbard.³

Observations (May 1950) :

Temperature of the water from the mouth of the gyser — 125°-130°F.

Discharge 5 to 7 gallons per minute, water sulphurous. Yellow-green. Brackish.

No gas given off.

Litmus paper turns Red.

pH — 5.2.

DATA COLLECTED IN 1955

Table I — Total solids in gms. as obtained in parts per 10,000 c. c.

Months	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Chopda Gyser	11.53	11.76	11.98	12.01	12.03	12.05	11.97	11.93	11.93	12.07	12.07	12.07

Table II — Atmospheric Temperature in °F at the Station

Months	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Chopda Gyser	90.0	96.30	103.3	112.01	115.31	110.01	96.51	93.61	94.03	95.93	91.97	89.06
Minimum	52.12	58.81	64.06	74.79	83.40	77.50	74.03	74.01	72.79	72.11	59.03	53.01

Table III — Total solids in gms. calculated in 20 litres of gyser water

Months	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Shahada	3.56	3.56	3.39	3.40	4.76	4.53	4.51	3.97	3.99	3.98	3.71	3.62

Table IV — Atmospheric Temperature in °F

Months	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Shahada	80.13	90.47	107.43	111.71	115.80	112.80	92.01	90.13	89.60	85.00	82.00	77.51
Minimum Shahada	55.10	58.01	69.10	85.10	87.81	77.19	74.80	76.10	77.01	69.40	69.92	56.13

THERMAL SPRINGS IN SATPURA FORESTS

The total solids are given in parts per 10,000 c.c.

NaCl — 7.92 gms.

Na₂SO₄ — 1.13 gms.

CaSO₄ — 0.041 gms.

S₁O₂ — 1.08 gms.

Total Solids — 10.171 gms.

Diatoms were noticed in this gyser in the months of November, December, January and February.

pH — 5.2-5.6

Temperature of gyser at the mouth — 125°-132°F.

In May 1955 — Gyser showed :

NaCl — 8.01 gms.

Na₂SO₄ — 2.11 „

CaSO₄ — 0.01 „

S₁O₂ — 1.90 „

and Total solids — 12.02 gms. in 10 litres.

II. SHAHADA—UNABDEV—SONUPDEV GYSER

It lies on a motorable forest road as we proceed to Akrani from Shahada. At the height of 70 feet on the hillock is a temple of Siva.

The water has a reputation to cure skin-diseases and ulcers.

Observations (May 1950) :

Temperature of the gyser at the mouth 130°-140°F intensely saline, brackish, litmus paper turns red. pH. 5.4. Surrounding rock—Black granite. Discharge very copious.

Total solids in 5 gallons—9.6 gms. consisting traces of NaCl and sulphate of lime.

The spring is renowned for curing skin-diseases. A fair is held every year in May. The place is held sacred and has become a resort to pilgrims.

In May 1955, the total solids obtained were 4.76 gms. in 20 litres of gyser water.

The presence of diatoms was noticed in cold season.

DISCUSSION

From observations made in the month of May 1950, it will be seen that the total solids present in the two springs were 10.171 gms. and 9.6 gms. respectively.

Table 1 and Table 3 show that the total solids vary from season to season.

From Table 2 and Table 4 it will be noticed that the quantity of total solids increase with the rise in temperature. Therefore it can safely be concluded

that there is, high evaporation, in the vicinity of these gysers during summer months, which directly depends upon the atmospheric temperatures. These high temperatures of the surrounding area, may, to certain extent, concentrate the fluids of the ponds; this may be the cause of accelerating chemical changes within the water of the gysers.

The variation in the concentrations of the gyser-waters in colder months seems to be helpful for the growth of diatoms.

The sulphurous waters of Chopda and Shahada show medicinal properties due to the presence of sulphates.

ACKNOWLEDGEMENTS

I wish to acknowledge my gratitude to the Central Silviculturist F.R.I. and to Shri S. K. Seth, Honorary Editor, *Indian Forester*, for going through this paper and suggesting necessary changes.

My debt is due to Shri S. M. Kalbag, D.F.O., East Khandesh, Shri D. D. Yellular, D.F.O., West Khandesh, Shri S. A. Mundkur, D.F.O., North Khandesh and Shri I. M. Qureshi, Silviculturist, Poona, for loan of books and affording facilities in the Ranges.

LITERATURE CITED

1. Blandford, W. T., 1921—On the Geology of the Taptee and Lower Nerbadda Valleys and some adjoining districts. *Mem. Geo. Sur. India*, VI, 2: 1-75.
2. Cumming & Kay, 1922—Quantitative Analysis, *Gurney and Kackson, London*.
3. Cuning and Hibbard, 1940—Methods of Analysis, *A.O.A.C.*

THERMO-NUCLEAR FISSION AND THE WORLD CLIMATES

INDER NATH CHAWLA.

Since March, 1954, when a Hydrogen Bomb was exploded at Bikini, in the Marshal Islands, quite a few statements have been issued, speculating the relationship between the Atom tests and the Global weather. The layman has attributed to these tests even the smallest variation in local weather conditions, irrespective of his past experience of weather variations. An analysis of these statements clearly reflects the element of sentiments rather than the principles of meteorology, or data of weather observations and the knowledge of weather variations in the past.

Some of the statements issued on the subject of co-relation of weather and the atomic explosions, are given below and discussed in the subsequent paragraphs.

1. The atom explosions delayed the on-set of monsoons in India in the year 1954.*

2. "Thick curtain of atomic ash hanging over the earth shut off the sun beams, causing cool summer and warm winter in Japan. The unseasonal weather last year, was almost a world wide phenomenon, bringing an unusually hot temperature in Russia, a long dry spell in India and a cool summer in Europe."†

3. "These tests are said to have caused above-normal temperatures in India."

4. The floods that swept North Bengal last year have also been attributed to the nuclear tests which were carried a few months earlier, in the Pacific Ocean. In an article published in the *Indian Journal of Power and River Valley Development* discussing the effects of nuclear tests it was added, ‡ "If the condensation nuclei and saturation considerations (arising out of atom explosion) could conspire to shorten the three-week drift period drastically, then the water evaporated from the middle of an ocean, which could otherwise be precipitated over the centre of a continent, might instead be dropped on the coast of that continent. Thus coastal regions would be expected to receive heavier than normal precipitation whereas areas remote from the coasts might be deprived of their normal supplies of water."

5. There is a widespread fear amongst the general public that these tests are likely to change the climates of the Man's inhabitate, finally resulting in the extinction of all types of life from our planet.

These fears are no doubt supported by the destructive forces of the H. Bomb, both direct and indirect, through increased radiation, release of immense destructive energy and pollution of atmosphere. But the case of bringing about

* Dr. Mahajan, L.D., India.

† Dr. Hidetoshi Arakawa, Central Meteorological Observatory, Japan.

‡ Indian Journal of Power and River Valley Development.

changes in the atmospheric circulation is different and the capacity of H-Bomb to release such effective energy as to change the world-wide pressure distribution is rather incredible. This however, can be easily understood by comparing the energy of a H-Bomb with that emitted by the sun and absorbed by the earth. The energy of the sun being the only effective force controlling our atmosphere, it is worthwhile to compare all other energies with that of the sun, in order to measure the latter's comparative effectiveness. Calculations reveal that Bikini test released energy which was only $1/4,000,000$ th of the energy absorbed by the earth per minute from the insolation and the earth absorbs only $1/2,000,000,000$ th of the total solar radiation. This comparison shows the magnitude of the energy of the sun which is the effective force governing our weather elements. This also shows the comparative insignificance of the energy released by the Nuclear Explosion, which has possibly no role to play in governing our weather conditions, due to its fractional nature.

In the foregoing paragraph, the incapability of the atom bomb has been discussed, in general. In the following paragraphs we will examine these statements, in the light of generally accepted principles of Meteorology, data of weather observations, and our knowledge of weather variations in the last half a century.

As far as the statement No. 1, regarding delay in the on-set of the monsoons in India, in 1954 is concerned, record of meteorological observations shows that there was no delay in the on-set of monsoons and they started on the due date in Bombay which generally receives the first monsoonic showers in India. Their advance over Panjab was delayed only by a week which is nothing unusual when compared with the previous record of the last half a century during which period the advance of monsoons over Delhi and Panjab has been delayed on more than 10 occasions (1902, 5, 7, 11, 21, 24, 26, 35, 41 and 1947) when the atomic tests were not carried out.

The second statement is contradictory in itself, because the atomic dust veil should affect the world-weather uniformly rather than differentially as envisaged in this statement. If seasons are extraordinarily warmer in India and Russia, due to atomic radiation, the dust veil should not protect Europe and Japan to give them cooler summers. Besides the sub-continent of India was not at all dry in 1954. Some places, on the contrary, received rainfall above normal. The rainfall broke the all time record in Bombay. Cherrapunji received 92.7", Bombay 20.9" and Poona 4.6", of rainfall above normal up to 24th July, 1954. The fact that the floods in North Bihar and Assam have been worst of their kind, are sufficient proof of the absence of any dry spells in India.

The idea of comparatively warmer seasons, due to radio-activity is also not acceptable because of the following reasons :—

- (a) The field of effective action of atomic explosion being limited to 7,000 sq. miles (80 miles in one side) it could not increase the temperature of the whole world (atmosphere).
- (b) The observation of facts is also against it.
 - (i) Contrary to the idea of warmer winter in India, Ambala (E. Panjab) broke the winter record of the last 40 years, by recording the minimum temperature of minus 28°F on the New Year's Day of 1955.

- (ii) The 1955 early summers have been comparatively milder in India. So the increased radiation could not after all decrease the temperatures. Therefore the idea of atmospheric control by atomic tests is not plausible.
- (iii) So far as the Indian area is concerned no rise or fall of temperature in the upper layers of the atmosphere has been observed.
- (c) The total energy released from H-Bomb explosion was only a negligible fraction of the Solar Energy which is the main controller of temperature and pressure changes.

The fourth statement contains the element of uncertainty in the form of big IF. It is highly improbable that a little increase in condensation nuclei should drastically shorten the period of drift and deprive the interiors of the continents from their normal supplies of water by giving all the precipitation over the coastal lands. But, even given this highly improbable presumption, the statement does not stand the test of facts observed, because it has not at all been dry in the interiors of the Indian sub-continent, as would have been the case, if the coastal areas had received more than their share of rainfall. On the contrary some inland stations had rainfall above normal. North Bihar had heavy floods in 1954 and the following stations had rainfall above normal.

Name of the station	During July 1954	During Sept. 1954
Abu Road	1"	—
Ajmer	5.3"	—
Ambala	3.1"	—
Delhi	1.5"	—
Udaipur	6.1"	—
Dehra Dun	—	13"
Lahore	—	9.7"
Simla	—	12.7"

Finally can atom tests bring about a change in the climates of the world? Climatic changes are envisaged in terms of increase in aridity or dampness. The increase in aridity implies either increase in temperature causing Hot Desert type of climates or decrease in temperature causing Cold Desert type of climates. On the other hand increase in dampness through rainfall implies evergreen forest type of climate or any other type with due regard to combination of temperature etc. Thus a change in the climates of the world or any part thereof requires changes in temperature and rainfall as pre-requisites. But in the foregoing discussion, it has already been proved beyond doubt that atomic tests are incapable of bringing about any substantial changes in temperature and rainfall, to be effective in causing climatic changes. Therefore, there is no danger of extinction of life from the earth due to climatic changes but life may become extinct due to physiological and genetic effects of the bombs rather than due to changes in the climates.

In fact the forces of nature are too vast to be influenced by atomic energy tests, however powerful they may be. As to the ineffectiveness of the energy released by the tests, in relation to the global structure involved it may be pointed out that the energy of a strongly developed low pressure is about a hundred times greater than that released by a H-Bomb.. To quote a London Meteorological authority Mr. B. J. Mason, "A modest thunderstorm releases as much energy as ten atomic bombs."

@ "Even the volcanic explosion at Krakatoa in Indonesia in 1883 which scattered debris as far as Madagascar—probably 1,000 times as powerful as an hydrogen bomb—did not produce noticeable changes in average surface temperature and rainfall." The dust particles, which this eruption threw in the atmosphere, have been giving the world, brilliant sunset colours for three years. Besides various volcanoes, which give out energy and dust particles to our atmosphere, it is being continuously bombarded by far more powerful meteorites, which also give it dust particles for nuclei. Dr. S. C. Bose, Ex-Director General of Meteorology in India, during the course of a press interview at Banaras, stated, "It is extremely improbable that a few Hydrogen Bomb tests could have had much effect on the conditions of rainfall in India." Another meteorologist went to the extent of saying that the world does not have yet enough Atom Bombs to provide even a fraction of the energy to influence the monsoons in any manner. At best the H-Bomb tests might have local repercussions but they are of no significance so far as the global atmosphere is concerned.

JAT SETTLEMENTS AND HABITATIONS

A. B. MUKERJI,

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(Continued from Vol. XXXI, Nos. 3 & 4)

FUNCTIONS

The Jat village like its universal counterpart is mainly a place of residence. The function of an overwhelming majority of the Jat villages is therefore purely residential and a few shops scattered here and there, as may be, cater only to the local needs limited only to the particular village community itself. It is obvious that the number of shops and artisans is directly proportional to the material prosperity of the village and also to its total population.

MARKETING

Market villages are numerous catering to the needs of the still smaller villages all around. These weekly markets are locally known as painth. The painth is held once or twice a week but different villages hold painth on different days, thus giving the cultivators the opportunity to market their products on all the days of the week in one village or the other, that is why there is no special preference for one particular day common to all villages for the painth. The origin of the market villages is easily explained. The cultivator does not want to have his harvest held up for future sale and thus run a risk. More often than not he wants an immediate cash deal which is possible only at a nearby market village. Moreover the crop of sugarcane loses much of its juice in the transportational delays. Hence the need and birth of the market village where the harvests are sold by the cultivator and bought by the money-lender's agents. The market village is in general a big village and connected by a cart-track working as a feeder road with one wide metalled, macadam or unmetalled road. These villages have in general a population ranging between 2,000 and 4,000. (In Muzaffernagar district Jauli, Tisa, Bhopa and Kakrauli having populations of 3,246, 3,499, 3,238 and 4,557 respectively are all important market villages.)

ADMINISTRATIVE

Administrative functions of villages are also determinant in their significance. In the past many villages were headquarters of tappas or mahals which were administrative divisions during the Moghul and late-Moghul times. Even after the dissolution of the old administrative pattern, these villages continued to enjoy the same importance and significance (an effect of historical inertia). Lawar (29° 7'N, 77° 47'E) now owned by the Jats was once the head of a tappa containing 45 villages, the villages owing its importance to its former administrative functions. The present headquarters of the different parganas are also very big villages with local administrative functions. It is here that the patwari (village headman) resides and it is here that all the statistics and other administrative documents are to be found.

HISTORY

It has been indicated earlier by the author of this paper⁸ that the migration of the Jats from Bharatpur toward the north in the Upper Doab area was effected by the fact of greater rainfall in the northern habitat. 'It moves in the direction in which the economic opportunity presents itself.'⁹ Jats were thus always and in almost all the eastern areas late colonisers, occupying villages already in existence and built by earlier communities specially Muslims. The migration of Jats from Jaisalmer to Bharatpur was in effect the operation of the same principle which caused their migration from the latter area to Upper Doab. The difference between these two migrations was one of a degree, not of a kind. In the desert habitat the villages of the Jat tribes were less permanent, much less were these prosperous. The whole existence of the Jats was based on perpetual movement. Like the perennial winds of the deserts the Jats were forced to revolve around isolated centres by their repulsive habitat. The permanent village as such was an impossibility. The more they moved towards the east and north, the more stable became their political and social organisation, the more sedentary their existence till the movement ceased altogether and found itself fixed in large permanent villages.

Jats first entered into the Doab in 1751 along with the Marhattas in a Wazir-Marhatta-Jat alliance in response to Wazir Safdar Jung's invitation for help to defeat and crush the Bangash Nawabs.¹⁰ Having entered into regional politics, they did not leave it after the battle was over, on the contrary they set their footholds firmly and began to extend their possessions at the cost of other weak and infirm tribes. The permanent settlements were thus born out of political chaos that prevailed in 1751.

APPROPRIATION

'Having once obtained a footing in the Doab, the Jats showed no inclination to resign the advantages they had gained. By degrees they got possession of the entire country and by about 1754 Suraj Mal took the fort of Sabitgarh from the Mussalmans and made it his capital for a time, changing the name to Ramgarh, a village close to the place being still known by that appellation. After the departure of the Afghans, Suraj Mal's power soon revived and he completely recovered his hold on the district.'¹¹ How the Jats had appropriated and settled the villages can be best understood by the case-study of Hathras. The Jat houses of Hathras, Mursan and Iglas trace their origin to one Makan, who came from Rajputana about the end of the 16th century and settled near Mursan. He was himself a Tenwa Jat and married a woman of the Khokhan sub-division at Mursan. Partly with the aid of her clansmen and partly by his own exertions, the country then being but imperfectly developed, he and his descendants acquired a considerable estate which was divided among the various sharers. The property as a whole was known as tappa Jawar or Joar and was originally included in pargana Jalesar. In course of time the parent village of each sub-division or tappa threw out hamlets or dakhili mauzas (pioneering villages), all occupied by descendants of the common ancestor and these clusters of villages became known as taluqas. The latter in their turn threw out more of the hamlets to be clustered and enlarged later on in big sized villages. In the reign of Aurangzebe the head of the Jat clan who had already enlarged the state and evaded the payment of revenue submitted to the Emperor and was rewarded with the revenue management of Jawar and Tochigarh and a subsequent grant conferring on him the title and office of fanjdar or head of the police administra-

tion. Makar had 14 sons who dispersed later on and got possession of Mursan and Hathras estates. Almost everywhere the Jats have captured the villages settled by other communities by violence, loot and arson and in some cases by shrewd diplomacy as well. Bakharba (Meerut district), a village originally belonging to Tyagees was captured by the Jats from the former. Now there is not a single Tyagi family in the village. Similarly Khekra (28° 52'N, 77° 17'E) a big village in Meerut district founded 1,600 years ago by Ahirs was captured by the Jats 1,000 years ago who drove the Ahirs out of the village and thereafter settled in it.

ANTIQUITY AND AGE

One of the principal characteristics of these Jat villages is their antiquity, some of which are as old as Mahabharata times as the village Parichhitgarh (28° 59' N, 77° 57' E) but mostly these are 200 to 600 years old. The antiquity of some of the Jat villages is remarkably noteworthy. Bagpat is believed to have been one of the five 'pats' mentioned in the Mahabharata like Sonapat and Panipat in Rohtak district of East Punjab. Its antiquity is also proved by the pattern of roads following the Swastika plan as was the rule in the Aryan villages of that period. Its original name was Vyagraprastha or 'place of tigers' which was changed into Bagpat by the emperors of Delhi. Some of the old villages have been founded and created by Jats themselves such as Daha (Meerut district) where Jats have been living since the last 700 years. The Thakurel Jats of Aligarh have for many centuries held the Hasangarh pargana of Aligarh district which was settled by them in 1046 A.D. when 54 villages were acquired by their ancestor Bikram Thakur. The Hele Jats of Meerut district state that they came here from Jaibalmer about 1100 years ago and that they first settled in Chhaprauli, Kutana and Bagpat. In Bulandshahr the acquisitions of the Jats do not date beyond the middle of the 18th century when during the short ascendancy of Suraj Mal of Bharatpur, they seized all the villages within their reach. Jat villages are in general younger in age than the Tyagi villages. But mostly the antiquity of the Jat villages does not prove the antiquity of the residence of the Jats in this area since the villages belonging to other castes and tribes were forcibly taken possession of by the Jats. Similarly since the Jats came to occupy the villages in the northern zone later than in the southern zone, it is obvious that the Jat occupation and residence in the northern villages are of a shorter duration than that of southern zone.

MATERIAL PROSPERITY

Apparently there seems to be not much difference between a Jat settlement and settlements belonging to other communities. Within-the-village survey and a deeper acquaintance with it however provides us with those characteristics with which we can differentiate very substantially. Firstly a Jat village unmistakably bears the stamp of material prosperity, the result of their rather austere and simple living and their cash-income from sugarcane. A Tyagi village too is studded with indicators of richness but the essential difference between a Tyagi and a Jat village is that the former is a decaying and ruined phenomenon, one which has passed the zenith of its glory and is presently being driven down the slope while the latter is a growing and progressive entity, one which is fast going up toward the peak. There are many reasons for the gradual decadence of the Tyagees. Tyagees are addicted to lust, vice and wine, things which reduce the efficiency of the peasants and the landlords. Tyagees are extravagant people always spending beyond the coffeur-limit and running into indebted-

ness. The vicious cycle goes on rotating perpetually. To clear the debt they sell off the land, when they have sold off the land, they require more loans. The holdings are thus continuously decreasing and the family is gradually being brought nearer to extinction. The village which is a macrocosm of family follows the same pattern. This is the reason as to why the holdings of the Tyagees go on decreasing and those of Jats go on increasing. What is perhaps more important in this connection is that the Tyagees do not cultivate their fields themselves but employ labourers to do the job of cultivation which involves a huge drainage on their financial resources. Jats on the other hand are expert cultivators and their standard of crop husbandry is very high. The field is their greatest concern. By clever manipulations the Jats have captured Tyagee holdings even the whole villages and extended their possessions. This process continues indefinitely. Since in a farming population group the material prosperity and richness is directly proportional to the area of the holding and its productivity it is obvious that the Jats who now own the largest amount of the most productive land are materially most prosperous. The study of cultural landscapes reveals this clearly. The importance of local sugar mills where the Jats dispose of their sugarcane harvests in lieu of cash income is very great as the basis of the material prosperity of these villages. Every material improvement of the Jat village is fed by the cash-income from these sugar mills. 'Remove the sugar mills and break the interdependence between agriculture and industry, and instantly the entire structure will collapse, the Jat will revert to his original unsettled life or at least become a hopeless Oudh peasant.'¹²

CULTURAL LANDSCAPE

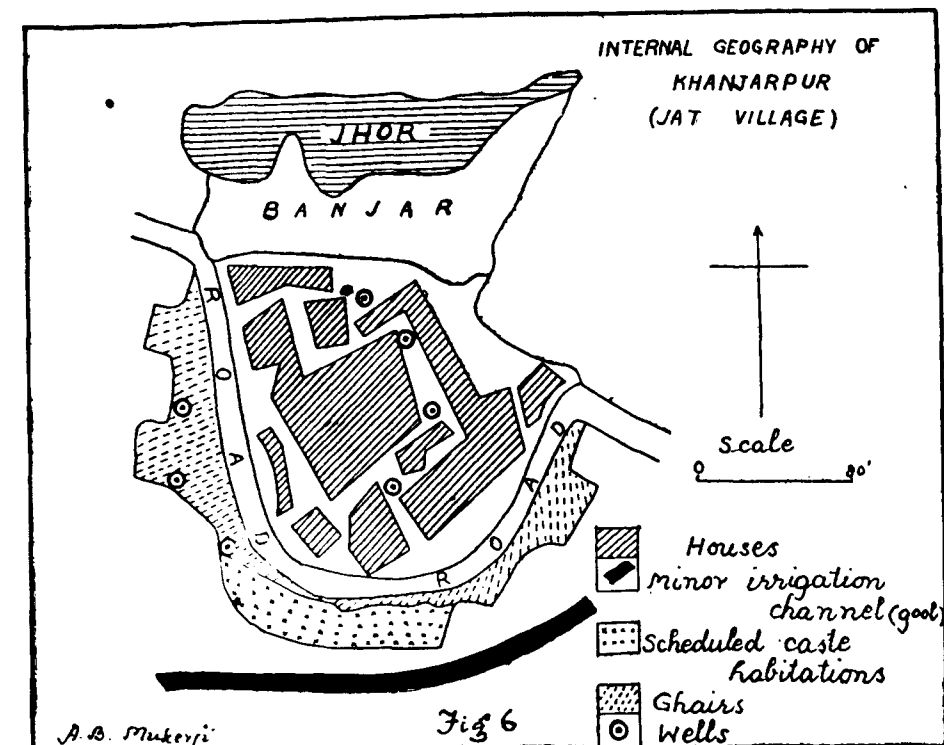
The cultural landscape of the Jat villages is an organic phenomenon gradually evolving and changing into new shapes according to the changing socio-economic environment of different periods of history, each bringing into play its own distinct cultural milieu. The elements in this cultural landscape are not only newly added items but also certain relicts remaining as residual items representing the ages and cultures which had existed earlier but are past and extinct, now (Ref. Fig. 6).

HABITATIONS

Jat habitations represent an optimum of habitat-adjustments inasmuch as the climatic, soil and building material factors have been synthesised into making it a static element in the cultural landscape. The shape, function and the build of the residential units remain as they were at the time of the establishment of the village. Since agriculture forced a restriction in the area of human habitation, compact and nucleated village became the necessity. Soon the settled life and an improved agricultural technique, and the conditions of sedentary civilisation had its resultant cultural advancement which manifested itself through the build of the houses and the internal structure and design of the villages. Though the artistic aspects were not given attention to, the functional needs were thoroughly catered for. Agriculture settled and tied the Jats to the soil and hence to the house which in its own turn put a brake on the nomadic instincts of the Jats and hence fixed them to one particular place.

BUILDING MATERIALS

The building materials used in the northern zone differ very substantially from those used in the southern zone due to the differences in the resources of the two zones. Since in an agricultural community not enough could be spent



on bringing building materials from a distance, almost all the houses are built of materials available at hand. Here we find invariably the dominant deterministic control of the environment. The universal use of mud and clay in the northern zone is specially striking. The use of wood and stone is very sparing and limited only to the more prosperous of the peasants. Wood is used in the frame of the roof and doors and windows but wooden furniture is strictly limited to very rich peasants, rather those who were formerly landowners. Dry climate with little rainfall permits the extensive use of clay and mud which is available everywhere and always so economical. In the absence of a cover of natural vegetation, the use of clay became still more inevitable. This is one of the reasons as to why the Jat houses are not thatched. The Jats, being rich, have enough to spare to build their houses with fire-baked bricks as well as with sun-dried bricks. The clayey soil can be easily moulded and dried in the strong sun occurring for the greater part of the year. No doubt these houses take comparatively longer time to be built up, because of the long time taken for the baking of the bricks but once built these remain sufficiently resistant to weathering agents and are therefore more or less permanent, requiring only minor repairs after the rains. Adobe or dried (as used in New Mexico) and sun-dried big bricks like toubra bricks (as used in Sudan) are very largely used. The heavy clay is suitable for strong, big bricks. In a Jat village nearly 40% of the houses are fire-baked pucca brick houses, again an indicator of material prosperity. The strength and the durability of the bricks is indeed remarkable. Some houses built of kuchcha bricks (unbaked bricks) are nearly 100 years old. Overall repairs are done during May and June before the rains and again in September and October after the rains. Repairing mainly consisting of a coating of mud is done both externally and internally. Clay mixed with crushed wheat stalks (bhoosa) is coated on the outer side of the walls while yellow soil (pilia) mixed with dung is

coated on the inner sides of the walls and on the floors. The average longevity of the kuchcha houses is approximately 30 years provided lisai and lipai are continued regularly. The average longevity of the pucca house however ranges from 70 to 100 years. In the dwellings of the poor, nim, mango and jaman wood is used for the construction of the beams. In place of stone, blocks of kankar (limestone conglomerate) are widely used. Sal and chisham wood is used in the houses of the prosperous and erstwhile landowners. The commonest timber tree grown over extensive areas is shisham. The wood of the dhak is also used in buildings. In the tracts of sandy ridges (bhur) and low-lying lands adjoining the rivers (khadar) the roofs are thatched with locally growing sarkara grass.¹³ In the khadar areas the houses are built of flimsy materials because of the annual floods. In the southern zone the habitat is full of rocks, naturally the universal building material is stone and mud is used very rarely. On the Malwa plateau clay tiles and thatches of local grasses are widely used. Wherever sandstone is plentiful as in Bharatpur, Alwar and Gwalior the houses are mainly constructed of this material.

FORM AND CONSTRUCTION

The overwhelming majority of Jat houses is of the rectangular type. The square or rectangular type of house offers more convenient floor space and can be more easily and better divided. The easy and acceptable division of the house is necessary when we consider the effect and necessity of joint family system. In appearance the Jat house is a little replica of the village itself. (Refer Photo 1) compact, strong and mysterious. The well-to-do peasants always possess two houses, one known as Janana used by the females and an outhouse known as ghair. The house is not only residential but divided into several distinct apart-



Photo 1. Jat Sector in a Jat village.

ments used for different functions. Very often a ghair is attached to the janana but has no connection with the interior of the house. The several apartments are used for animal shed, grain store, fodder silos and an indigenous cane-crushing machine and open ovens on which gur is prepared. The one or two-roomed apartments with sufficient bare land for congregations and animals' rest is usually surrounded by a low boundary wall made of mud. This outhouse is ghair and it serves the same purpose as chaupal of Oudh. The ghair is something essentially northern in nature and is not generally found in the southern zone.

The construction of the house is done with the object of maximum strength and security. The thickness of the walls (asar) is nearly one yard while their height (bheet) is nearly 5 yards. The walls being made of mud and being thick are very strong. The structure of the roof is not so primitive. On the walls is kept a wooden frame to support the roof and the long beams are known as kari and shorter cross-pieces placed on the karis are known as barange. On this frame the first layer is of dried grass (poola), then above it the second layer is of mud (gara) and then above it is the third layer of dried powdered earth. Thus the roof is a three-layered surface structure. In the interior chamber is a mud or wood-chamber (kuthla) for storing grain and the light for this darkest of all the rooms comes from an opening (dhumala) in the roof. Amongst the Chahils, the largest Jat tribes in Punjab, no openings are made in the roof even to this day. The reason ascribed being the historical fact that once Chahal, the son of Raja Kang and founder of the tribe saw some fairies bathing in a tank. He at once seized their clothes and only restored them on the condition that one of them became his bride. One Ichcharan was given to him on condition that he never abused her and she bore him a son, but one day he spoke harshly to her and she disappeared through an opening in the roof. Hence to this day, the Chahil Jats of Punjab do not make any opening in the roof. We know that the districts of Patiala, Ludhiana, Ambala, Amritsar and Gurdaspur are terribly hot places during the summer, the temperature shooting as high as 100° F which would have necessitated an opening in the roof as well. Thus the openings are necessary but due to the perpetuation of a historical myth the peculiarity in the make-up of the roof persists to this day. This clearly proves that in many cases it is not geographical conditions but the social heritage that becomes the determinant of the elements of geographical reality. Upper storeys are rarely constructed primarily because the mud walls and mud roofs are not so strong so as to support the weight of the upper storey. Upper storeys are often tabooed as well; for example the Najar Jats of Ludhiana district think an upper storey brings bad luck. Thus superstitions too play a significant part in the form and build of the house. It is always unlucky to build a house broader in front than at the back. Such a house is called sher-dahan (lion-mouthed) or bagh-dahan (tiger-mouthed). A house to be lucky should be cow-mouthed or broader behind than in front. Houses are also, to be lucky, to contain an even number of sides preferably four, six or twelve sides. A southern aspect of a house is believed to be unlucky. If in a house there is a door on the southern side, another house with a north-facing door is built just in front of the former to counteract the evil effect of the south-facing door. In Gurgaon a house should, if possible, face towards the Ganges, that is toward the east, but never toward the south. The explanation of this superstition is to be found in Hindu mythological ideas according to which south is the direction dominated by Yama Raj or the God of Death. (Swastika, the most pious and representative symbol of Aryans manifests Yama Raj through its southern limb). It might also be interesting to note here that the southern sector of the village is also the main residential area of the families belonging to scheduled castes. The house very often faces east (the direction of the sunrise or Suryodaya) or north (the direction of the Himalaya). The geographical factors are also discernable. A house facing south would always be and most exposed to the heat of the sun. Little rainfall permits the construction of broad and flat roofs. Clay bricks also keep the rooms cooler during the hot summer and the larger surface of the roofs allow a quicker and a greater amount of back radiation of heat during the night. In the Khadar and Bhur areas substantial houses are rare and the people resort to the construction of cheaper and easily made houses of local material. The impact of urban patterns of houses and their structures on the rural residential

units is clear. The large number of houses built of brick not only indicates a material improvement in the conditions of the peasants but also reveals the binding influence of the urban type. Therefore it is that the internal pattern of construction and the plan of the pucca house show marked similarity to the urban houses. The cutting of ventilation rectangles, for example, is a recent addition to the house introduced at the instance of the urban usage. Two houses belonging to different periods of construction, though standing side by side reveal such unmistakable contrasts which can be explained as due to the different influences of rural and urban usages. The 'urban' invades within the village and draws the 'rural' out. This sociological phenomenon has its own effects on the types and elements of residential units. (Ref. Photo 2).



Photo 2. Old Type Haveli.

The ground-floor plan of the Janana house is often very simple. There is a large courtyard having mud-floors in the centre of the house; in more prosperous houses the flooring of the courtyard is made of stone. Surrounding this courtyard are three long rooms on the three sides but on the front side there is a long verandah or a high wall containing a door which opens into a room known as dubari which contains two doors but no windows. The dubari opens on the outer courtyard, one corner of which is occupied by a large room known as baithak (drawing-room) used for the congregation of the land-owner, his friends and his relatives. Sometimes the dubari opens on the courtyard. The dubari is built primarily to serve as the first door of defence. Similarly, the back-door so common to Jat houses serves as the exit for the females in times of security but in times of danger this is the door through which Jats fly out for safety. Sometimes on the second floor a small room like verandah is built known as bairja which is mainly used by the females for relaxation in fresh breezes. The number of windows and doors being kept to the minimum, the amount of light and winds is acutely limited. Very often the houses open on narrow and tortuous lanes. Before the houses and in the ghairs are seen conical grass sheds closed from all sides (boonga) in which fodder is stored and closed conical sheds made of grass and stalks (bitora) in which dung-cakes are stored. There is no general practice of white-washing and painting of the walls so that the colour of all the houses are earth-like.

In the northern zone the architecture is very simple and sculpturing is almost totally absent indicating a lack of artistic interest of the Jats. Moreover

the main building material of clay does not yield to artistic treatment as wood or stone. The daily routine in the lives of these peasants passionately devoted to the realm of agriculture does not leave them enough time for their cultural development whether material, intellectual or spiritual. A Jat's life is a perpetual movement between his fields, farms and his animal sheds. Such a life has got no impetus to give to creative aspects of culture. The absence of cultural forms affects directly the build of the houses and the villages. The houses are grotesque in form, their walls are bare of ornamental and artistic decorations. Perhaps the one striking fact is the great emphasis laid on the functional aspects of the form and construction of the house. The functional aspect thus completely wipes off the artistic imprint. Artistically speaking the Jat village, though looking tribal externally, betrays the tribal characteristics internally.

Another characteristic type of habitation found in the northern zone is the isolated residence built like a fortress and known as garhi. These are situated near the village proper but separate from it and often connected by a cart-track. Garhis are very big residential houses but are divided within into apartments for different functions. Garhi is surrounded by a high boundary wall and is entered by a high-vaulted doorway. It, being the residence of the premier landlord, is always surrounded by huts and residences of his cultivators, labourers (kamers) and a large number of servants who also act as guards for the safety of the residence. Garhi among the Jat residences is an element of prestige and is easily comparable to the castles of the local lords in the mediaval ages.

Almost every village has got several big residences belonging to the prosperous peasants and also to the premier magnate in the centre of the village. This high walled residence built of pucca bricks (thin bricks are known as lakhauri) is known as haveli. Its thick brick walls are further doubled with very thick mud walls and it was often used to give shelter in times of general disorder.

In the southern zone of Bharatpur, Alwar, Malwa and Eastern Rajput Upland the houses of the agricultural classes are small mud dwellings. Thatched houses are again very rare. The characteristic dhaba houses built of mud walls or cement walls have flat mud roofs built on wooden planks. The rectangular frame-work of wood is absent in general. The stone walls and stone floorings are common but the dominant use of mud and clay still remains extensive. The build of the house does not vary much but the ghair is dispensed with. Tiled roofs are also common. The stone-floored courtyard is the nucleus around which the rooms are built but verandahs and long corridors play an important part in the build of the house. The room in the upper storey is called kotha which is also a sign of wealth since the poorer houses have thatched roofs or chappars. In the neighbourhood of the hills the habitations are commonly built of unhewn stones cemented with mud. An isolated homestead consists of a courtyard surrounded by a wall along which are rooms and sheds or of simply a mud hut provided with a sloping tiled roof. Upper storeys in substantial houses are often ornamented by picturesque carved wooden balconies and projecting windows. The architecture of the southern houses is highly attractive, as stone, the fundamental building material, yields very well to chisel to produce intricate and well-balanced carvings. The contrast in architectural ornamentation between a southern and a northern house is at once very striking. The northern village has however undergone changes due to modern urban influences but the southern village has remained truly rural and resistant to changes due to urbanity.

CASTEWISE AREAL DISTRIBUTION

The caste-wise specialisation in the occupation of land for settlements within a village is remarkably noteworthy. First the forces of caste-differentiation operated throughout the whole village community and effected a segregation of schedule-caste dwellings in the most unhealthy site available in the village, near some waste-drainage or mosquito-ridden marsh-polluted pool. It is also interesting to note that the outer belt (as if serving like the first line of defence) consists mainly of the out-houses of the Jat families and residences of low and scheduled-caste families. The central cell consists mainly of Jat residences. Later on even when the force of caste-differentiation became feeble, the original nucleus pulled the new families of scheduled castes toward itself and thus every incoming new family was absorbed in the parent community's segregated settlements. (Though the original force of caste-differentiation never ceased to operate, yet after the establishment of the segregated dwelling-group it becomes unnecessary). The advantages that have accrued out of such a pattern of habitation distribution are only balanced by its disadvantages. More than any other progressive community, this community of scheduled-castes requires a consolidation well beyond its scope and capacity. The internal unity of this down-trodden community is an indispensable factor in their progress and growth toward getting an equal status with others in the structure of the whole village society. A community of interests can grow and develop only out of a community of men belonging to the same caste, heritage, traditions and customs, living together. Such a social phenomenon is possible only in the circumstance when the pattern of habitation-distribution in a village is based on caste-wise specialisation in the land-utilisation for dwellings. Living together means almost always living with the same outlook on life, working and progressing together. But such a segregation should be limited only to the sphere of settlement, it should never become functional. The fact of separate habitation-area often emphasises the caste-differentiation in the structure of the entire village community. And herein lies the evil. Segregation should not be allowed to function in the sphere of work, it can only operate, justifiably so through certain historical circumstances which may become even non-existent in future. So we find that the anomalous distribution of habitations has advantages as well as disadvantages—the community solidarity as an advantage and weakness in the structure of the village community as the disadvantage. Thus we find that the areal distribution of the houses in a village are directly related to caste-structure. In general the houses of the low and scheduled castes are found in the southern sectors of the villages. One of the most striking fact that emerges out of the study of habitation-distribution pattern in many villages is that the houses of the scheduled-caste families are found in that part of the village whose direction is opposite to the direction of the prevailing winds. In the northern villages of Upper Doab, the southern sector contains the largest concentrations of low caste habitations, the direction of the prevailing wind being east-west. This allows the winds to blow untouched by the houses of the scheduled-caste families. So deeply rooted is the caste-prejudice that even the wind touched by the scheduled caste people becomes sullied and sacrilegious and so the new orientation of the lower caste dwellings is effected to maintain the purity of the higher caste peoples. Though this attitude is now non-existent the dwelling pattern has become fixed and re-orientation can be effected in this direction to break the caste-barrier. Even the Jats themselves have a gotra-wise division of areas of habitations. Every locality (mohallas) contains a majority of a particular gotra-group and is named after the gotra. This gotra-wise division of the habitation-group is universal.

A compact block of houses belonging to families tracing their origins to the same source are often found within one compound. Such a compact family block is locally known as bakhal. Bakhal is not a caste-feature but a family-feature. When the property of a family is divided and the house is divided within, one-roomed houses are created each having its separate door but the original house as such remains intact externally. The different houses in a bakhal are occupied by several families tracing their origins to a near and immediate ancestor. Jats and other communities have their separate bakhals so that in a limited area only one community has its residences.

There are many notified areas and municipal settlements which have once been very big villages. Even in these villages where Jats are found, their number is in general a very significant one. Though they have been new immigrants into the villages their population bears a very significant proportion to the total population. The following table is evidence of the fact of Jats' importance in the caste-wise structure of the distribution of population.

TABLE 3*

Settlement	Administrative Status	Jat pop in the caste—cell (a)	% of (a) to the total population
Baraut	Municipality	4,124	25%
Chaprauli	Town Area	700	10%
Muradnagar	„	582	12%
Pur Qazi	„	617	10%
Etmadpur	„	1,251	20%
Jagner	„	488	15%
Achnera	„	1,015	15%

* Based on District Census Handbooks of Meerut, Muzaffernagar, Agra and Muttra.

All these towns were once big villages and not owned by the Jats but by gradual grabbing the Jats have increased their holdings and with it their influence in the local society. It is clear therefore that the new immigrants were not silent spectators but active workers in the field of economic achievements. The Jats are found in these towns not in a dispersed manner in different localities but are mainly concentrated in a distinct locality or population-cell often bearing the name of Jatavan or Chowdhran. This pattern of habitation-distribution is specifically based on caste-structure and has almost nothing to do with economic functions. The Jats who are essentially rural people build their houses in the towns only for the purpose of increasing and expanding trade and having been drawn inward by the likenesses of the caste they begin to live together. Another peculiarity of the Jats is that since they own lands in different villages, they have residences in different villages. Every village thus contains at least a few residences of people who do not cultivate actively in their major lands in that village.

RELICT FEATURES

These mainly consist of walls and forts built in mediaeval ages with the purpose primarily of defence. It is interesting to note in this connection that there are scores of Jat villages where remains of fortresses are still commonly found such as Kunjpura in Karnal, Jalalabad and Chachrauli in Muzaffernagar and Danpur in Aligarh districts. In the southern zone innumerable forts both ruined and intact are scattered widely and extensively. There are many villages which are surrounded by walls such as Jalalabad in Muzaffernagar district. The walls are now in a broken and dilapidated condition. Such walls are found mostly near the Ganges and Jumna khadar lands. The walls are not only built of mud but also of burnt bricks (lakhori). The outer walls of the houses standing in the outskirts are generally adjoined to form a sort of wall and viewed from outside these often give the appearance of a continuous front.

PLACES OF WORSHIP

The most striking fact that emerges out of a study of these Jat villages is the absence of temples. The absence of temples is a striking fact because an Indian village without a place of worship is a rare phenomenon and obviously hides some clue to certain historical processes. It therefore needs an explanation. It not only reflects the indifferent feelings of the Jats toward their religion or God, it proves another historical process also. These villages which are now occupied by the Jats were founded originally by the Muslims and even now several Jat villages have mosques as relict elements of a cultural landscape that has vanished along with the historical period which produced it. It is obvious therefore that the villages did not possess temples originally and when Jats occupied these villages, they ignored totally any necessity of building temples or fixing sites of worship. Out of a random sample counting of 177 villages in Ghaziabad sub-division only 31 villages were found to possess temples.¹⁴ Jats in the first period of their history have been nomads and wanderers, hence their minds, always occupied with the planning of the new move, could never have time nor intelligence to work out a system of religion. It was only when the Jats finally and firmly set themselves down in the northern sector, they imbibed some of the religious ideas of other Hindu castes and began to worship, sometimes or other, the Hindu Gods and Goddesses. Since it was not an element inherent in their own culture but was taken from outside and assimilated within, the religious tendency has never become an important social force in the community organisation of the Jats. The absence of temples and other places of higher category of worship is best explained in this light of absence of religious tendencies and feelings for the supernatural. Being intensely tribal in spirit, the Jats have unconditional respect and a sentimental attachment for their ancestors and their heroic deeds. Ancestral achievements are the nuclei of many of the Jat folk tales and folk literature. Ancestor worship is thus an important element in Jat culture. Thus we find in villages several places connected with the ancestor-worship where the Hindu god has been replaced by the ancestor-spirit of the particular clan inhabiting the village. Among such places of ancestor-worship is the place of Jathera cult. Jathera is a form of ancestor-worship in which cult the bridegroom at his wedding proceeds to a spot set aside to commemorate some ancestor who was either a martyr (shahid) or a man of some note. This spot is marked by a mound of earth or it may be a pakka shrine. Since the Jathera is essentially a tribal and not a village institution, there may be several Jathera places in a village composed of several Jat tribes, each having its own Jathera place. In marked contrast to the tribal Jathera is the village Bhumia in the south-east Punjab. Here

when a new colony or village is founded, the first thing to be done before houses are actually built is to raise a mound of earth on a spot near the proposed village and plant a jand tree on it. Houses are then built. The first man who dies in the village whether he be a Brahman or Jat or Chamar is burnt or buried on this mound and on it is built a masonry shrine which is named after him. The fortunate man is deified as the Bhumia or Earth-god and worshipped by Hindus of all classes in the village, being looked upon as its sole guardian deity. As we move toward the east we find more of the Brahmanical orthodox ideas coming into play in the cultural make-up; hence are found the temples built by landlord Jats and usually given to some mendicant (sadhu). Almost always these temples are situated outside the village proper's habitations.

ROADS

Though the external road system of the Jat villages is very extensive and well-developed, the internal system is of a primitive nature. The Jat villages are seldom situated on the railway lines, rather they are always found at some distance from the nearest road or nearest railway station.

EXTERNAL SYSTEM

Road is the essential uniting link between two villages. The Jat villages are in no case isolated, since the material prosperity has enabled the Jats to construct an elaborate pattern of village link roads. In nearly all the cases the **nucleated compact villages are coupled with a radial pattern of communication lines consisting mostly of cart-tracks (Dagra)** which join the nearby local highway and act as feeder roads. The dagras are floored with mud and lie on the same level as that of the fields adjoining them. In the rains the paste-like mud makes movement impossible except on a cart (gaddee). Sugarcane, being a cash-crop, must move out of the villages, hence it requires an elaborate system of cheap and efficient transportation. The relationship between these roads and sugarcane economy is best proved by the fact that the busiest traffic on the roads is to be observed in the period of cane-crushing in sugar mills from November to March. The percentage of metalled and kankar-floored roads is rising very fast. The macadam or metalled roads end at the boundary of the village from where a mere cart-track enters into the village. Dagra is of course highly useful because the harvesting and transportation of sugarcane is done in winter which is the dry season. The numerous canals and distributaries all serve as means of transportation because on both sides of these, for scores of miles, the embankments can be very efficiently used as roads. Canal roads are used largely for pedestrian and cycle-traffic as other vehicular traffic is barred by certain canal laws. Utility however remains great.

INTERNAL SYSTEM

Within the village the road system is highly intricate and complex. The cart-track that enters into the village is soon divided into innumerable tortuous and narrow lanes almost always ending blind and it is often very difficult to find the way out from the centre. Lanes are not only narrow but also winding. No road runs across the main body of the village but when the road is built through the village it always hugs the boundary of the village. The road runs in the form of a half-ellipse or horse-shoe. The breadth of the roads is of course directly related to the size of the vehicles, which are rather small and old-fashioned carts drawn by bullocks. Transportation like other elements of village economy and life remains as ancient as before. There are extensive brick-floored

lanes (kharenja) found in the denser parts of the settlement. The horse-shoe shaped road serves the objectives of seclusion and defence. 'The streets become narrower and more irregular, not only because of over-crowding but also because they offered thereby greater resistance to attacks.'¹⁵ This horse-shoe shaped road has only two mouths often opening on the same side. The road like the village is a closed entity. Though there is a labyrinthine pattern of gullies and narrow lanes within the village, these do not divide it into minute sectors, their mysteriousness is sometimes overwhelming. In the southern zone the villages are isolated and external system of roads consists only of cart-tracks on the rocky floors.

MARKETS

The commercial core as conceived in Urban Geography is almost non-existent in the Jat villages or at best is composed of a few shops only but never forming a compact core. The shops are found scattered in the villages at odd places. Ephemeral shops are crudely constructed near the temples or other places where fairs are annually held. Instead of shops a large site is often reserved for weekly markets (painth). The actual site where the painth is held is in general always found at the boundary of the village near some distributary from which a large supply of water is always available. It is also found situated near a tank or a pond (jhor). In many villages the day on which the distributary receives water from the main branch is the market day. In a few big villages there is a regular bazaar of several shops.

WATER BODIES

The water bodies are in general artificial creations and hence very important elements in the cultural landscape. Wells, tanks and distributaries especially play important parts in the village economy.

PONDS (JHOR)

Every Jat village has one or more pond (jhor) adjoining it and always situated outside the settlement area. These are almost always artificial ponds created by the digging of earth for the construction of the houses at the time of the settlement of the villages. Hence some ponds are as old as the villages themselves. The jhor water is used by the low-caste peoples and also for the bath of animals. Otherwise their human use is very restricted. Water-nuts (singhara) are grown along with lotus flowers. The natural lakes (jhils) are mainly low-lying tracts of waste-lands subject to annual inundations locally known as dahars and ill-defined natural drainage lines locally known as sotis.

TANKS

Tanks are common features in the southern zone while in the northern zone their occurrence is very rare except in those areas of the extreme west where rainfall is not only deficient but also irregular. Tanks are rather easily built in the southern zone. All tanks are artificially constructed and used specially for irrigation. Tanks are in general rectangular in form. Sometimes embankments are also constructed on its sides.

WELLS

Every Jat village contains a large number of wells, mostly lined and pucca. The number of wells is always far greater in the villages having larger population, as also in the village of the northern sector. The wells in the khadar are generally kuchcha since due to the annual floods they often collapse but in

the central upland or bangar the wells are pucca and the walls of the wells are lined with laknaori bricks. The distribution of wells is directly related to caste-structure. Wells belonging and used mainly by a caste are situated in its own special habitation sector. The three broad types of wells on the basis of castes are, wells meant for Jats and other higher castes who have no caste-prejudice against each other; wells meant for Muslims and wells meant for scheduled-caste peoples. Even the wells meant for scheduled-caste peoples are further subdivided amongst its sub-castes. A well meant for Chamars cannot be used by Bhangees who come at the lowest rung in the ladder of the caste-hierarchy. Wells are dug not only within the settlement but also outside it amidst the fields, the former used for domestic purposes and the latter for irrigation. The pucca wells within the settlement are of very large diameters and are very old. In the Gangetic alluvium the greater height of the water-table facilitates the construction of wells whereas in the Jumna alluvium the greater depth of the water level hampers the progress in the construction of wells. Water is lifted in metal pitchers by a rope that runs up and down on a pulley. In the southern zone the rocky sub-soil makes it difficult to dig wells, hence the number of wells is very limited.

CANALS AND DISTRIBUTARIES

Canal is the most important and typical element in the cultural landscape of the Jat village. Canals are extensively distributed in the doab and south-eastern and eastern Punjab but in the southern sector their mileage and density are comparatively little. The importance of the canals in the village economy cannot be over-emphasised. Canals have increased both agricultural security and agricultural productivity. The more important canals in the doab tract are Upper Ganges Canal, Lower Ganges Canal, Eastern Jumna Canal and their innumerable distributaries. In the districts of Eastern Punjab is the famous West Jumna Canal System. The Bhakra-Nangal Canal System is already becoming world-famous. In the southern sector Agra Canal serves the villages of Agra and Muttra but in Malwa plateau, Bharatpur and Alwar the canals become rare. Distributaries have been constructed to act as feeder channels from which brick-lined or earthen little channels (gools) have been constructed. Many big villages are situated on the main canal as these were constructed keeping proper regard for the larger agglomerations of people.

SCHOOLS

Most of the Jat villages, being very rich, contain many small buildings kuchcha or pucca, to house the schools that range from primary status to college status. The material prosperity of the northern villages being comparatively greater the school buildings are common features in the northern villages. The buildings are of course always small containing a few rooms only. The primary school building is often found in the centre of the village near a big neem or bargad tree under whose extensive shade the open-air classes are held. These buildings contain only one or two long rooms adjoining a raised mud plinth.

CONCLUSION

A Jat village is essentially the product of mediaeval age, historically, and of the plains environment, geographically. Many of its essential characteristics such as compactness, lack of roads, growth and decay have been determined by the historical forces as existing in the mediaeval age especially in the later periods of Moghul rule when the Delhi Sultanate was in the process of disintegra-

tion but the large size, cash-crop agriculture which is the basis of prosperity, the extensive system of communication between the villages and the community solidarity have been largely determined by the environment of the plains. Thus geography has helped the birth and growth of the community solidarity and material prosperity of the villages.

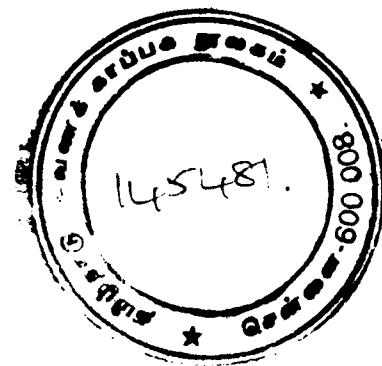
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REFERENCES

1. Mukerji, A. B. (1954). Jats, a Study in Human Geography. Geog. Rev. of India, XVI, 2, p. 28.
2. Nevill, H. R. (1904). Meerut Gazetteer, p. 103.
3. Same as 1. p. 19.
4. La Blache, Vidal de. (1950). Human Geography. (Constable, London). pp. 278, 279.
5. Richtofen, V. China II; p. 680.
6. Same as 4. pp. 316, 317.
7. Semple, E. C. (1947). Influences of Geographic Environment. (Henry Holt, New York). p. 61.
8. Same as 1. p. 14.
9. Goodrich, C. (1936). Migration and Economic Opportunity. (Philadelphia), Chapter VII.
10. Srivastava, Dharam Bhanu. (1954). The Moghul-Maratta Treaty of April 1952. Journal of Indian History, Vol. XXX, Part III, p. 249.
11. Nevill, H. R. (1909). Gazetteer, Aligarh District; pp. 170, 171.
12. Same as 1., p. 27.
13. From a personal communication from Prof. A. N. Bhattacharya, Head of the Geography Department, Balwant Rajput College, Agra.
14. From a personal survey.
15. Bogle, J. M. Linton. (1929). Town Planning in India, p. 15.



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