

ON THE STRATIGRAPHY OF BHADARWAH AND BHALLESH, JAMMU AND KASHMIR

H. M. KAPOOR

84, B. Nirala Nagar, Lucknow 226007

ABSTRACT—The Bhallesh basin, mentioned in the paper includes areas of Bhadarwah and Bhallesh of Jammu and Kashmir. Its stratigraphy is significant in delineating the palaeogeography of Palaeozoic and Mesozoic. The same has been discussed in the paper. A review of the stratigraphy described by McMahon (1882, 1883, 1885) for the adjoining area is also dealt with.

INTRODUCTION

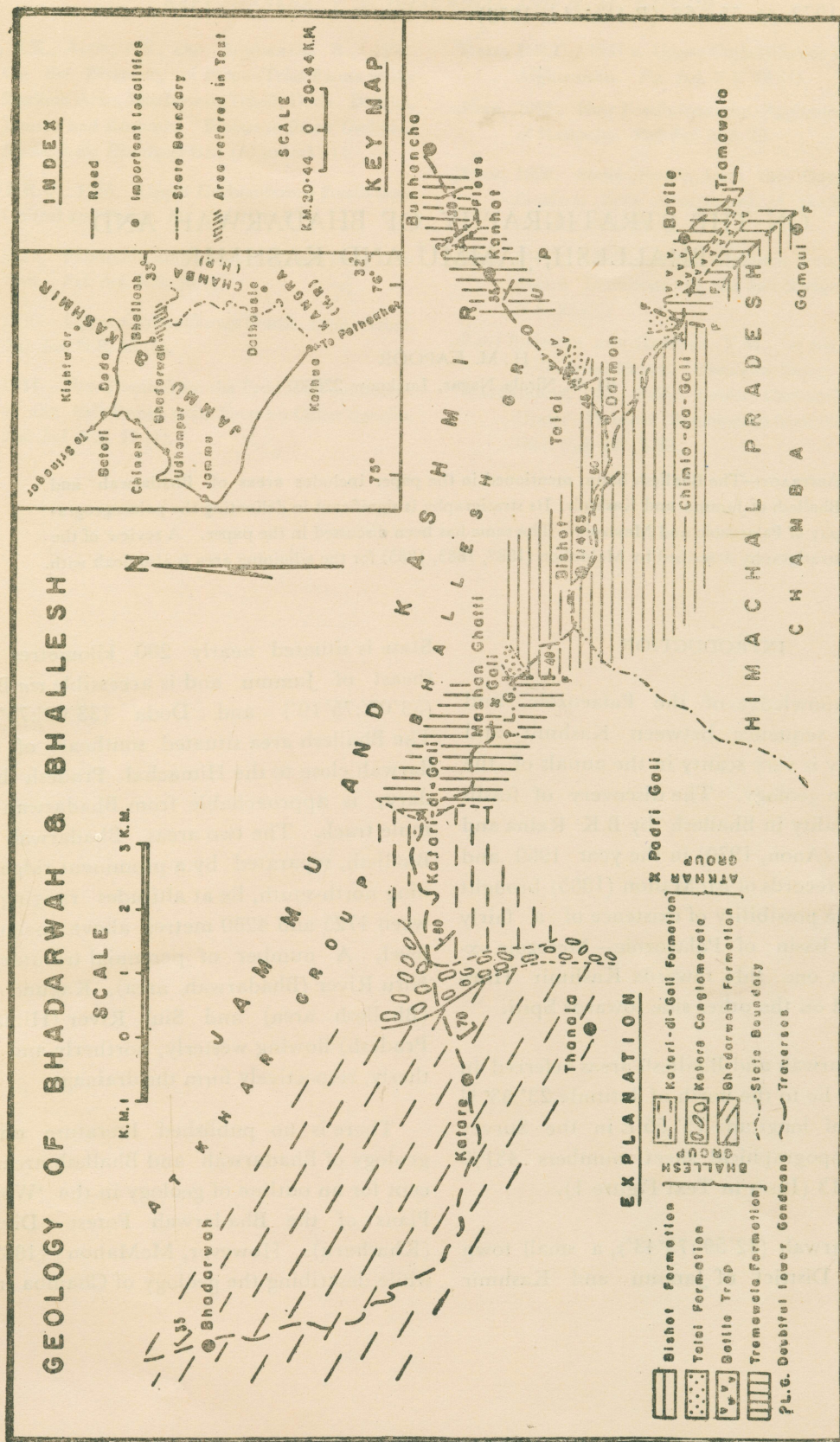
The knowledge of the Palaeozoic, and Mesozoic sequence between Kashmir and Spiti valley is very scanty in the annals of the Himalayan geology. The discovery of fossils from a locality in Bhallesh by B.K. Raina and B.K. Alok (Anon, 1970) in the year 1969 and the earlier records of McMahon (1885) brought to light the possibility of existence of a fairly extensive basin of Palaeozoic—Mesozoic extending on one side towards Kashmir Himalaya and on the other side towards Spiti.

Bhadarwah and Bhallesh areas referred in this paper lie to the north of latitude $23^{\circ} 53' N$ and west of longitude $75^{\circ} 55' E$ in the Survey of India topographical sheet numbers 43P/9 and 43 P/13 (Inset in Text Figure 1).

Bhadarwah ($32^{\circ} 59': 75^{\circ} 43'$), a small town of Doda District of Jammu and Kashmir

State is situated nearly 200 kilometres northeast of Jammu and is accessible *via* Batoti ($33^{\circ} 07': 75^{\circ} 19'$) and Doda ($33^{\circ} 09': 75^{\circ} 32'$). The Bhallesh area situated southeast of Bhadarwah close to the Himachal Pradesh boundary, is approachable from Bhadarwah by a mule track. The two areas, Bhadarwah and Bhallesh, separated by a prominent ridge running north-south, lie at altitudes ranging between 1725 and 4280 metres above mean sea level. A number of perennial tributaries of Niru River (Bhadarwah area), Kagune Gad (Bhallesh area) and Siul River (Himachal Pradesh) flowing westerly, northerly and southerly, respectively form the drainage.

There is no published literature on the geology of Bhadarwah and Bhallesh areas, except for an outline of geology in the 'Working Plans of the Bhadarwah Forest Division' (Khasharu). However, McMahon (1882-85) while describing the geology of Chamba refer-



TEXT FIGURE-1

red to many localities near Bhallesh and Bhadarwah. H.M. Kapoor (1962) and C. Mallikarjuna (1962) (in unpublished work), who mapped part of the Bhadarwah area included the metasediments within the 'Salkhalas'.

The fossil collection made by Raina and Alok from Chimlo-da-Gali ($32^{\circ}66':75^{\circ}53'$) was examined by the author. The collection showed two distinct faunae, one exhibiting Lower Permian affinity while the other Lower Trias. The author thus in the year 1970 took a few selected traverses in the area, which could give the clear picture of the regional stratigraphy as well help in differentiating formations, and also know the position of Upper Permian which was not represented in the collection of Raina and Alok. Raina, Alok and Sundaram (1971) have briefed their finding in the short note presented in the Seminar of Recent Studies in the Himalayas. The present paper however, gives the results of findings based on traverses and the study of collections made by the author and also by Raina and Alok in 1969 and Alok and Sundaram in 1970.

The traverses selected for the study are :

- i. Bhadarwah—Katari-di-Gali ($32^{\circ}57':75^{\circ}49'$),
- ii. Katari-di-Gali—Dalmon ($32^{\circ}65':75^{\circ}53'$)—Batile ($32^{\circ}55':75^{\circ}53'$) and
- iii. Dalmon—Bunhencha ($32^{\circ}57':75^{\circ}55'$). (Text Figure 1).

STRATIGRAPHY AND DISCUSSIONS

McMahon (1885), in the map of Chamba which adjoins Bhallesh area, has shown four geological formations *i.e.* Middle and Lower Silurian, Upper Silurian, Volcanic Series and Carbo-Triassic.

The finds of fossils in Bhallesh, as well in Chamba (*pers. comm.* R.K. Dutta), however

suggest a complete review of the stratigraphy of Bhadarwah and Bhallesh, because the formations included by McMahon (1885) show a different age. The nearest area with which the present area can be compared is that of Kashmir Valley, but its continuity with Kashmir is not yet established, as such it is at present preferred to give the area a status of a separate basin *viz.* Bhallesh basin and classify the different rock groups and follow tentatively a different stratigraphical classification as given in Table 1.

The oldest unit referable to 'Salkhalas', is exposed north of Bhadarwah and is mainly composed of mica-schists. The rocks overlying typical 'Salkhalas' and included here in Atkhar Group, were earlier considered by Mallikarjuna (1962) as "probably Salkhala Series", in the area between Bhadarwah and Katare-di-Gali. The contact between 'Salkhalas' and the overlying group of rock is not very clear but likely to be a fault.

The Atkhar Group (apparently unfossiliferous) consists of phyllite, slate, sandstone and conglomerate, whereas Bhallesh Group (fossiliferous) comprises of tuff, shale and limestone. The contact between the two groups is not very clear—it could be faulted or gradational contact; there is no clear evidence of its being unconformable. A gradational contact is however, postulated by the appearance of the tuff in the uppermost part of the Katari-di-Gali Formation which is the characteristic rock unit of the overlying Tramawala Formation—lowermost of the Bhallesh Group.

The Atkhar Group includes Bhadarwah Formation and the Katari-di-Gali Formation separated by Katare Conglomerate. The Bhallesh Group, characterised by fossiliferous

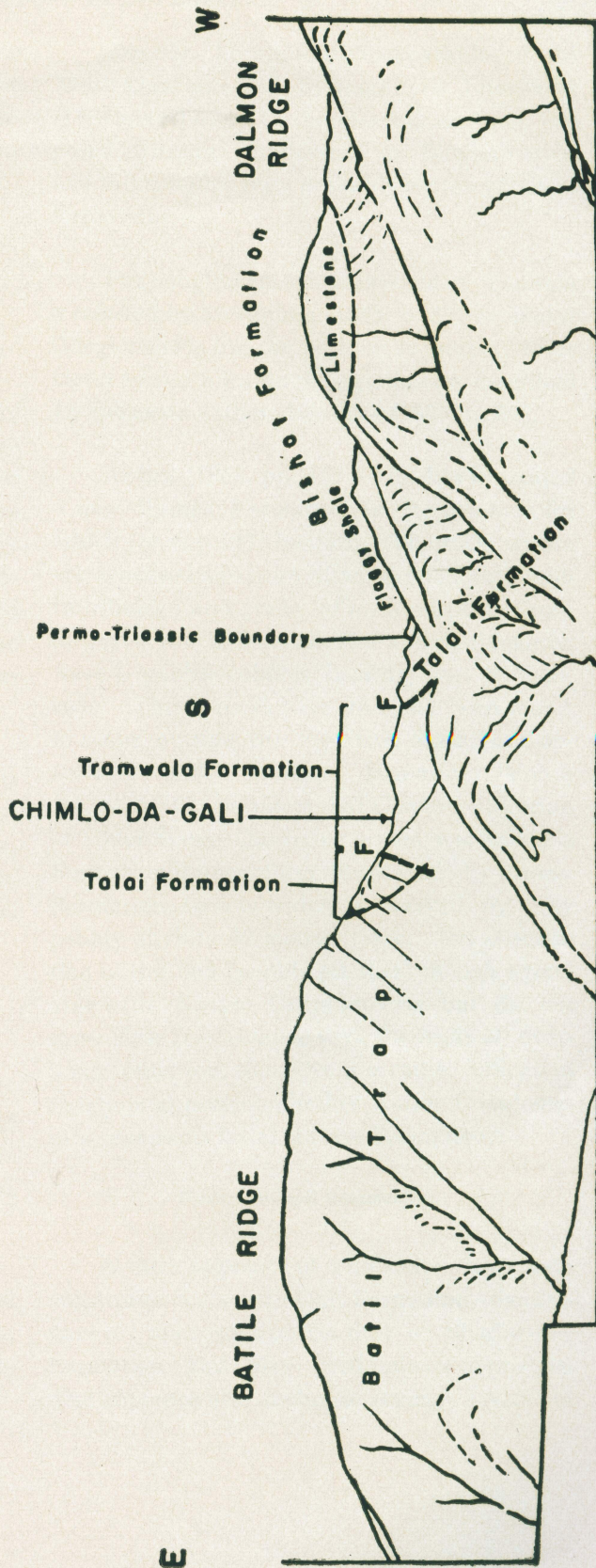
TABLE 1

STRATIGRAPHY OF BHADARWAH AND BHALLESH

		Member	Age	Equivalents in Kashmir Himalaya	
B H A L L E S H G R O U P	Bishot Formation	4. Limestone	Lower Trias	Lower Trias of Guryul Ravine	
		3. Limestone and flaggy shale			
		2. Flaggy shale and limestone			
		1. Flaggy shale			
Talai Formation.	2. Calcareous shale, sandy shale, and sandstone	Upper Permian	Zewan Series of Liddar Valley		
	1. Limestone (Basal)				
Batile Trap	Volconic trap-rock with flow agglomerate and conglomerate; also over and underlying conglomerate	? Lower Permian	Panjal Trap		
Tramawala Formation	Tuff	Lower Permian	Agglomeratic Slate of Bren and Nagmarg		
A T K H A R G R O U P	Katari-di-Gali Formation	Micaceous sandstone, slate with limestone layers in middle part and tuff in upper part	? Middle to Upper Carboniferous	? Fenestella Shale	
		Katare Conglomerate	Conglomerate bed with slate and phyllite	? Devonian to Lower Carboniferous	? Muth Quartzite and Syringothyris Limestone
			Bhadarwah Formation	Phyllite, slate and sandstone	Algonkian to Silurian
----- Probably Fault -----					
Salkhala Series		Schists	? Pre-Cambrian		

EXPLANATION OF PLATE 1

A panoramic view of Bhallesh near Dalmon, showing different formations.



H. M. KAPOOR : STRATIGRAPHY OF BHADARWAH AND BHALLESH

beds ranging in age from Lower Permian to Lower Trias includes three distinct marine sedimentary formations *viz.* Tramawala, Talai and Bishot and a volcanic unit lying between Tramawala and Talai Formations and designated as Batile Trap (Plate 1).

ATKHAR GROUP

Bhadarwah Formation

The Bhadarwah Formation is composed of slate, phyllite with interbedded sandstone-quartzite and occasionally carbonaceous phyllite. It is very nicely exposed between Bhadarwah and Katare ($32^{\circ}57':75^{\circ}41'$). Phyllite and slate near Bhadarwah are sometimes highly weathered, flaky, brittle and purple. A sample of slate on maceration yielded ill preserved spores showing Lower Palaeozoic affinity.

Remarks. The formation, by virtue of its stratigraphical position is comparable with Dogra Slate and Cambro-Silurian of Kashmir, though difficult to correlate with the type, because of the metamorphism which rocks of this area has suffered.

Katare Conglomerate

Katare Conglomerate is composed of pebbles, cobbles, and rarely boulders—mainly of quartzite but occasionally of slate and other rocks. Thin layers of phyllite and slate are also common.

The conglomerate bed is well exposed near Katare ($32^{\circ}57':75^{\circ}46'$), where it is about 400 metres thick, it continues further in Thanala ($32^{\circ}56':75^{\circ}46'$).

Remarks. Formations comparable to the Muth Quartzite and Syringothyris Limestone (Devonian-Lower Carboniferous) are not exposed either in Bhadarwah or Bhallesh areas and this conglomerate probably represents these formations.

The conglomerate bed exposed at Thanala is referred by McMahan (1883, p. 37) as Blaini Conglomerate but the position suggests it to be closer to the Silurain Conglomerate described by the same author elsewhere (1885, p. 82).

Vohra (1966, pp. 157—170) has instituted a new Ramsu Formation in Ramsu area for which (*op.cit.*p.157) he states "The rocks within the synclinal structure differ considerably both in lithology and grade of metamorphism from the rest of the 'Salkhala Series' and significantly, have a pebble-cobbles bearing unit at their base. These rocks have recently been found to occur outside the 'Salkhala Series' and associated with younger formations." Vohra (*op. cit.* p. 161) considers that Cambro—Silurian or Older Slate—Quartzite sequence or Salkhala Formation is unconformably overlain by Ramsu Formation, base of which is marked by grey pebbly phyllite 40 metres thick. His description of this bed (pebbly phyllite) though agreeable with Katare Conglomerate but do not show close resemblance with the rocks of overlying formation, therefore it is rather difficult to conclude at present whether Katare Conglomerate represents Basal Ramsu Formation.

Katari-di-Gali Formation

A thick sequence of sandstone and slate constitutes Katari-di-Gali Formation. Sandstones are micaceous unlike that of Bhadarwah Formation and also predominate over slate. The sequence also includes several layers of

grey limestone (upto 15 metres thick) which are prominently noticed about 2 kilometers east of Katare; and tuffaceous slate, about 5 meters thick, outcropping on western scarp near Katari-di-Gali.

Remarks. This formation is lithologically similar to the Fenestella shale of Liddar Valley and Banihal in Kashmir. The correlation is also supported by the fauna of the overlying formation, which has fossils of the Agglomeratic Slate. Though at present we have no fossil evidence to confirm this view, but it is hoped that one day fossils may be found in this formation. The upper most layers of the formation where tuffs have started appearing may represent Upper Carboniferous-lowermost Lower Permian. McMahon (1885) included this formation in the Upper Silurian.

BHALLESH GROUP

Tramawala Formation

The Tramawala Formation comprises entirely of tuff, which at several places is slaty. This is well developed at Tramawala (hence named) where numerous fossiliferous layers are seen; three of them *viz.* *Lissochonetes* rich beds, *Dictyoclostus* layers and *Pseudosyrinx*—*Neospirifer* bed, are easily recognisable.

The formation can be traced from Katari-di-Gali to Mashan Ghatti Gali (32°56':75°50'); again near Chimlo-da-Gali and in the localities south of Batile peak and SSW of

Batile, from where this enters in Himachal Pradesh territory. Folded outcrops of this formation are also exposed between Kanhot (32°57':75°54') and Bunhencha and show poorly preserved fossils.

Thin layers of tuffs sometimes have abundant lapillae, cinders, volcanic bomb, phosphatic nodules as well fossiliferous nodules.

The fossils are usually distorted and deformed on account of intense folding, but even then they are recognisable. The important fossiliferous localities are Chimlo-da-Gali and Southeast of Batile (Tramawala) and include the following species :

Ambikella darwini (Morris)*, *Cleiothyridina* aff. *gerardi* (King)*, *Derbyia* aff. *subaurita* Reed*; *Dictyoclostus gratiosus* (Waagen), *D. semireticulatus* (Martin)*, *Fusispirifer nitiensis* (Diener)*, *Lissochonetes* sp., *Marginifera himalayensis* Diener**, *M. cf. spinocostata* Abich**, *Neospirifer fasciger* (Keyserling)***, *N. kimsari* (Bion), *Notospirifer cf. duodecimcostata* McCoy*, *Paeckelmannella* aff. *niger* (Waagen)***, *Pseudosyrinx* sp., *P. nagmargensis* (Bion)***, ?*Schellwienella* sp., *Streptortynchus* sp.*, "Spirifer" cf. *keilhavii* von Buch**, *Taeniothaerus kashmiricus* (Reed)*, *T. permixtus* Reed*, *Trigonotreta stokesii* (Koenig) ;

Deltopecten sp.***, *Euomphalus (Phymatifer)* sp.*, *Eurydesma cordatum* Morris*, *E. cf. globosum* Dana*, *Myonia cf. morrisoni* Etheridge**, *Mytilomorpha* sp.***, *Solenomorpha* sp. ind.*;

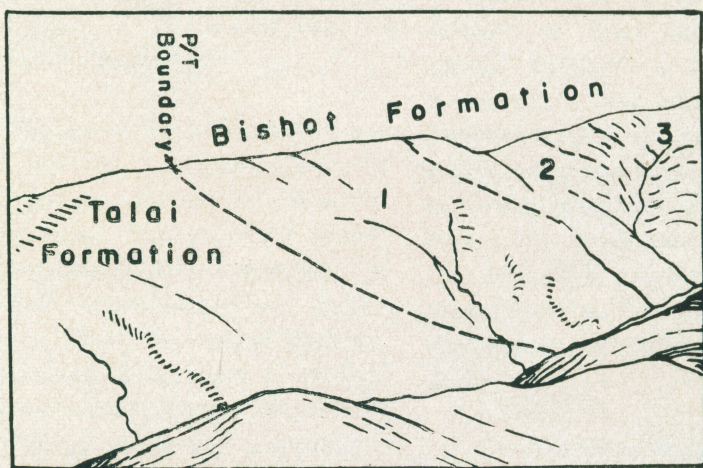
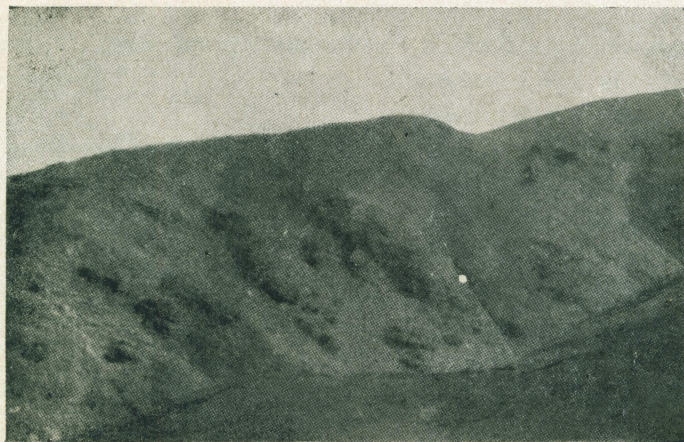
Orthoceras sp. and ammonoid (? *Perrinites* or ? *Stacheoceras*) ;

EXPLANATION OF PLATE 2

Talai Slope

1. Flaggy Shale member ; 2. Flaggy Shale-Limestone member ; 3. Limestone-Flaggy Shale member.

P/T Permian-Triassic



P/T Permo-Triassic

H. M. KAPOOR : STRATIGRAPHY OF BHADARWAH AND BHALLESH

Acanthocladia sp.***, *Calceolispongia multifor-*
mis Teichert, *Entrochus* sp.*

The specimen marked* are collected from Chimlo-da-Gali while marked** from Trama-wala ; rest are from both the localities.

In a locality, east of Mashan Ghatti Gali, the tuffs gradually pass to dark splintery tuffaceous slate, which at times show on cleaved surface indistinct faint markings of doubtful organic origin resembling with the venations of plant leaves (unlike dendrites). As no good specimen was encountered their organic nature could not be ascertained. Slates also did not reveal any microflora to confirm this.

Remarks. Though different fossils zones in this area could not be ascertained but the fauna of the formation undoubtedly indicates a Lower Permian age. The tuff of the formation, both lithologically as well faunistically is comparable with the upper part of the Agglomeratic Slate of Bren Section in Kashmir. Middlemiss (see Reed, 1932, Plate 3—section) has referred to beds overlying the Trap sill (or dyke) as sandy shale, but recent examination by the author indicates it to be of tuffaceous in nature ; the presence of volcanic bombs, (Misra, 1948), cinders etc. like Bren in the sediments of this formation also confirms their being of volcanic in nature, though laid in marine environments.

The fossil elements from Agglomeratic Slate of Nagmarg (Bion and Middlemiss, 1928) and Bren (Reed, 1932) are present in the formation, as such one can easily conclude the age of the beds as Lower Permian and not Upper Silurian as concluded by McMahon (1885) in the adjoining parts of Himachal Pradesh.

At Bren, *Eurydesma* is known from two horizons – one, at a very low position, exposed near the quarry ; and the other, very high (28–5–30 in Plate 3, Reed, 1932). In the lower horizon the genus is abundant and is associated mainly with *Deltopecten*, whereas in younger it is rare and associated with a warm climate brachiopod fauna. In Bhallesh *Eurydesma* is rare and is associated with a brachiopod fauna, like younger horizon of *Eurydesma* in Bren, although a solitary specimen resembling *Deltopecten* was also encountered. The assemblage, of Trama-wala Formation as a whole is in favour to be closer to this horizon of Bren Section, which in author's opinion indicates a Lower Artinskian age; however, a few elements like ammonoids having younger affinity suggest to put them at a higher position than the Bren, though still in Lower Artinskian. *Eurydesma*, in Trama-wala Formation is another strong support to Dickins' (1961, p. 140) and Sastry and Shah's view (1964, p. 142) that *Eurydesma* in Kashmir lingered on slightly longer than elsewhere in India.

In Australia, similarly this genus is known from several horizons eg. in the Hunter Valley from three formations viz. Allandale, Farley and Branxton ; and in the South East Coast from the Lower Unit of Conjola Formation and Ulladulla Mudstone (*pers. comm.*; Runnegar, 1968; 1969 ; Dickins, 1968; 1969). The Trama-wala Formation thus can be compared with Branxton and Ulladulla Formation of Australia ; though index species considered by Runnegar (1969) in Australia may not be characteristic for the Bhallesh basin. It is of course, evident that for this part of Himalaya (Kashmir and Bhallesh) the oldest and true *Eurydesma* zone is one in which this genus occurs in abundance in association with *Del-*

topecten, whereas in younger the genus is only a subsidiary element.

Eurydesma reported by Gupta *et al.* (1970) from Manali Road Section, also appears to come from the same horizon, though its details are still unknown. The fauna of Lower Permian from Khemgaon, Sikkim in Eastern Himalaya (Sahni and Srivastava, 1956, pp. 202-214) appears to have forms closer to Tramawala Formation, as such both occupy the same stratigraphical position. It is rather difficult to comment on the position of *Eurydesma* bearing layers of Bhallesh with that of Peninsular India (Manendragarh and Umaria). The position of *Eurydesma* bearing bed of Manendragarh is considered by Sastry and Shah (1964, p. 140-141) to be the same as Khemgaon in Sikkim; but to this author, it appears to be lower if compared from Bren Section. Manendragarh is closer to the *Eurydesma* Zone of Bren, while Khemgaon with the Tramawala fauna, whether Tramawala fauna or Khemgaon fauna occupy position of Umaria or below it and above Manendragarh, depends on future work. Thomas (1969, p. 217) has already indicated that part of the Agglomeratic Slate show Umaria nature.

Reviewing the distribution of Lower Permian faunae, which have common affinity and age the statement of Dickins and Thomas (1959, pp. 88-89) can be reproduced 'in early Permian times, the marine fauna of Western Australia, Peninsular India, Himalayan India, Eastern Australia and Argentina belonged to a common faunal Province'. The Bhallesh basin fills one of the gaps in the province and it is hoped further search may prove the continuity between Bhallesh and Eastern Himalaya.

Batile Trap

McMahon's (1885, Map) Volcanic Series

is renamed here as Batile Trap after Batile peak, where it is conspicuously exposed all along the ridge. The trap includes a number of flows separated by flow conglomerates and flow agglomerates. At Batile, as well near Talai (32°56':75°53') the Trap is separated by underlying formation by the presence of 6 to 20 meters thick conglomerate bed, which has a number of lenticular layers of quartzite and cherty shale. A little east of Kanhot, a 5 metres thick flow rock outcrops as sill in an anticlinal fold within the tuff and probably marks the earlier flow than the main effusive flows of Batile. In general the hand specimen of the trap rock is grey to greyish green, amygdular and vesicular as described by McMahon (1883, pp. 175-185), basaltic in composition.

Remarks. The Batile Trap though has almost same stratigraphic position as Panjal Trap in Kashmir (Middlemiss, 1910), but the lower and upper limits of flows appear to show a different nature *i.e.* younger than the flows of Liddar valley. Flows in this area appear to have a number of breaks of short duration. The total volcanic activity was also not of much thickness in comparison with the Panjal volcanic flows.

Talai Formation

The rocks with bryozoa and brachiopod fauna lying above the Batile Trap and showing lithological similarities with the Zewan Formation of Kashmir are grouped here under Talai Formation. This formation has two recognisable members *viz.* a Limestone member and a Calcareous Shale-Sandy Shale-Sandstone member. Both the members are, in position as well as in lithology akin to the members exposed in the Liddar Valley section of Kashmir, where Limestone member has

been referred as Basal Limestone. The Limestone though fossiliferous but fossils are badly preserved and unrecognisable; sections of bryozoans, corals and brachiopods are only seen. The second member, is rich in fauna but fossils are highly weathered and friable.

The formation is exposed near Mashan Ghatti Gali, near Chimlo-da-Gali, Bishot and Dalmon, exhibiting thin limestone, sandy shale and Calcareous shale. In Talai however, limestone unit is probably absent due to fault. The fossils are seen at Talai and Chimlo-da-Gali exposures and include: *Polypora ampla* (Lonsd.), *Dictyoclostus graciosus* (Waagen), *Lissochonetes* cf. *lissarensis* Diener, *Marginifera himalayensis* Diener, *Spiriferella rajah* (Salter), *Spiriferina* sp. These fossils are mainly from second member.

Remarks. Beds equivalent to Lower Gondwana (Gangamopteris bed), so characteristic in Kashmir were not recognised here and are probably not developed.

The beds lithologically as well in stratigraphic position are similar with the Zewan Formation of Kashmir. A rich fauna as seen in most of the exposures of Kashmir, was not encountered but there is possibility of its being present. A number of species of Tramawala formation (species of *Dictyoclostus* and *Marginifera*) continued in this formation, suggesting that the volcanic activity did not effect much to the life existing in the area at that time, causing a gradual faunal change but not a faunal break.

The age of the formation is considered to be Upper Permian, based on the age of similar beds in Kashmir and also the position, in which it lies. This is also strongly supported

by the fauna of the overlying formation, which show Lower Scythian elements.

Bishot Formation

Overlying the Talai Formation, the group of rocks comprising of four distinct members viz. Flaggy shale; Flaggy Shale-Limestone; Limestone-Flaggy Shale and Limestone, having typical Lower Scythian fauna are included into Bishot Formation (Plate 2).

The Flaggy shale is mostly slaty, dark and purple, fine to very fine, argillaceous rock splitting into fine flakes; resembling closely in nature and fauna of the Flaggy Shale of Kashmir (Guryul Ravine, Liddar Valley and Pir Panjal etc.). The similarity in position, lithology and fauna of these rocks, insist the author to consider this unit as part of the similar member exposed in Kashmir. The limestones are usually grey, massive but impure; the weathered limestones appear dirty brown to light grey.

The Formation is exposed between west of Bishot (32°55': 75°55') and half a kilometer west of Chimlo-da-Gali, where they are repeated several times due to folding. The slope between Dalmon and Talai also shows this formation.

The fauna from different localities is mentioned below:

A. Flaggy Shale member

- a. West of point 11465 feet near Mashan Ghatti Gali, in Bishot

Claraia concentrica Yabe, *Glyptopliceras* sp.

- b. South of Talai

Claraia cf. *aurita* Bittner, *C. concentrica* Yabe.

c. Gamgul (32°54': 75°55') in Himachal Pradesh

? *Linoproductus* sp., *Claraia concentrica* Yabe, *C. painkhanda* Bittner, *Glyptophiceras* sp., *Ophiceras* sp.

B. Flaggy Shale-Limestone member

a. Bishot Ridge

Claraia spp., *Ophiceratid*.

b. Chimlo-da-Gali

Claraia concentrica Yabe, *Glyptophiceras* sp., *Ophiceras* sp.

C. Limestone—Flaggy Shale member

Half a kilometer west of Dalmon peak

a. Lower limestone bed

? *Otoceras* sp. ind.

b. Upper limestone bed

Claraia sp. ind., *Entolium* sp., *Modiola* sp.

D. Limestone member

Half a kilometer west of Dalmon peak

Nautiloids, *Ophiceras* spp., ? *Paratirolites* sp.

Remarks. The fauna and lithology has close resemblance with the Lower Triassic (Lower Scythian) section of the Guryul Ravine of Kashmir described by Teichert *et al.* (1970) and Nakazawa *et al.* (1970); these also can be compared with Lower Triassic strata exposed in Liddar Valley and Pir Panjal.

There is a gradual change of fauna from lowermost bed to the youngest. *Claraia* shows

its beginning just at the contact of Flaggy Shale with the youngest Upper Permian bed; a little above the Permo-Triassic contact and the lower layer of *Claraia*, the Ophiceratid ammonoids appear. Ophiceratid and *Claraia* continue in the second member as well in the third; in the middle of the third ?*Otoceras* shows its appearance in the limestone unit, but continues only for a short duration; only change in this member is the dominance of ammonoids over the bivalves.

No Permian survivor was encountered in the Lower Triassic strata of Bhallesh basin except from the collection of Gamgul, a locality in Himachal Pradesh, described by McMahon (1885) as Upper Silurian. ? *Linoproductus* is associated with Lower Scythian bivalves in the fauna. The marked difference in the fauna of Kashmir and Bhallesh is the earlier appearance of *Claraia concentrica* in the latter area.

CONCLUSIONS

The Bhallesh basin, consisting of both fossiliferous and apparently unfossiliferous sediments has a great significance in the geology of Himalaya due to its geographical position between Kashmir and Spiti and tends to support the continuity of the basin from Kashmir to towards further southeast. The fossiliferous strata have very close resemblance with the Lower Permian to Lower Triassic sediments and fauna in Kashmir, while the unfossiliferous strata are akin with the Lower Palaeozoics; only missing formations are Muth Quartzite and Syringothyris Limestone which are probably represented here by Katara Conglomerate.

It is also clear that Upper Silurian of Mc Mahon included sediments from ? Middle

Carboniferous to Lower Trias. It is however, very difficult to know the exact position of 'Blaini' and 'Infra Krol' Conglomerates mentioned by the same author. The area has a number of conglomerate layers and it is hoped the trace of lateral continuity will in future reveal its position and presence.

The Carboniferous to Triassic sequence which McMahon terminated near Duire (32°56' : 75°05') appears to continue into Bhalleesh.

ACKNOWLEDGEMENTS

The author takes the special opportunity to thank Dr. J. M. Dickins, Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia; Shri M.V.A. Sastry, Director and Shri S.C. Shah, Senior Geologist, Geological Survey of India who have been kind enough to give their opinion on the fossils and scrutinising the manuscript with their concrete suggestions.

He also wishes to put on record his sincere gratitude to Dr. M.K. Roychowdhury, Director General; Shri V. K. S. Vardhan, Deputy Director General, Sarvshri T.K. Kurien, G.M. Banerjea, Directors and Shri J.P. Srivastava, Senior Geologist, Sarvshri B.K. Alok and R. Sundaram, Geologists, Geological Survey of India for their constant help, encouragements and suggestions both in the laboratory and in the field.

REFERENCES

- ANON, 1970. New Permo-Trias Locality in Jammu and Kashmir. *Geol. Surv. India NEWS*. 1 (3) : 7.
- BION, H.S. AND MIDDLEMISS, C.S., 1928. The Fauna of the Agglomeratic Slate Series of Kashmir, *Pal. Ind. N.S.* 12.
- DICKINS, J.M., 1961. *Eurydesma* and *Peruwispira* from Dwyka Beds of South Africa. *Palaeontology* 4 (1) : 138-148.
- IDEM, 1968. Correlation of the Permian of Hunter Valley, New South Wales and the Bowen Basin, Queensland. *Bull. Bur. Min. Res. Geol. & Geoph.* 80 : 29-44.
- IDEM, 1969. Correlation Chart of the Permian System in Australia. *Gondwana Stratigraphy IUGS Symp., Buenos Aires 1967*. 2 : 475-480.
- DICKINS, J.M. AND THOMAS, G.A., 1959. The Marine Fauna of the Lyons Group and Carrandibby Formation of the Carnarvon Basin, Western Australia. *Rep. Bur. Min. Res. Geol. & Geoph.* 38.
- GUPTA, V. J., BISARIA, P.C., CHADHA, D.K., MAHAJAN, G., KUMAR, S., KASHYAP, S.R., KOCHAR, N. AND VIRDI, N.S., 1970. Stratigraphy along the Malani—Leh Road. *Publ. Center Adv. Study in Geology Punjab Univ.* 7 : 77-84.
- KHASHARU, R.N., Revised Working Plan of Bhadarwah Forest Division (S-1909-69) Govt. of Jammu and Kashmir Publication.
- MCMAHON, C.A., 1882. Some Notes on the Geology of Chamba. *Rec. geol. Surv. India* 16 (1) : 35-42.
- IDEM, 1883. On the Altered Basalts of the Dalhousie Region in the Western Himalayas. *Rec. geol. Surv. India* 16 (1) : 178-185.
- IDEM, 1885. Some Further Notes on the Geology of Chamba. *Rec. geol. Surv. India* 18 (2) : 79-110.
- MIDDLEMISS, C.S., 1910. Revision of Silurian-Triassic Sequence of Kashmir. *Rec. geol. Surv. India* 40 (3) : 206-210.
- MISRA, R.C., 1948. Occurrence of Volcanic Bomb in Agglomeratic Slates of Kashmir. *Nature* 162 : 895.
- NAKAZAWA, K., KAPOOR, H.M., ISHII, K., BANDO, Y., MAEGOYA, T., SHIMIZU, D., NOGAMI, Y., TOKUOKA, T., AND NOHDA, S., 1970. Preliminary Report on the Permo-Trias of Kashmir. *Mem. Fac. Sci., Kyoto Univ., Ser. Geol. & Min.* 37 (2) : 163-171.
- RAINA, B.K., ALOK, B.K. AND SUNDARAM, R., 1971. On the Discovery of Permo-Trias Fauna in the Bhalleesh Area, Bhadarwah Tehsil, Doda District, Jammu and Kashmir. *Seminar Recent Geological Studies in the Himalayas. GSI (Abstract)*. : 11.
- REED, F.R.C., 1932. New Fossils from Agglomeratic Slates of Kashmir. *Pal. Ind. N.S.* 20 (2) : 1-79.

- RUNNEGAR, B., 1968. *Eurydesma* and *Glandella* gen. nov. (Bivalvia) in the Permian of Eastern Australia. *Bull. Bur. Min. Res. Geol. Geoph.* **116** : 83-106.
- IDEM, 1969. The Permian Faunal Succession in Eastern Australia. *Spec. Publ. Geol. Soc. Australia* **2** : 73-69.
- SAHNI, M.R. AND SRIVASTAVA, J.P., 1956. Discovery of *Eurydesma* and *Conularia* in the Eastern Himalaya and Description of Associated Fauna. *J. Palaeont. Soc. India* **1** : 202-214.
- SASTRY, M.V.A. AND SHAH, S.C., 1964. Permian Marine Transgression in Peninsular India. *22nd Int. Geol. Congr.*, New Delhi. Pt. 9 (Gondwana) : 139-150.
- TEICHERT, C., KUMMEL, B. AND KAPOOR, H.M., 1970. Mixed Permian Triassic Fauna, Guryul Ravine, Kashmir. *Science* **167** (3915) : 174-175.
- THOMAS, G.A., 1969. The Permian Brachiopod Fauna of Western Australia. *Gondwana Stratigraphy*. IUGS. Symp. Buenos Aires 1967. **2** : 217-228.
- VOHRA, C.P., 1966. The Salkhala Series of a Part of Doda District, Kashmir. *Publ. Center Adv. Study in Geol.*, Punjab Univ. **3** : 57-170.