A GEOBOTANICAL ASPECT OF THE TIRUMALA HILL RANGE, CHITTOOR DISTRICT, ANDHRA PRADESH, INDIA

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ABSTRACT

Geobotanical response to different rock types in the semiarid tract of the Tirumala hill range in Chittoor District, Andhra Pradesh, is conspicuous for rapid and precise geologic mapping. *Decaschistia crotonifolia*, particularly in full bloom, is an ideal lithologic indicator of phyllite. The shallow excavations of platy quartzite, used as grinding stone, all along the contact with phyllite across the hill slope have resulted in the development of a well-defined linear band of vegetation, emphasizing the contact zone detectable even by aerial photography.

INTRODUCTION

Many important factors in the natural development of plants arise either directly or indirectly from their geological and geochemical environment. Billings[1] observed characteristic vegetation in areas of rock alteration and pyritization. Nicolls *et al*[2] delineated different characteristic floras over alluvial sediments, siliceous and calcareous rocks, and mineralized zones of Pb-Zn-Cu. Cole[3] used plant species to distinguish shallow bedrock, relatively deep sand cover, laterite, calcrete, and normal soils over siliceous and calcareous rocks. Recently, the plant *Gymnosporia falconeri* as an indicator of pegmatite in a granitic terrain[4] and *Barleria longiflora* of dolomite[5] have been reported.

During the course of the engineering geological investigations, carried out for the proposed construction of a dam across the Kapilatheertham stream in the Tirumala hill range in Chittoor district of Andhra Pradesh (Toposheet No. 57 0/6), certain interesting and important geobotanical aspects have been revealed. The area of study lies between 3rd and 4th km of Tirupati-Tirumala old ghat road. It is a highly undulating hilly terrain primarily consisting of quartzite and phyllite both trending N45°W with a gentle northeasterly dip of 10°–25°.

In this part of the hill range, reaching a maximum height of 600 m, zonal distribution of vegetation at different altitudes clearly reflects its geological aspects even from a distance. At the ground level, hard, mostly barren, flesh or pink coloured quartzite (figures 1A and 2A) occurs with two sets of prominent vertical joints – one set trending N30°E while the other N60°W. These joints support scarce vegetation consisting of the tree species – *Chloroxylon swietenia, Pterocarpus santalinus, Boswellia ovalifolia*; shrubby species – *Coclospermum gossypium, Crotalaria pulcherrima, Dodonaea viscosa, Waltheria indica, Vernonia albicans*; and the herbaceous species – *Dysophylla myosuroides, Cymbopogon coloratus* and *Phoenix* species. Among this assemblage, *D. myosuroides*, occurs exclusively on quartzite.

Conformably overlying the quartzite occurs phyllite zone which supports thick vegetation with a well-defined line of demarcation (figures 1B and 2B) of the phyllite-quartzite contact at an altitude of 320 m. The phyllite (figures 1C and 2C) consists of the same flora of quartzite (except *D. myosuroides*) together with *Decaschistia crotonifolia*, and *Albizzia amara*. The entire phyllite zone with occasional intercalations of chlorite schist is covered by rock fragments; and the *in situ* outcrops are rare or absent. But, here, the most conspicuous feature is the abundant growth of a shrub, *D. crotanifolia*, with profuse yellow flowering, distributed exclusively in the phyllite zone but not found on quartzite; thus it serves as a lithological indicator faithfully reflecting the phyllite substrate facilitating geological mapping of quartzite-phyllite contact (figures 1B, 1D and 2B, 2D) which is concealed by rock fragments and thick vegetation. It may be noted that it is only with the aid of the full bloom of this species, its indicator value was easily recognized; otherwise it could have been overlooked. Hence, Rose *et al*[6] stated that "indicator plants are best found and mapped when they are in bloom, and at other times of year there is a danger of overlooking the occurrence of useful species".

In addition to *D. crotonifolia*, a tree species *Albizzia amara* has also been found to be distributed confined

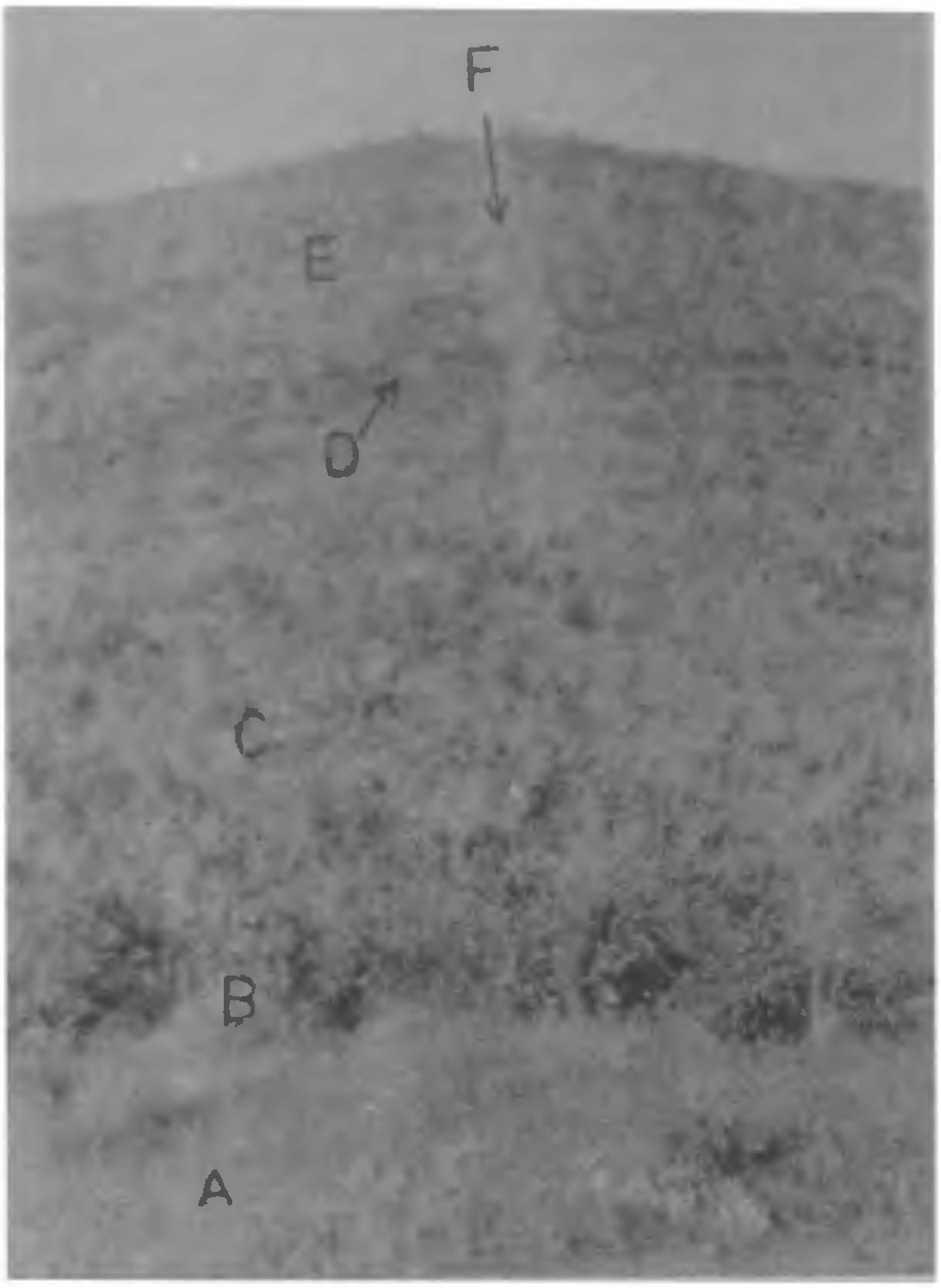

Figure 1. Geobotanical features at a part of the Tirumala hill range; A—quartzite; B—well-defined quartzite phyllite contact emphasized by thick vegetation; C—Phyllite emphasized by the growth of *Decaschistia crotonifolia*; D—linear band of vegetation across the slope demarcating the slaty quartzite in the contact zone with phyllite; E—Platy quartzite with thick vegetation; and F—fire breaker made by forest department.

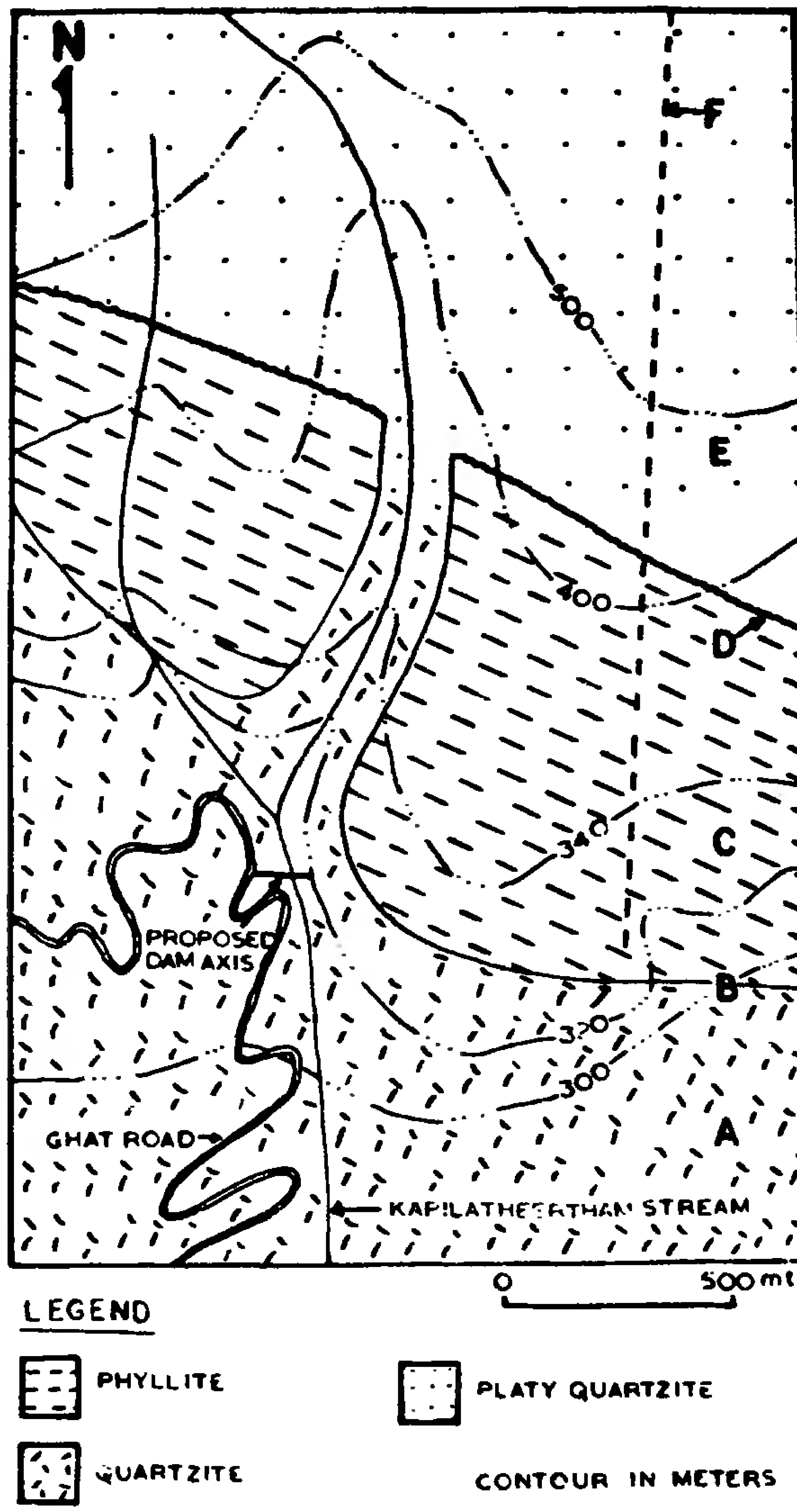

Figure 2. Geological map with the aid of Geobotanical response. Details are same as given in figure 1.

to the phyllite zone. Hence, as already reported from the Bandalamattu zone of lead mineralization in Guntur district, Andhra Pradesh[5], this species in this area also serves as another lithological indicator of phyllite.

Above the phyllite occurs fine-grained 2 m thick, quartzite with pronounced development of slaty cleavage; and above this zone, the rock type (figures 1E and 2E) shows incipient or diminished development of slaty cleavage with thin intercalations of phyllite and occasional chlorite schist. Except the two indicator plants, *D. crotonifolia* and *A. amara* of phyllite, the same plant assemblage continues to flourish in this zone with more or less same frequency and dominance.

Plants are extremely sensitive to variations in moisture and nutrients particularly in arid and semiarid regions[7]. Encouraging results in geobotanical studies have been obtained with film techniques of remote sensing in dry tracts[8]. A strikingly visible geobotanical response is clearly reflected by man's interference on the slopes of this hill range. The band of platy quartzite, all along its contact with phyllite, has been mined for use as grinding stones. The excavated zone, across the slope at an altitude of 420 m, with improved moisture condition, is revealed by a bushy growth of vegetation (figures 1D and 2D) which runs as a well-defined dark band clearly demarcating the contact between phyllite and the overlying platy quartzite.

To prevent the forest fires, the forest department has removed the vegetation along the slopes to serve as "fire breakers" which appear as well-defined linear band (figures 1F and 2F).

Thus, *D. crotonifolia* serves as an excellent lithological indicator of phyllite. The striking contrast in the geobotanical response to different lithological units at different altitudes can be employed for rapid and precise geological mapping, including aerial photographic techniques of the hilly terrains which are devoid of outcrops and covered by soil and vegetation.

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NEWS

ESTER-PULPING PROCESS—A MAJOR CHANGE IN PAPER MAKING

Wood can be processed into pulp for making paper with almost no air or water pollution and with an 80 per cent decrease in production costs, says Raymond Young of the University of Wisconsin (Madison, Wis.). Young uses a mixture of water, acetic acid, and ethyl acetate to dissolve the wood's lignin to produce the pulp-wood. The chemicals can be recovered through distilling towers. Wood is usually processed to pulp-wood by being cooked with highly polluting sulfites. Building a typical paper mill costs $500 million; pollution control systems cost between $2 million and $3 million more. Young estimates that fitting a paper mill with the ester-pulping process costs about $50 million with a 10–20 year payback. Biodyne Chemicals (Neenah, Wis.) is building a 10–15-t/d pilot plant in Neenah to test the ester-pulping processes, which Young says is the first major change in paper making in a century. (*Environ. Sci. Technol.*, Vol. 20, No. 6, 1986, p. 537; The American Chemical Society, 1155, 16th Street, N. W. Washington D. C. 20036, USA).