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# Vegetational history and palaeoenvironment of Hirpur Locality-I, Lower Karewa, Kashmir

H. P. Gupta & Chhaya Sharma

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The present palynostratigraphical studies carried out on the exposed sediments of Hirpur Locality-I, lying under the earlier worked out Hirpur Locality-III, has revealed continued dominance of arboreal elements in the sequence depicting comparative preponderance of spruce and oak, although showing abrupt change in their values. The palynodata thus obtained has been interpreted to reconstruct the palaeovegetation pattern and to deduce the possible climatic fluctuation witnessed during the course of sedimentation of the 40 m thick lithocolumn. The pollen diagram has been divided into four pollen assemblage zones.

**Key-words**—Palynostratigraphy, Palaeoenvironment, Palaeovegetation, Lower Karewa (India).

H. P. Gupta & Chhaya Sharma, Birbal Sabni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India.

## सारांश

काश्मीर में अग्रि करेवा की हीरपुर संस्थिति-प्रथम का वनस्पतिकीय इतिहास तथा पुरावातावरण

हरीपाल गुप्ता एवं छाया शर्मा

हीरपुर संस्थिति-प्रथम में अनावरित अवसादों के परागणुस्तरीय अध्ययन से इस अनुक्रम में वृक्षीय अवयवों की अविरल प्रचुरता व्यक्त होती है। तुलनात्मक दृष्टि से इन अवयवों में स्प्रूस एवं ओक की बाहुल्यता है हालांकि इनकी मात्रा में अनायास परिवर्तन देखा गया है। उपलब्ध परागणविक आँकड़ों के आधार पर पुरावनस्पतिक स्वरूप तथा इस 40 मीटर मोटे अवसादी स्तम्भ के अवसादन के समय संभव जलवायवी परिवर्तनों की भी व्याख्या की गई है। परागकण-चित्र चार परागकण समुच्चय मंडलों में विभाजित किया गया है।

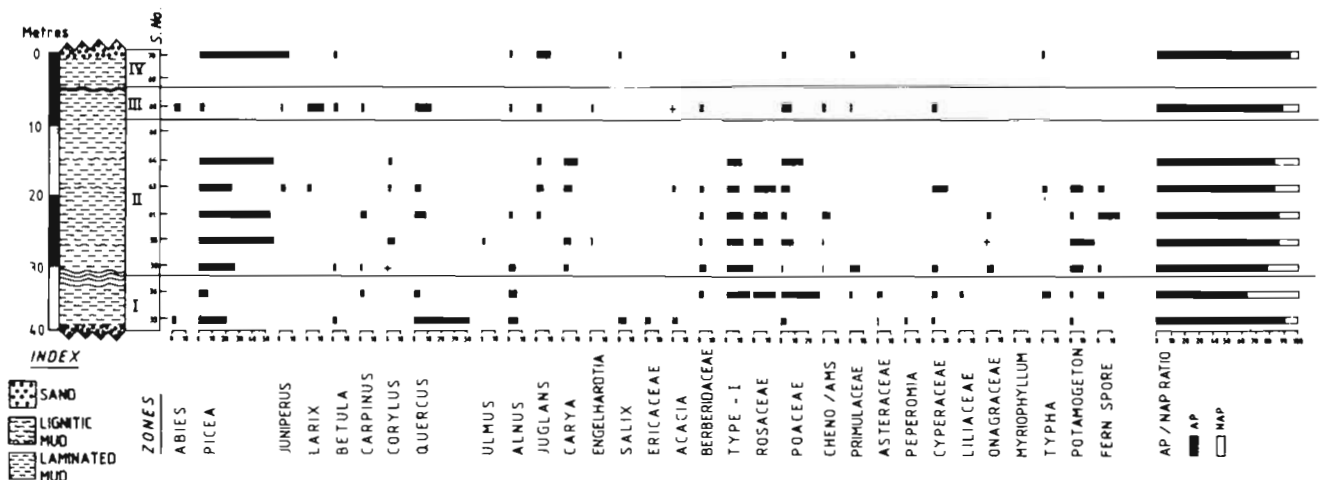
THE present investigations carried out on the exposed sediments from Hirpur Locality-I (33°42'N-75°41'E) cover the downward extension of earlier worked out Hirpur Locality-III (Gupta *et al.*, 1984a, 1984b) of Lower Karewa in Kashmir Valley. Apparently, the lithofacies in Hirpur Locality-I is very similar to Hirpur Locality-III. The sediments in Hirpur Locality-I consist of laminated as well as lignitic mud with distinct overlying and underlying beds of sand. The former was found palynologically barren whereas, later yielded pollen in appreciable frequency. The techniques employed for the present analysis of soil samples are the same as already discussed in an earlier communication (Gupta *et al.*, 1984a).

## POLLEN DIAGRAM AND COMPOSITION

The pollen analysis of nine samples from

different horizons of a 40 m thick lithocolumn from Hirpur Locality-I has revealed the predominance of *Picea* and *Quercus*, together with other broad-leaved arboreal elements, which is divisible into four pollen assemblage zones, viz., HLI-I, HLI-II, HLI-III and HLI-IV in ascending order. These zones are primarily aimed to interpret palynological data so as to throw light on the palaeovegetation and if possible to decipher the corresponding climatic changes during the period of sedimentation.

**Zone HLI-I**—The early phase of this zone is recognized by exceedingly high values of *Quercus*, followed by *Picea*, *Alnus*, *Salix*, *Acacia*, Ericaceae and low frequency of *Abies*. The scarce non-arboreal vegetation is represented by poor values of Poaceae, Asteraceae, Cyperaceae and *Peperomia*. AP/NAP ratio has demonstrated over dominance of arborescent vegetation.



**Text-figure 1**—Pollen diagram from Hirpur Locality-I, Lower Karewa, Kashmir (percentages calculated in terms of total terrestrial pollen)

The later phase of this zone is marked by steep fall in the values of *Quercus* and *Picea* coupled with the appearance of *Carpinus* and Berberidaceae, and disappearance of *Salix* and Ericaceae. However, *Alnus* remains static in its values. *Arcicolpites birpurensis* (Gupta *et al.*, MS) and Rosaceae also appear in this phase showing fairly high values—maintaining 17 per cent each. The values for Poaceae markedly improve to reach its maximum whereas, other non-arborescences such as Asteraceae, Cyperaceae and Liliaceae are lowly present. Primulaceae in low frequencies and *Typha* in moderately high values appear in this phase. *Potamogeton* maintains almost same low values. The emergence of ferns exhibit low percentage. AP/NAP ratio shows considerable depression in the overall arboreal vegetation as compared to the early phase.

**Zone HLI-II**—This zone is identified by the preponderance of *Picea* pollen throughout, indicating the existence of spruce forest. The broad-leaved element *Quercus* which was once most dominant declines to moderate values and remains confined only to the middle of the zone. Other associates of *Picea* forest namely *Juniperus*, *Larix*, *Betula*, *Carpinus* and *Ulmus* are sporadic in this zone. *Corylus* remains confined to this zone only with fluctuating values. *Alnus* continues its high values till the beginning of this zone and then dwindles down in the middle and disappears in the upper half of the zone. However, *Carya* too, is restricted to this zone in good frequencies right from the base of the zone showing an upward trend in its values. *Juglans* appears about in the middle of the zone accompanied with *Carya* up to upper half of the zone, the later with comparatively high values.

Amongst the shrubby taxa, Berberidaceae and Rosaceae are recorded throughout the zone in low and high values respectively, but both disappear at the top of the zone. *Arcicolpites birpurensis* (Type-1 pollen) in pollen diagram is represented in considerably high values throughout the zone.

The non-arborescences are depicted distinctly in low frequency. Even Poaceae is poor throughout the zone except for considerable improvement in its values at the top of the zone. The other herbaceous taxa such as Chenop/Ams, Primulaceae and Onagraceae show fairly high values but are chiefly confined to the lower half of the zone. The aquatics are represented by good frequencies of *Potamogeton* throughout the zone except for its intermittent fluctuations. *Typha* is encountered in moderate values but slightly below the top of the zone. Ferns are lowly present except their enhanced values at the middle of the zone. AP/NAP ratio indicates dominance of arborescent vegetation except that it is slightly reduced in the upper half of the zone.

**Zone HLI-III**—This is a markedly short-spanned zone as compared to the preceding two zones, i.e., HLI-I and HLI-II and is demonstrated by an abrupt fall in the values of *Picea* which has reduced to merely a fraction. The downfall of *Picea* is witnessed by the dominance of *Larix* and *Quercus* in almost equally high values, followed by *Abies*, *Betula* and *Carpinus*. *Alnus* and *Juglans* remain as before whereas, *Carya* is unrepresented and *Engelhardtia* emerges in low values in this zone. Berberidaceae continues with almost the same values. *Arcicolpites birpurensis* is surprisingly absent in this zone when compared to its tremendous increase to about 30 per cent of the total values in zone II.

The ground cover is further reduced as compared to what has been witnessed in the previous zone, and is represented by low values of Poaceae, Chenopodiaceae, Primulaceae and Cyperaceae. Aquatics and ferns remain totally unrepresented in this zone. The AP/NAP ratio again demonstrates the overall continued dominance of arboreal vegetation.

*Zone HLI-IV*—This zone is demarcated by the re-emergence of *Picea*, showing exceptionally high values of *Picea* forest along with *Juglans* and less frequent other broad-leaved arboreal elements namely *Betula*, *Alnus* and *Salix* showing much reduced values. However, *Juglans* shows fairly high values. No shrubby element is witnessed in these *Picea* woods. *Arcicarpites hircurensis*, though reappears in this zone, is in much reduced values.

Herbaceous vegetation too is poorly represented as compared to the preceding zone with scanty values of only Poaceae and Primulaceae. Aquatic elements are totally absent in this zone too, except for *Typha* which is represented in low frequencies. Non-arborescences remain distinctly scanty in contrast to the arboreal taxa present in this zone.

## DISCUSSION

The palynostratigraphical studies of the sediments from the Hirpur Locality-I demonstrate the existence of a thick *Picea* forest. Nevertheless, *Picea* forest did not remain predominant throughout the pollen sequence but it experienced two major depressions, one at the later phase of zone-I and another showing its very low frequencies during zone-III of the pollen diagram. The fluctuations in *Picea*, associated with the replacement or corresponding fluctuations in the broad-leaved elements especially *Quercus* has led to the formulation of four pollen zones through which the palaeovegetation pattern is demarcated and the data obtained is interpreted to throw light on the palaeoclimatic changes in time and space in this region of inner Himalaya.

The well-marked preponderance of *Quercus* followed by *Picea* along with associated two taxa, *Abies* and *Betula*, is suggestive of temperate and humid climate at the beginning of zone-I. Later on, at the close of this zone, both *Quercus* as well as *Picea* registered significant depression besides the disappearance of *Abies* and *Betula* indicating amelioration in the temperature or change over to the warm temperate climate.

Similarly in Zone HLI-II the restoration of *Picea*, an element of continued dominance, followed by *Arcicarpites hircurensis* and Rosaceae in good frequencies along with insignificant or sporadic

presence of other taxa is indicative of the type of vegetation sustained under cool temperate and humid climate.

Zone HLI-III has witnessed a catastrophic degradation of woods where *Picea* reduced to its ever minimum frequencies on one hand but associated with the appearance of *Larix* as a dominant element restricted to this zone only which is indicative of a cool temperate and still more humid climate comparable to the present sub-alpine zone in the north-west Himalaya.

Zone HLI-IV again reflects a change in the vegetation pattern where *Picea* restores to its maximum dominant position indicating the advent of cool temperate but dry climate.

However, it may be pointed out that the occurrence of *Arcicarpites hircurensis* in high values throughout the Zones HLI-I and HLI-II in the pollen diagram has led to the inference that the sediments of Hirpur Locality-I are in continuance with the underlying sediments of Hirpur Locality-III (Gupta *et al.*, 1984a, 1984b).

## CONCLUSIONS

Pollen analytical investigation of the sediments has led to the following conclusions:

1. Based on the changes witnessed in the palaeovegetation, the pollen diagram has been divided into four pollen assemblage zones, viz., HLI-I, HLI-II, HLI-III and HLI-IV in chronological order.
2. Arboreal vegetation remains dominant throughout the pollen diagram as compared to the non-arboreal vegetation.
3. Climatic fluctuations inferred from the worked out palaeovegetational data of different zones are summarized as under:

|              |                                                                              |
|--------------|------------------------------------------------------------------------------|
| Zone HLI-I   | —Temperate and humid climate in the beginning and warm temperate at the top. |
| Zone HLI-II  | —Cool temperate and humid climate.                                           |
| Zone HLI-III | —Cool temperate and still more humid climate.                                |
| Zone HLI-IV  | —Cool temperate but dry climate.                                             |

4. The occurrence of *Arcicarpites hircurensis* Gupta, Sharma & Yadav (MS) in Hirpur Locality-I demonstrates its downward extension in Hirpur Locality-III.

## REFERENCES

- Gupta, H. P., Sharma, C. & Yadav, R. R. (MS). A new pollen type *Arcicarpites hircurensis* gen. et sp. nov. from Hirpur Formation

- (Lower Karewa), Kashmir Valley. *Palaeobotanist* (in Press).
- Gupta, H. P., Sharma, C., Dodia, R., Mandavia, C. & Vora, A. B. 1984a. A palynological interpretation of climatic changes in Kashmir (India) during the past three million years, in: Robert O. Whyte (Ed.)—*Proc. Evolution of the East Asian environment* **2** : 553-568. Univ. of Hong Kong.
- Gupta, H. P., Sharma, C., Dodia, R., Mandavia, C. & Vora, A. B. 1984b. Palynostratigraphy and palaeoenvironments of Kashmir Hirpur Loc. III, in: D. P. Agrawal *et al* (eds)—*Climate and geology of Kashmir and Central Asia: Current trends in geology* **6** : 75-90. Today & Tomorrow's Printers & Publ., New Delhi.