
**ABRASIVES : NOTE ON THE
POLISHING MATERIAL OF RISIN SPUR,
KHUNAMUH, NEAR SRINAGAR,
KASHMIR,**

BY

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(with Plates I and II)

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THE rock which has yielded the above polishing material has for many years been known to geologists as the *Gangamopteris* rock or shale of Permian age, which became of importance as stratigraphically linking the fresh-water Gondwana formation of Peninsular India with the corresponding marine sedimentary systems of the Himalayan area: (see Records Geological Survey of India, Vol. XXXVII, 1909, pt. 4, pp. 286, 287 footnotes.).

A close examination of the rock under the microscope, however, has since revealed the fact that the finely textured shale-like rock in which the impressions of *Gangamopteris* and other ferns, fish, etc., are so beautifully preserved, is in reality a tuff, composed of minute particles of volcanic glass. The rock may be regarded in fact as a compact pumice. Pumice in its normal, light, spongy form from the Lipari Islands and other places has long been gathered for its mild abrasive qualities, which render it so useful for cleaning, scouring, and as a metal polish. The present rock, when pulverised, sieved and washed, acquires all these qualities in a high degree. Its nearest analogue appears to be in Nebraska, and Kansas, where have been found extensive beds of a fine, white powder of pumiceous origin called at first "Geyserite" by mistake. This has been exploited for polishing purposes and as a cleansing and scouring agent in soap (see "The Non-metallic Minerals" by G. P. Merrill, 2nd edition, 1910, page 411). In the event that it might be found a profitable undertaking to work the Kashmir material for similar purposes this brief note has been prepared.

2 *Reports of the Mineral Survey of Jammu & Kashmir.*

My attention originally was drawn to the Gangamopteris rock as a mild abrasive and polishing material during the early years of the war, when the difficulty of obtaining imported water-of-Ayr stone in this country induced a well-known firm in Calcutta to apply to the Geological Survey of India for any local substitute that would be useful for polishing work. Among some few others in the Geological Survey of India collection, I selected the Kashmir Gangamopteris rock as being a likely material. Later I made a number of trials of the powder used with water and other media.

Early trials of Gangamopteris rock. The rock is everywhere characterised by being black inside and bleaching or weathering a pale or whitey grey colour. The black colour has given rise to some discussion which need not be mentioned here. It appears to be largely due to carbon and secondarily to iron in some form. For the rest the material is a fine glassy volcanic tuff, or, from the point of view of its uses, a compact pumice.

Colour and petrological characters. The exact locality of the Risin spur is 1 mile N. W. of Khunamuh near Srinagar (latitude $34^{\circ} 4'$ longitude $74^{\circ} 56'$), where it forms the lowest point of a ridge descending from the Chergand peak (9,680 feet). To the east of it lies the Guryal ravine and to the west another long narrow ravine cut out of the eastern slopes of the Panjal trap massif of Chergand.

Locality. The size and shape of the spur will be gathered from the detailed plan (Plate I.) which has been specially prepared for this report by Pandits Labhu Ram and Sohani Ram, of this department, on the scale of $1'' = 200$ feet and showing 50 feet contours.

Detailed plan and section. The bands of shading on the plan represent the formations, and of these the diagonally shaded tint depicts the Gangamopteris rock in three crescent-shaped arcs of outcrop, which, as the section shows (Plate II.) embrace a set of beds inclined at an average angle of 37° . Of these the outward or lowest bed is so thin as to be negligible, but the other two of 17 and 6 feet thick respectively, 23 feet in the aggregate, correspond to a triangular block of material containing 1,164,450 cubic feet down to scree level. This, reckoning the specific gravity of the rock as 2.5 (giving $13\frac{1}{2}$ cubic feet to 1 ton of rock) corresponds to 86,250 tons altogether in the Risin spur.

Outcrops and cubic contents.

Of the associated rocks the lowest of all is the Panjal trap, a basic volcanic rock which has an enormous development in the hills all round, whilst the other bands are limestones and siliceous shales, including a band next the trap of white novaculite. The hard siliceous novaculite can always be used as a whetstone for putting a fine edge on hard cutlery.

The whole of the solid rock of the spur is surrounded by a thick talus slope composed chiefly of rough blocks of the trap descending at a steep inclination towards Khunamuh.

The Risin spur having the dip of the beds down-hill and coinciding with the surface of the hill-slopes over considerable areas, renders the quarrying of the rock extremely simple. As will be seen from the plan and section, it is only necessary to remove the partial overburden of the middle limestone band (10 feet. thick) and the scree material at the foot of the slope, to lay bare the whole of the Gangamopteris rock and quarry it away down to the general level of the surrounding talus slope.

On this account and because of the fair thickness of the deposit this spur has been described in detail. But the rather similar spur at Zewan, a distance of about 2 miles away in a west-south-west direction, also contains bands of the Gangamopteris rock. These are, however, much thinner and dip more steeply into the spur, so that the bands would either have to be mined like a lode or thin steeply dipping bed, or else the quarrying away of it would necessitate the removal of large quantities of unproductive¹ rock. A map and section of the Zewan spur have been constructed on the same scale as that of the Risin spur, but they have not been reproduced here.

Still further away up the Jhelum river near Pansapura and Marahama occur two more closely approximating hill-spurs containing this rock which have been visited and briefly reported on.² It seems likely that a very large supply can be obtained from here also in time to come. Should a demand arise after exploitation of the Risin spur, a fully detailed map and section can be prepared of this locality also.

¹ Except as limestone and building stone for which it is now being quarried.

² By Prof. D. N. Wadia.

The chief uses to which the powder of the *Gangamopteris* rock may be put are :—

(1). As a metal polish, especially of such metals as brass and copper. It is possible also that finer varieties of it obtained by elutriation may, when suitably treated, be made into a plate powder for silver and gold articles.

(2). For polishing certain stones, especially marbles, serpentine and cement floors, such as are laid down by Bird & Co., in Calcutta.

(3). As a window-glass cleaner.

(4). As a razor paste for strops when mixed with some fatty substances.

All the above ways of utilising it have been tested by me and by several people to whom samples have been given, with the best results. It will be seen that the substance only requires a little enterprise and a small outlay of capital to enable it to take the place of the imported articles such as "Globe Metal Polish," "Monkey Brand Soap," "Brasso," etc.

Samples were sent to the Small Industries Development Co., Ltd., Calcutta, and also, at the suggestion of the Munitions Department, to the Director of Ordnance Factories, Calcutta, for trial. From the latter I received a reply that the sample forwarded had been tested and found suitable as a metal polish ; but that their requirements were very small. It was not found suitable for Ordnance Factory requirements other than as a metal polish. No details were furnished by the Ordnance Factory as to the other uses for which it had been tested and not found suitable.

A number of experiments have, however, been made by Mr. D. N. Wadia, then Professor of Geology at the Prince of Wales' College, with the object of making a cement of the nature of Pozzuolana cement from the rock powder.

The following is a brief summary of results. It is hoped eventually to have samples of the cement tested systematically. It is unfortunate that the later trials conducted by Mr. Wadia are not so promising as the earlier ones. However, I give Mr. Wadia's latest note in his own words. He writes :—

" The systematic tests I have carried out during the last month with samples of *Gangamopteris* rock taken from different horizons have shown that the pozzuolanic character possessed by this rock on the whole is feeble. This is contrary to the expectations raised

by the earlier experiments on samples sent by you for chemical and petrological determinations. This property, which depends upon the presence of small amounts of *free* or available silica in the rock, which can combine with ordinary (fat) lime, when added to it, to form a calcium silicate or calcium alumino-silicate, seems to be very sporadically distributed, not only in different beds but also in different parts of the same bed."

(i) "In some cases the rock is quite inert, *i.e.*, the proportion of free *silica* in it is nil (Specimen No. 4.)

(ii) "In a greater number of cases the pozzuolanic character is present, there being an appreciable amount of available silica, but the time taken by the cements and mortars to acquire the requisite degrees of hardness and strength is so long, and the initial setting also takes such time that the commercial value of the cement is greatly impaired. For it requires that the moist condition of the mixture should be maintained for some days before the "setting" has fairly commenced. This would be a serious defect in ordinary masonry practice, especially in summer."

(iii) "In some cases the pozzuolanic property is well developed ; this is notably the case with the samples I got from the office (both powder and fragments) in Jammu in March-May, 1918, and those which were sent to me from Srinagar in October last ; and to a less extent in samples No. 9 and 8 of the present collection. Cements, hydraulic cements and mortars of a strength approaching to Portland cement can be made out of the powdered rock (cf. specimens submitted to you on 16th July, 1918, at Srinagar Office, and specimens 1-6 which are with me at the Laboratory)."

"The process of making pozzuolana cement from the *Gangamopteris* rock is one of great simplicity and comprises only the following stages :—

(1) Grinding to powder to pass through sieve of 120 mesh.

(2) Addition of fat lime (slaked), and sand

Gangamopteris powder	.. 12 parts.
Slaked lime (powder)	.. 3-5 parts.
Sand	.. 4 parts.

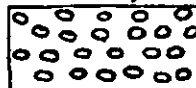


5 *Reports of the Mineral Survey of Jammu & Kashmir.*

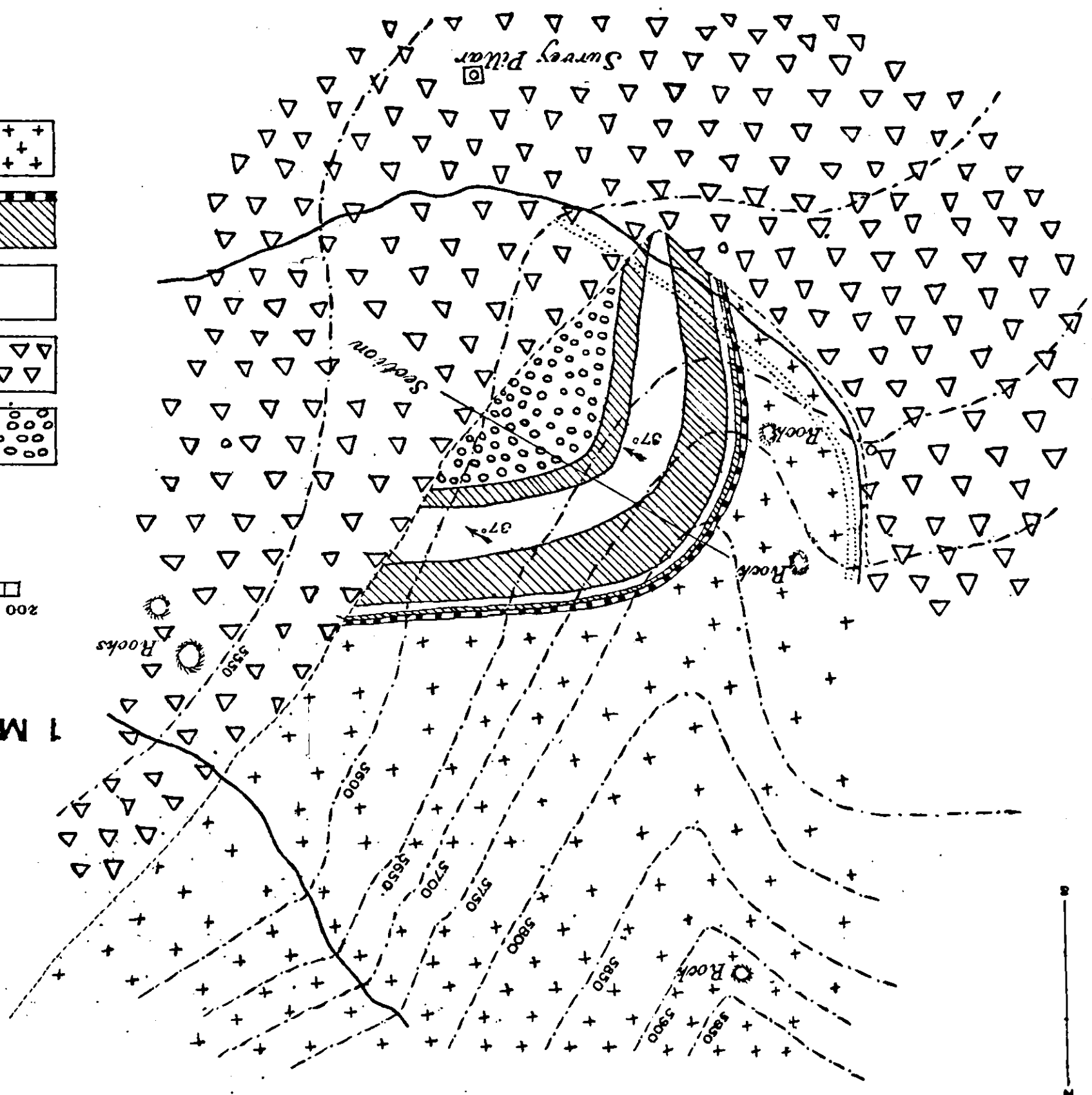
- (3) Thorough mixing so that the lime and pozzuolana are very intimately combined.
- (4) Screening to remove sand and lime grit.
- (5) Grinding so as further to mix lime and pozzuolana closely. (The addition of sand may be delayed to this stage)."

PLAN OF ABRASIVE ROCK OF RISIN SPUR 1 MILE W.N.W. OF KHUNAMUH

Scale: 1 inch = 200 Feet
Contour intervals 50 ft.

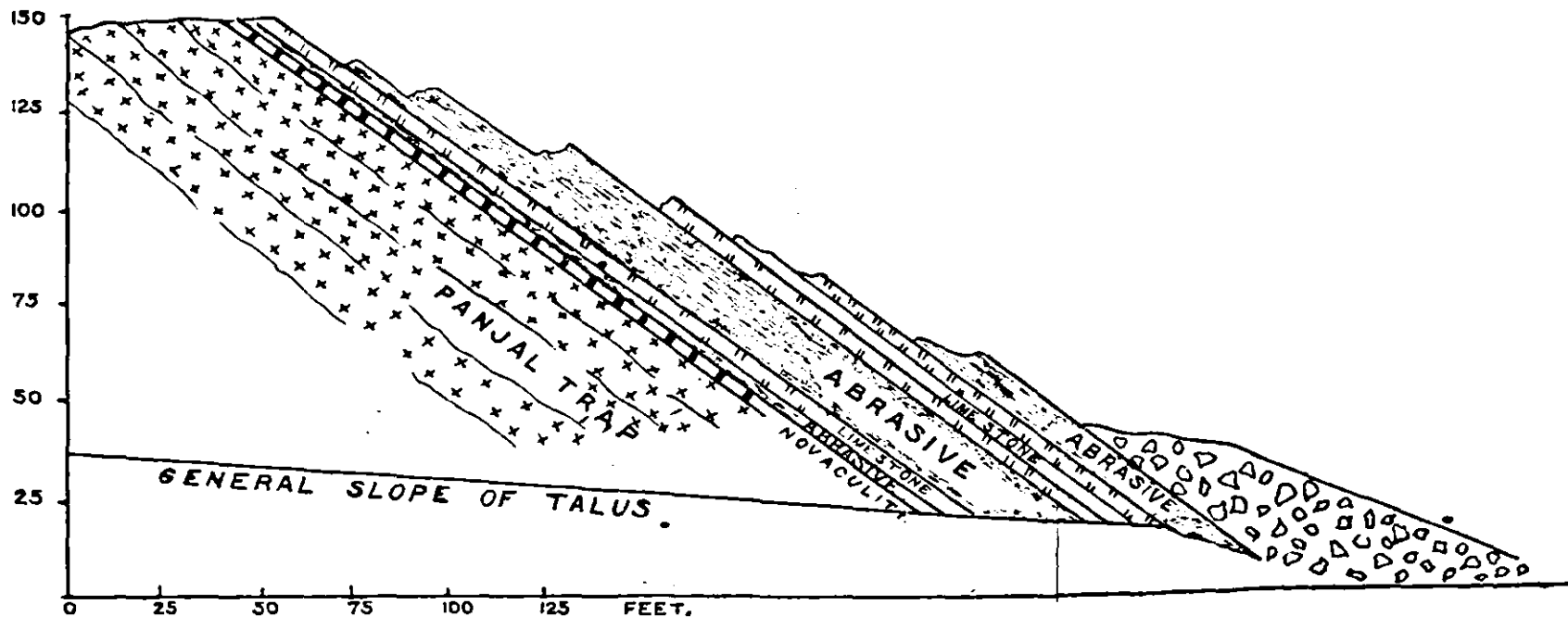
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ABRASIVE ROCK RISIN SPUR NEAR KHUNAMUH SECTION

FEET.



SCALE: 2 INCHES = 100 FEET.