LOWER GONDWANA OF NISHATBAGH, KASHMIR AND ITS SIGNIFICANCE

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ABSTRACT

The earliest plant bed of the Lower Gondwana affinity, lying at the base of the Panjal Trap in Kashmir is designated as Nishatbagh bed, giving preference over the earlier known plant beds from Nagmarg and Bren. The terms 'Nagmarg bed' and 'Bren bed' are preoccupied for the marine zones of the Agglomeratic Slate. The Nishatbagh section is the type for the Nishatbagh bed. The beginning of this bed marks the emergence of the continental phase in Kashmir during the early part (not earliest) of the Artinskian Stage.

INTRODUCTION

The special interest of the Early Permian plant beds (Permian Gondwana, KAPOOR & SHAH, Ms.) of Kashmir lies in their position, in association with the marine beds, which provide some evidence for dating the Lower Gondwana Formations of the peninsular India.

The current studies in Kashmir by the author have established the existence of at least five distinct plant horizons of the Lower Gondwana, occurring at different levels and showing change in the flora from lower to upper bed. These horizons are designated as Nishatbagh bed, Vihi bed, Marahoma bed, Munda bed and Mamal bed. The Nishatbagh bed is the earliest plant horizon in Kashmir and lies at the base of the Panjal Trap and over the pyroclastic division of the Agglomeratic Slate.

The record of the presence of the plant bed at Nishatbagh is by BION AND MIDDLEMISS (1928, p. 10). They report obscure plant impressions from fine slate (65-90 m) becoming quartzite at the junction with the Panjal Trap. Besides Nishatbagh, they report another locality of the plant bed with *Gangamopteris*, *Glossopteris*, and *Psygmophyllum* in the same position and with similar lithology at Nagmarg. BOSE (1925) also discovered a plant bed at Bren Spur, with *Gangamopteris* sp. and *Glossopteris angustifolia*. This spur is close to Nishatbagh and the plant bed is in the same position as in above localities.

The finds of the plant beds at the base of the Panjal Trap revised the then existing concept of MIDDLEMISS (1909, 1910) of a single stratigraphical position of the Lower Gondwana beds (=Gangamopteris bed), i.e. only above the Panjal Trap. BION AND MIDDLEMISS (1928) even after recognising two different positions of these beds considered that "both are identical and do not signify much, since the outpouring of the trap might have been a rapid proceeding in spite of the colossal scale." This view, of course now, does not stand as between the two plant beds (Nishatbagh bed and Vihi bed) the thick Panjal Trap includes innumerable flows, flow agglomerates and intertrappean shales, clearly suggestive of breaks in the flow activity. It is undoubtedly difficult to find the durations of the breaks.

Nishatbagh, the famous Mughal garden of Kashmir is situated close to the Nishatbagh village, at a distance of 17 kilometres from northeast of Srinagar on Srinagar-Harwan road. The Nishatbagh section is described from East-West spur, east of the garden, which can be approached by crossing the boundary wall of the garden, from where it is about a kilometre.

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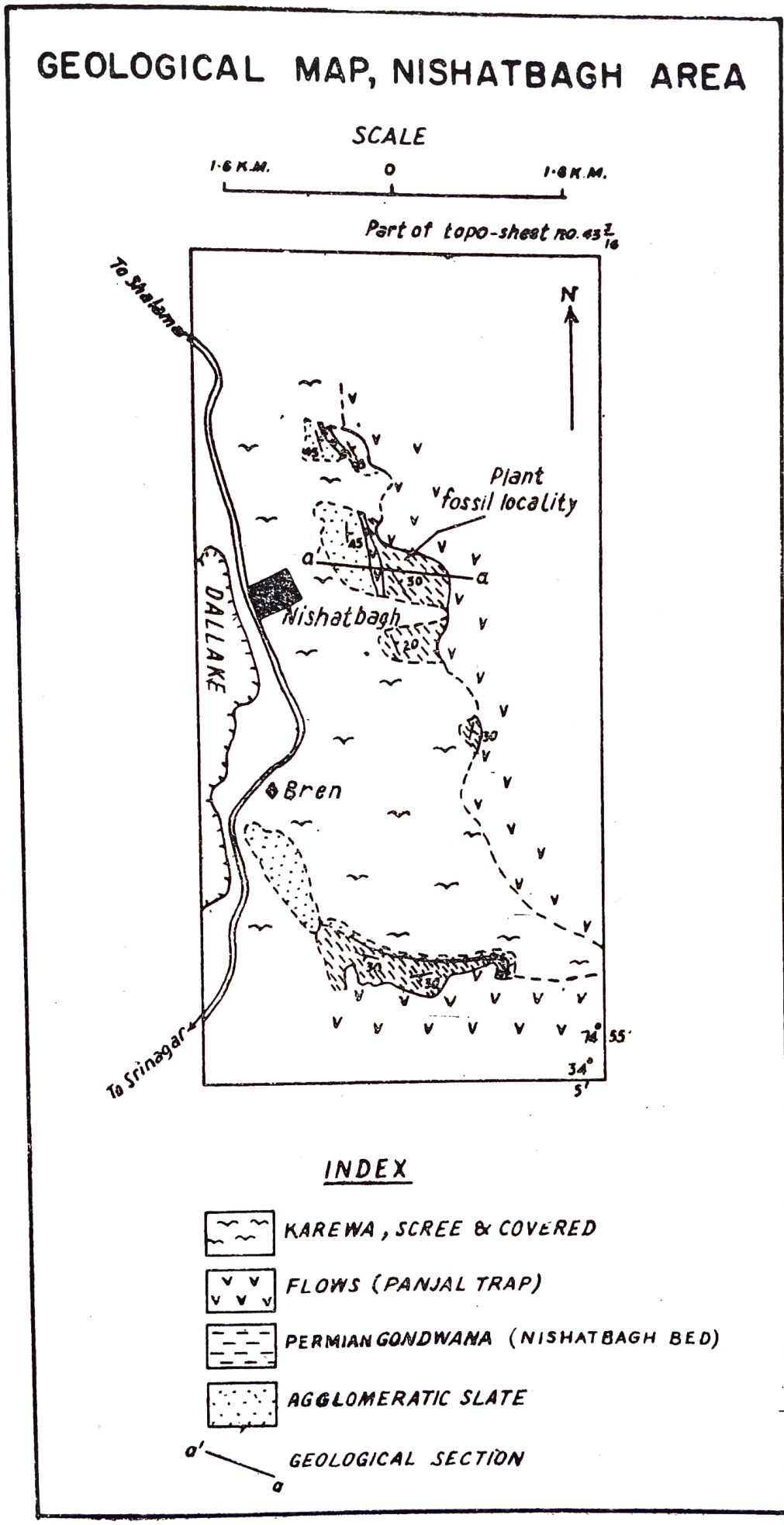

GEOLOGICAL MAP, NISHATBAGH AREA
SCALE
1·6 K.M.
0
1·6 K.M.
Part of topo-sheet no. 43 J/16
To Shalimar
N
Plant fossil locality
a
a
45
30
Nishatbagh
20
DALLAKE
30
Bren
To Srinagar
74° 55'
34° 5'
INDEX
KAREWA, SCREE & COVERED
FLOWS (PANJAL TRAP)
PERMIAN GONDWANA (NISHATBAGH BED)
AGGLOMERATIC SLATE
a'
a
GEOLOGICAL SECTION

Text-fig. 1

NISHATBAGH BED

The plant bed of the Lower Gondwana affinity at the base of the Panjal Trap and lying over the pyroclastic division of the Agglomeratic Slate has been designated as Nishatbagh bed. They are known as isolated outcrops from various localities of Dal Lake, Basmai, Nagmarg, Tragbal etc. but famous are Nagmarg, Bren and now Nishatbagh.

The section of Nagmarg, in the geological literature, is famous for its fauna of the upper division of the Agglomeratic Slate, but the outcrops of the various rock units are scattered and concealed under thick soil cover and vegetation. The plant bed is also recognised from a very small outcrop. The other section at Bren has a well developed section of the marine Agglomeratic Slate but the plant bed is not fully developed due to structural disturbances.

The Nishatbagh spur, on the other hand, has a complete development of the plant bed and is not much disturbed. It is, therefore, selected a type for the Nishatbagh (plant) bed giving preference over the earlier known sections of Bren and Nagmarg. The term 'Bren bed' and 'Nagmarg bed' are preoccupied for *Eurydesma-Deltopecten* assemblage zone and for *Syringothyris nagmargensis* assemblage zone, of the Agglomeratic Slate (Bion & Middlemiss, 1928 ; Reed, 1932 ; Shah & Sastry, 1975).

Bion and Middlemiss (1928) preferred to include this plant bed within the Agglomeratic Slate but the present author has elsewhere (Nakazawa *et al.*, 1975) suggested that it should be excluded from this formation, as it outlines the subaerial parts (emergence of the continental phase) of the marine Agglomeratic Slate (revised definition, Nakazawa *et al.*,1975).

The continental Nishatbagh bed and the marine Agglomeratic Slate are separated by a volcanic flow. Underlying the flow are tuffaceous shale, tuffaceous slate and tuff with cinders, volcanic bombs etc. and rich marine fauna. The lithology of this pyroclastic division is very clear at Bren Spur. The flow mentioned above is II volcanic flow of Bren section and is also included within the Agglomeratic Slate (Nakazawa *et al.*, 1975).

GEOLOGY

The rocks of the Agglomeratic Slate, Nishatbagh bed (Permian Gondwana) and Panjal Trap are exposed on the hill slopes and spurs of the Dal lake area (Text-fig. 1). The Nishatbagh bed can be traced even further south in the neighbourhood of Pari Mahal and beyond, in ravine cuttings, which occasionally show plant fossils. The good localities for fossils are, however, only Bren and Nishatbagh.

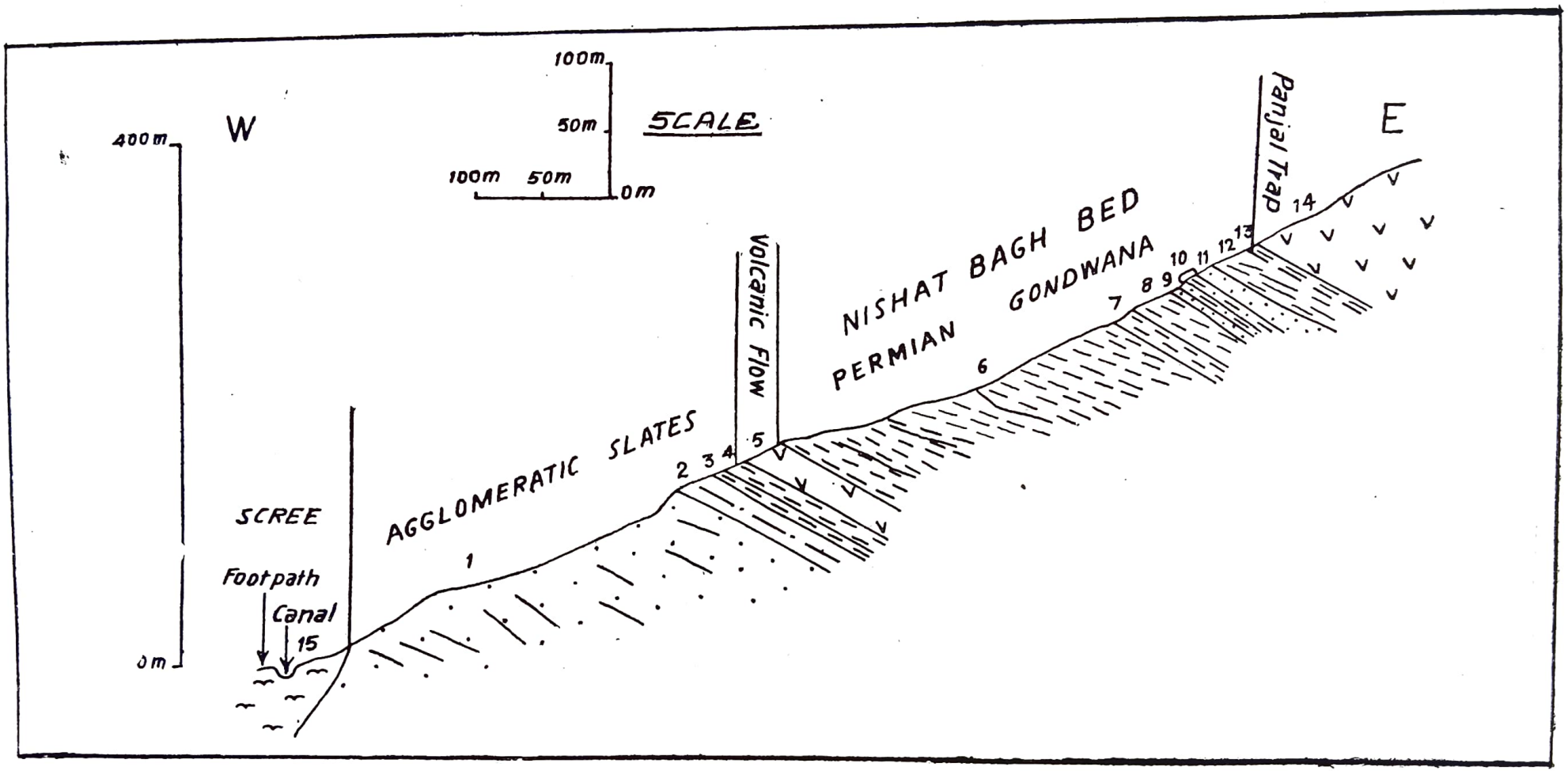
The geological section and the geological column of Nishatbagh spur are given in Text figs. 2, 3, and Table. 1.

Agglomeratic Slate

The units 1 to 5 are included under the pyroclastic division of the Agglomeratic Slate based on the study at Bren spur by the author (Kapoor & Shah, Ms.). The lithological succession of the formation of Nishatbagh does not differ with the Bren, although only a part of the division is exposed in this spur. The volcanic flow corresponds in all respects with the second volcanic flow of the Bren and is considered to mark the upper limit of the Agglomeratic Slate (Nakazawa *et al.*, 1975).

Tuff and shaly tuff vary in colour from various shades of grey, cream and sometimes, light green; these are coarse grained and friable. Tuffs show rounded, sub-rounded and sub-angular cavities of various sizes and are distributed haphazardly. The cavities appear to have formed by the removal of rock fragments (? agglomerates), cinders, volcanic bombs and sometimes fossils. The petrology of the similar rocks of Bren has already been described by Ganju and Srivastava (1961) and of volcanic bombs by Misra (1948).

GEOLOGICAL SECTION, NISHATBAGH SPUR



Text-fig. 2

Table 1

Formation	*Lithology*	*Thickness*
Panjal Trap	Basic and acid flows with thin intertrappeans of tuffaceous slates	
Nishatbagh bed (278 m)	10. Sandstone and shale alternations	8 m
	9. Shale with varves ? (Varvites ?)	20 m
	8. Sandstone with ripples	15 m
	7. Shale and sandstone alternations	15 m
	6. Dark shale with plant fossils	200 m
Agglomeratic Slate (pyroclastic division) (+378 m)	5. Basic flow (?pyroxene-andesite) (II volcanic flow of Bren)	25 m
	4. Dark tuffaceous slate	25 m
	3. Shale and tuff interbands	8 m
	2. Tuffaceous shale with fragmentary invertebrates	20 m
	1. Ash colour tuffs with lapillae, cinders and volcanic bombs and also invertebrate fossils	+300 m
	Base covered under scree and Karewa	

The marine fossils from this division include brachiopods, bivalves, gastropods, bryozoans, trail marks probably of annelids. A few worth mentioning are :

Reedoconcha, *Buxtonia*, *Strophalosia*, *Praeundulomya*, *Sanguinolites?*, *Buccania*, *Warthia*, *Pleurotomaria*, *Fenestella*, etc.

The flow rock is light greyish green, with plenty of pyrite hollows. Buff colour felspar and green minerals are seen in hand specimens. Petrologically rock has been identified as pyroxene-andesite.

Nishatbagh Bed (Permian Gondwana)

The dark colour tuffaceous shale is the main constituent of this bed, although in the upper part the bed becomes arenaceous. The presence of varves in the unit 9 is interesting, and is likely due to severe cold climate for short duration. The recognisible plant fossils are seen in the middle part of the unit 6, although fragmentary leaf and stem are present in the lower part of this shaly unit and no fossil in the upper part.

The plant fossils from this bed include :

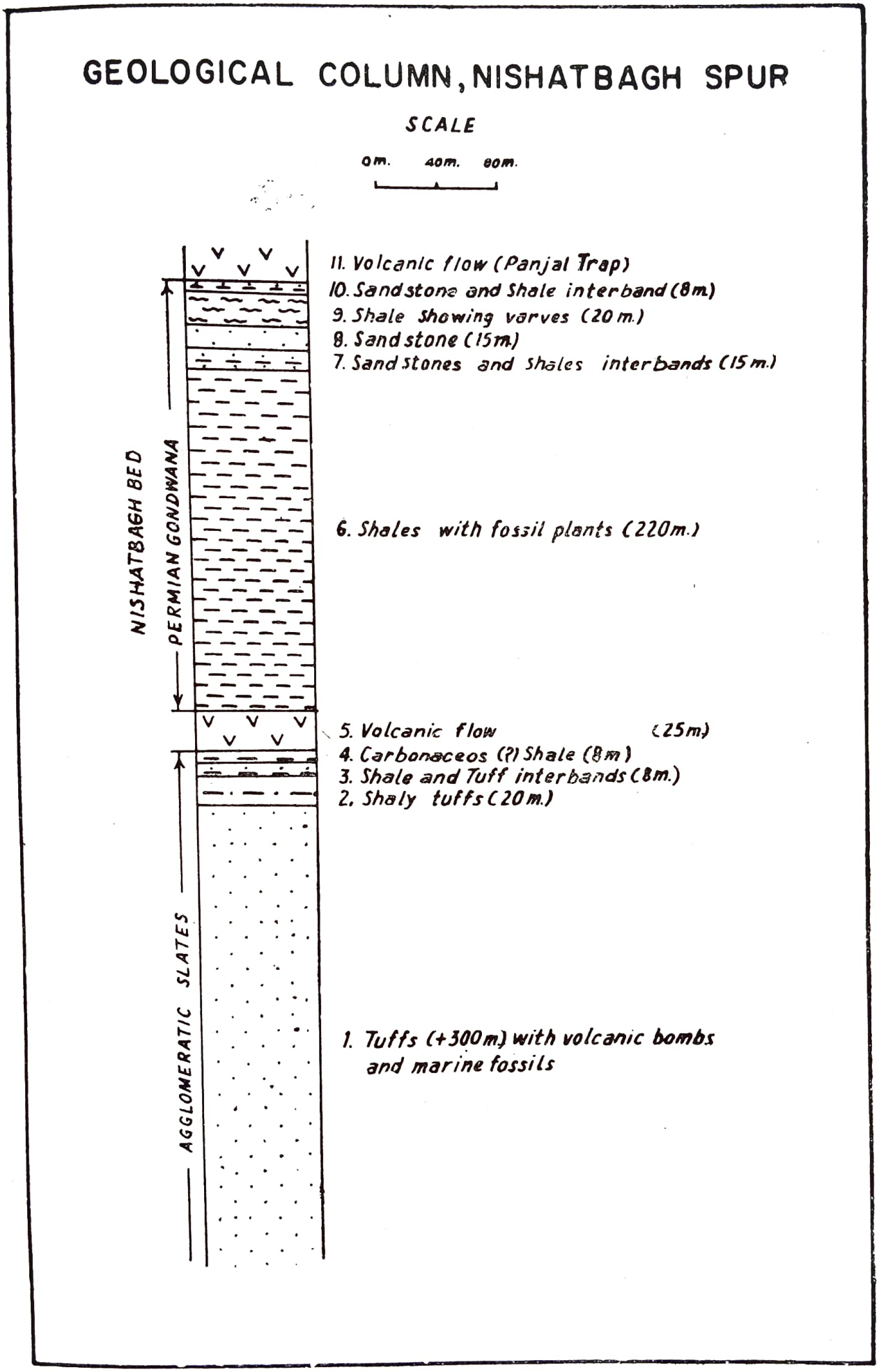
Gangamopteris angustifolia, *G. kashmirensis*, *Glossopteris angustifolia*, *Gl. indica?*, *Psygmophyllum haydeni*, *Cordaites hislopi*, *Samaropsis*, *Cordaicarpus?* and stem impressions, etc.

The leaves of *Gangamopteris* and *Glossopteris* present in this bed have narrow lamina and small size with an exception of a single specimen identified tentatively as *Glossopteris indica*. The *Gangamopteris* is the dominating element of the bed. The bed has not shown any marine mega- or micro-fossils. The spores present are ill preserved and unsuitable for identification.

The Nishatbagh bed is succeeded by the Panjal Trap.

REMARKS

The Lower Gondwana of Kashmir, (Permian Gondwana) popularly known as 'Gangamopteris bed' has always been treated as a single horizon though different positions of the plant beds were recognised by pioneers. The Gangamopteris bed (Vihi bed of the


GEOLOGICAL COLUMN, NISHATBAGH SPUR
SCALE
0m. 40m. 80m.
11. Volcanic flow (Panjal Trap)
10. Sandstone and Shale interband (8m)
9. Shale showing varves (20 m.)
8. Sandstone (15m)
7. Sandstones and Shales interbands (15 m.)
6. Shales with fossil plants (220m.)
5. Volcanic flow (25m)
4. Carbonaceos (?) Shale (8m)
3. Shale and Tuff interbands (8m.)
2. Shaly tuffs (20 m.)
1. Tuffs (+300m) with volcanic bombs and marine fossils
NISHATBAGH BED
PERMIAN GONDWANA
AGGLOMERATIC SLATES

Text-fig. 3

author) was introduced by HAYDEN (1907) to the plant bed discovered by F. NOETLING in 1902 at Risin spur in Khunamuh ; the designation was based on the dominance of the *Gangamopteris* (rather only of the *Gangamopteris kashmirensis* Seward) over other elements. No specimen of the *Glossopteris* has so far been found in the Gangamopteris bed (*sensu stricto*). MIDDLEMISS (1910), however, included Golabgarh and other localities within this plant bed, where he definitely recognised two different horizons of *Gangamopteris* and *Glossopteris*. To such beds, WADIA (1928, 1934) preferred to call Lower Gondwana bed, rather the Gangamopteris bed. HAZRA AND PRASAD (1957) were the first to point out different nature of the plant beds in Kashmir. They considered the plant bed of Upper Munda in Pir Panjal to be higher than plant bed of Vihi, still they preferred to include Munda bed within the Gangamopteris bed. In their collection *Gangamopteris* is a rare element. CHAKRAVARTI (1968) made a clear analysis of the plant beds of Kashmir and defined Gangamopteris bed in a restricted sense, i.e. the plant bed where a flora in which *Gangamopteris* is the dominant element should be called the Gangamopteris bed.

SHAH AND SASTRY (1975) in their recent publication have recognised two plant beds in Kashmir, viz. Gangamopteris bed A and Gangamopteris bed B. Gangamopteris bed B refers to the Gangamopteris bed of Vihi area included by the present author under Vihi bed, while Gangamopteris bed A is Nishatbagh bed of the present paper. They have, however, interpreted incorrectly the position of the Nishatbagh bed between Bren bed (*Eurydesma-Deltopeceten* assemblage zone) and Productus bed (*Taeniothaerus-Buxtonia* and *Buccania-Warthia* assemblage zones); while in their section of reference at Bren, it actually overlies the Productus bed. This position of Nishatbagh bed is very clear in the descriptions of BION AND MIDDLEMISS (1928), BOSE (1925) and also the observations made by the present author (NAKAZAWA *et al.*, 1975). It is, therefore, very clear that the position of the Gangamopteris bed A in Table of SHAH AND SASTRY (1975), is actually that of the Gangamopteris bed B. Gangamopteris A and B are separated by thick Panjal Trap.

The Nishatbagh bed and Vihi bed differ considerably with each other in lithology. The Nishatbagh bed is mainly constituted of tuffaceous slate and shale of dark colour with development of arenaceous facies in the upper part. The Vihi bed, on the other hand, has varieties of rock units viz. novaculite, limestone, tuff, siliceous shale, calcarinite, pebble layers, arenite etc. All these units are thinly bedded. In Nishatbagh bed, there is no vertebrate fauna while Vihi bed includes fishes and amphibians, which are characteristic of this particular bed of Kashmir. Although *Gangamopteris kashmirensis*, species of *Psygmophyllum* and *Cordaites* are common in both, but species of *Glossopteris* which are scanty in the Nishatbagh bed are not found at all in the Vihi bed.

There is no support from fossils to consider Nishatbagh bed as marine deposits. The underlying succession, on the other hand has marine fauna even in the uppermost sedimentary layer. KAPOOR (in NAKAZAWA *et al.*, 1975) believes that the underlying Agglomeratic Slate is the effect of composite diastrophic changes in the basin. According to KAPOOR AND SHAH (Ms.) the Agglomenatic Slate is divisible into diamictite and pyroclastic divisions. The lower part of the formation is formed on the depression in the rising crust, while the pyroclastic part both in depressions and raised portions. The Nishatbagh bed outlines the subaerial part of the succession and is, therefore, separated from it.

The distribution cycle of the fauna of the pyroclastic division of the Agglomeratic Slate, shows a change from *Taeniothaerus-Buxtonia-Polypora* assemblage to *Buccania-Warthia* assemblage with almost disappearance of bryozoans. The gastropod and the bivalve fauna of the uppermost part of the pyroclastics occurs usually as small pockets in the tuffaceous rock. Such types of faunal changes from lower to upper with bellorophonotid distribution

in the upper horizon within small pockets have been considered to show extreme shallowing of the marine basin.

CHAKRAVARTI (1968) made a brief review of the Gangamopteris bed of Vihi area, and pointed out its correlation with Carboniferous or Permo-Carboniferous (as considered by previous workers). But his view is ruled out because of the presence of characteristic Early Permian fish and amphibian fauna. He correlated Gangamopteris bed (Vihi bed) with the Rikba Stage of the Talchir Series of the Peninsular India and not with the Karharbari. In Karharbari, according to him, *Glossopteris* element equals *Gangamopteris*. Such a position, according to present author, is seen in Marahoma bed of Kashmir. CHAKRAVARTI (1968) further considers the age of the Gangamopteris bed correlatable to Manendragarh marine bed and Eurydesma-Conularia bed of the Salt Range, and assignable to an Artinskian age. He also thinks that the Umaria marine bed is likely to be the horizon of Karharbari and basal Kungurian in age.

CHAKRAVARTI (1968) has not suggested any thing about the Nishatbagh bed, although it was known earlier at Bren and Nagmarg. His correlation of Gangamopteris bed with *Eurydesma* zone or Manendragarh bed does not justify the geological set-up of Kashmir stratigraphy. At Bren Spur, the *Eurydesma-Deltopecten* assemblage zone is 600 or more meters below the Nishatbagh bed. The Nishatbagh bed and Gangamopteris bed are separated from each other by several thousand metre thick Panjal Trap. The *Eurydesma-Deltopecten* assemblage, undoubtedly, be correlated with Eurydesma-Conularia bed of the Salt Range and Manendragarh bed but not with the Gangamopteris bed, i.e. Vihi bed of the present author, which is much higher. The Nagmarg fauna of Bren Spur, i.e. Productus bed which lies above *Eurydesma-Deltopecten* assemblage zone has already been considered by DICKINS AND THOMAS (1959), THOMAS (1967), WATERHOUSE (1970) and SHAH AND SASTRY (1975) to represent the Umaria marine bed. The consideration of a basal Kungurian to Umaria marine bed by CHAKRAVARTI does not arise if Productus bed of Bren is homotaxial to it, as it occupies much lower stratigraphic position with the Vihi bed. CHAKRAVARTI's assignment of an Artinskian age to Vihi bed is undisputable but it does not represent the entire Artinskian of the Standard Scale, rather only a part of the middle.

SHAH AND SASTRY (1975) and ACHARYA AND SHAH (1975) made further improvements in Kashmir's Early Permian faunal and floral stratigraphy by indicating Vihi plant bed to be Artinskian, Productus and Nishatbagh bed to Sakmarian and Bren bed, i.e. *Eurydesma-Deltopecten* assemblage zone to be Asselian. They have, however, shown Nishatbagh bed in an incorrect position.

Now, if we consider the Kashmir sections of Lower Permian with the Salt Range, picture emerges a bit different from above workers. The Eurydesma-Conularia bed, which is definitely correlatable to Bren bed of SHAH AND SASTRY (1975), is considered to be Late Asselian by TEICHERT (1965) and KÜMMEL AND TEICHERT (1970). The other members of Nilawan Group and lower part of the Amb Formation has fauna of *Taeniothaerus* and other brachiopods which can easily correlate with the upper division of the Agglomeratic Slate. In Salt Range, the succession referred above has been considered to represent entire Sakmarian and also early part of Artinskian. This range is also agreeable to the younger part of the Agglomeratic Slate. Automatically, this brings the Nishatbagh bed in the Early Artinskian, but not the basal. In Salt Range the plant bed is reported in the youngest part of the Amb Formation, with two distinct horizons of *Gangamopteris* and *Glossopteris* (TEICHERT, 1965).

This set-up of the plant bed appears to be as that of Marahoma and Golabgarh in Kashmir, where Vihi bed with prolific *Gangamopteris* is succeeded by Marahoma bed

with both *Glossopteris* and *Gangamopteris*. The equivalent of Nishatbagh bed in the Salt Range section, therefore, is within the Amb Formation and below the plant beds.

The Nishatbagh bed, the earliest known Lower Gondwana horizon of Kashmir, therefore, is concluded to have appeared in the early Artinskian, but not the earliest. It also shows the emergence of the land conditions.

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