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Presidential Address delivered at the 28th National Conference of Indian Institute of Geomorphologists (IGI) held at the North Eastern Hill University, Shillong, during 29–31 October 2015

Geomorphological Research in India: Present Status and Future Direction

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It gives me a great pleasure to thank all the members of the executive council of IGI to have recommended my name for the post of President of IGI for the year 2015 and all the members of the institute who have elected me to the post. It is indeed a matter of great honour and privilege to get this opportunity to address the gathering of stalwarts, scientists, researchers and research students in the field of geomorphology.

On this occasion I would like to thank my teacher and guide Dr. K.R. Dikshit. All my interest, understanding and passion about the subject are only due to his towering efforts in shaping my research career and emphasising utmost importance of field work in my geomorphologic research. I owe him more than I can probably express.

I would also like to thank Prof. Savindra Singh for recommending my name to this post. I was fortunate enough to get him as an external referee for my first two Ph.D. students in 1993. At that time I really needed a great support and appreciation of my work in geomorphology from someone not belonging to Pune group. Prof. Savindra Singh not only appreciated my research efforts in Coastal geomorphology but also referred it to others interested and working in coastal geomorphology. My acquaintance with him began from this incidence in 1993. Since then I am his great admirer especially for his enthusiasm and tireless efforts and ability to work as the Secretary of IGI which I feel is too difficult a task.

It will not be out of place if I mention some of my friends and renowned personalities in their own field of research, on this occasion. These people have given me a great support and proper direction to my research in geomorphology, especially coastal geomorphology when I needed it most. I am sure you all will realise the significance of their role in my research career. For the major part of my academic career I was teaching and engaged in research in a college and not in any university department. My work in coastal geomorphology therefore was noticed after a considerable span of time only when I got appreciation from all these stalwarts. The credit of all this definitely goes to scientists namely Dr. A.R. Gujar, Dr. G.N. Nayak, Dr. N. Chandrashekar, Dr. Sunil Kumar De, Dr. H.S. Sharma, Dr. V.C. Jha, Dr. S.N. Rajaguru, Dr. G. Victor Rajamanickam, Dr. Amal Kar, Dr. A.K. Paul and Dr. Hema Achyuthan.

I will be delighted to share this honour with all my students who were constantly with me in all research endeavours. The credit to rectify, modify and correct many of my ideas, concepts and impressions goes to these students who are like my best friends today. I have always enjoyed inquisitive and thought provoking discussions with all of them.

I sincerely feel that the mission of our IGI in future should be to make our students more research oriented, promote research that is done faithfully, scientifically and that which is applicable and reaches to world standards. Regional seminars and workshops can be arranged on behalf of IGI to give training in writing a good research paper, not written with the only intention of improving Academic Performance Index score. They should be made exposed to research papers published in high standard journals.

Most of the students are the followers of their teachers and research supervisors. This is reflected in the style and substance of their paper writing which in most of the cases need improvement and proper direction. Same is the case with their paper presentation in seminars and conferences. Here they surely need a good training so that they will prepare themselves before venturing into such a high profile and scientific method of presenting research exercise effectively. The part of the responsibility regarding the selection of such papers for presentation no doubt lies with the organisers of seminars and conferences. IGI certainly has a potential to organise high standard and quality conferences where participants can get exposure to fruitful deliberations.

We at Tilak Maharashtra Vidyapeeth try to improve the quality of seminars and conferences under the faculty of earth sciences by making strict scrutiny of research papers, attempting best time management for presentation sessions and making them fruitful and useful. Theme selection is found to be crucial in most conferences. Our experience is that in modern days the interdisciplinary themes get more response from the researchers working in various fields. Seminars and conferences restricted to a narrow and limited scope do not attract participants and therefore do not help in either knowledge building in the discipline or adding to the existing body of research methods.

I also feel that field orientation programmes in geomorphology, of short duration, say a week or so can be arranged at various colleges and university departments under the banner of IGI. At many occasions it has been seen that our students and even some teachers are at a loss about what is to be done in the field. Ultimately field visits turn out to be pleasure trips. Our students can be trained in scientific techniques of fieldwork through such programmes. Such field training programmes can be arranged periodically wherein experts from other disciplines such as geology, hydrology, pedology, botany and chemistry can be called.

Geomorphological mapping still plays an important role in understanding the earth surface processes, geochronology, natural resources, natural hazards and landscape evolution. It is a very effective technique which basically tries to partition the terrain into different conceptual spatial entities (Fig. 1). Modern survey tools have made this technique more meaningful.

Our student researchers must know how quantitative characterisation of landscape morphology is achieved through this technique. Integration of landscape with thematic information can be done. Many conceptual, theoretical and information technology issues are the essence of digital

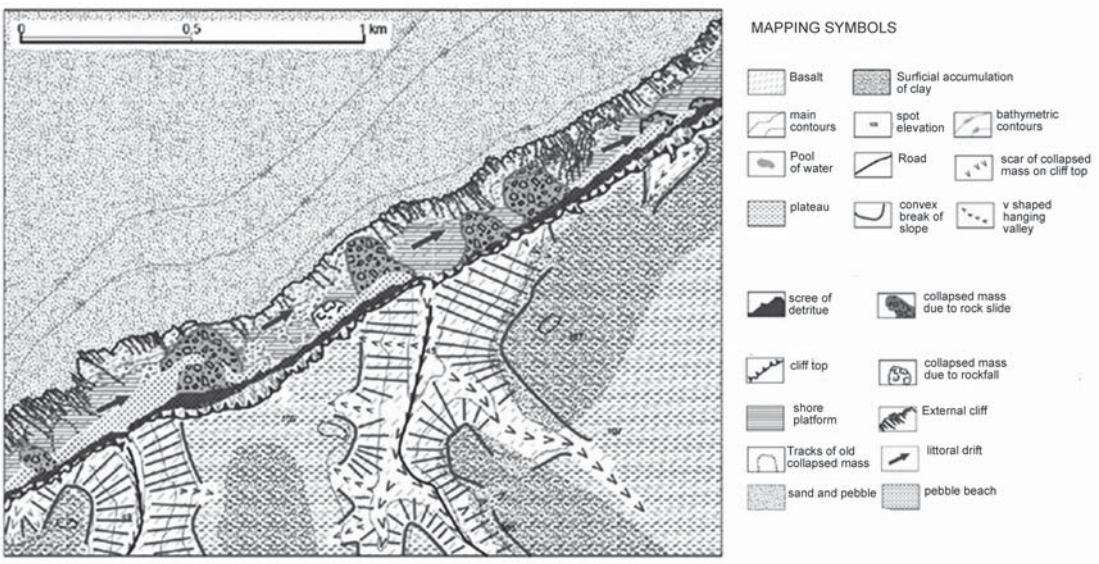

Figure 1. Geomorphological map of rocky coast.

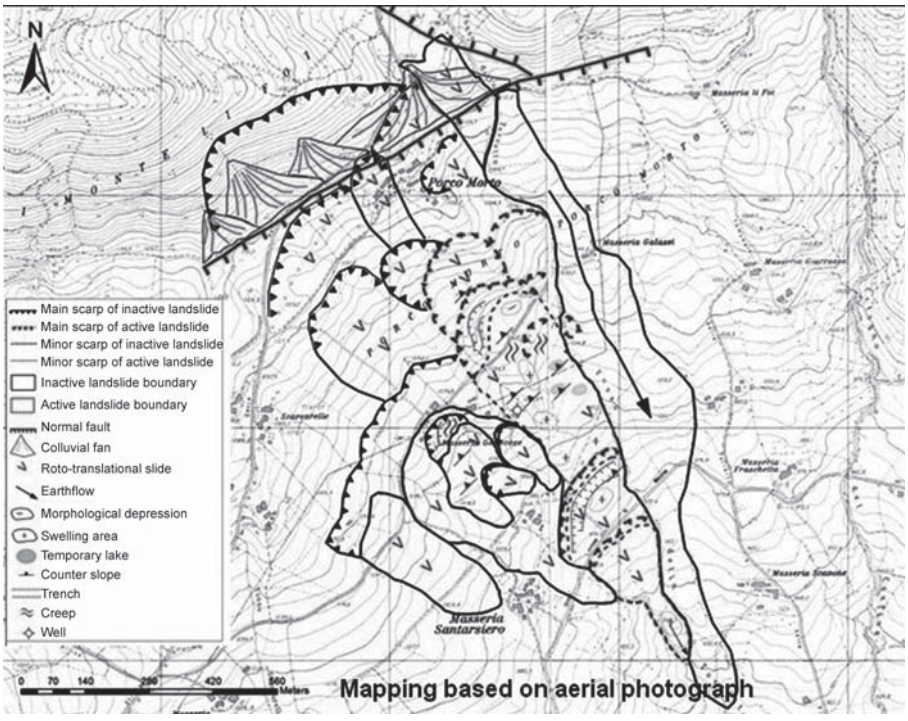

Figure 2. Geomorphological map based on aerial photograph, superposed on topographical map.

geomorphic mapping which could be used to produce good quality information related geomorphic maps.

We have to train our students in multiple geomorphic mapping, carried out for a section, to show outcropping lithologies, processes, morphometric units, morphochronological units, morphogenetic units, for mapping of resources and mapping of hazards. They should also be trained in mapping based on aerial photographs and imageries (Fig. 2).

It is high time that we take a serious note of the recent trends in the research in geomorphology world over. I would like to elaborate on this with special reference to coastal geomorphology since it is my main area of interest. You will see that the scenario in other branches of geomorphology is more or less similar to that in coastal geomorphology.

The coastal studies prior to 1970s especially in India were mostly conjectural and subject to varying interpretations. The main reason for this was the non availability of precise analytical tools and techniques. The field equipment that was in use was often primitive and unreliable. The results and interpretations obtained by these earlier studies are now being seriously questioned by modern researchers in coastal geomorphology.

We now have at our disposal many good quality analytical tools and data sources. The most exciting development in coastal studies recently is the availability and use of satellite images. It is giving an entirely new view of our coastlines and allowing accurate interpretation and quantification of coastal forms and processes, especially the sediment movement. The sediment movement directions along the coast can now be identified using geomorphic indicators by remote sensing techniques. Indicators like stream mouth diversion, spit growth, sediment plumes can be effectively used to understand the wave and tidal processes.

GPS units are increasingly being used by many researchers to get the exact locations on the coast. Previously, fixing the position of any observation on the shore or demarcation of beach, dune, mud flat and mangrove swamp boundaries was a very difficult and at times impossible task. Researchers no doubt collected samples of sediment and water earlier but the exact location from where these were collected could not be shown precisely on the maps. This can be done easily nowadays by using GPS.

The core tubes, current meters, fluorescent and aromatic tracer dyes, wind velocity measurers, salinity meters, turbidity meters, filtration units, sieving apparatus etc. are all easily available now to a person working in coastal studies.

Field mapping and surveying has also become easy and convenient with the availability of total station or at least a digital theodolite. Levelling instruments were used earlier, but it was not possible to get exact location and alignment of profiles surveyed in the field. With GPS at hand it has become an easy job now. Since the data collected are more sound, reliable and significantly with lower level of noise in it, the analytical results, mapping, and interpretations are now more dependable, useful and applicable.

Coastal studies these days are more focused and therefore level of understanding of coastal forms and processes and their variability has surely improved. It however does not mean that the earlier studies are of no use. They have certainly helped in providing basic framework or broad outlines of forms and processes. Earlier coastal studies were more of a generalisation type. They used

to give a broad regional picture of the coasts. The modern day research in coastal geomorphology seems to have concentrated more on site-specific local studies. Although such studies are more in number, it is also true that there is hardly any effort to compile, integrate and collate these studies together.

In spite of the availability of precise analytical tools and techniques it is becoming very difficult in these days to study the coastal and other geomorphic landscapes in their natural form. This is because of the fact that quite a substantial area of the earth is under the influence of various anthropogenic activities. Natural erosional, depositional and even weathering processes are getting altered due to human impact causing significant landscape modifications.

It is the need of the hour to assess the quantum of human impact on landscapes and gather precise quantitative data to understand it. It is heartening to note that the theme of the present seminar is exactly the same. I am sure there would be many fruitful and useful discussions pertaining to this theme in these three days of the conference.

The human impact today is seen in multitude of micro- to meso-scale landscape scenarios. The list can be endless but the major ones which can be sited are as follows.

- Impact of land-use and land-cover change on river systems
- Flow regulation by dams
- Drastic changes in river channels and fluvial systems due to urbanisation
- Impacts of vegetation clearance on channel change
- Impact of anthropogenic activities on

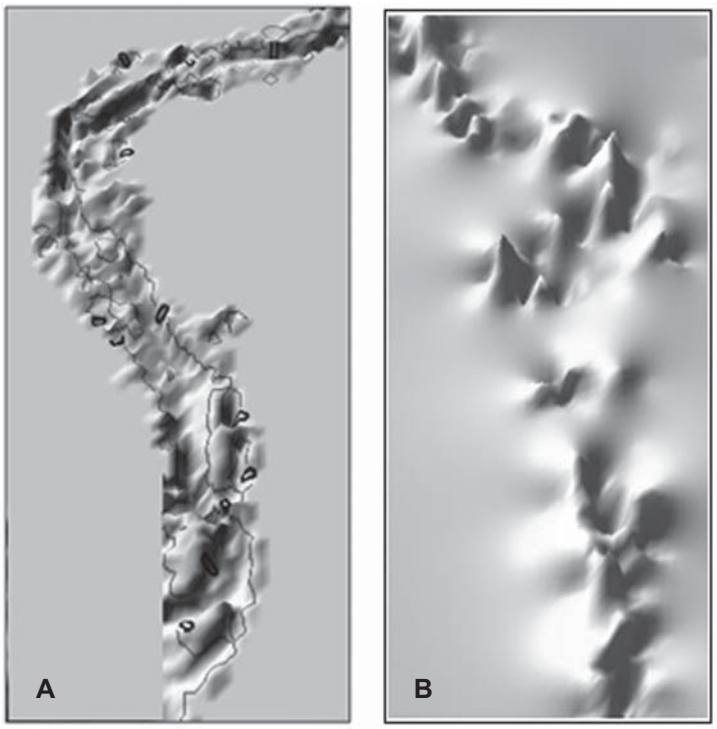

Figure 3. (A) Elevation model showing bed morphology of Karli creek, Maharashtra; (B) Directional derivative showing complex, hidden estuarine bedforms.

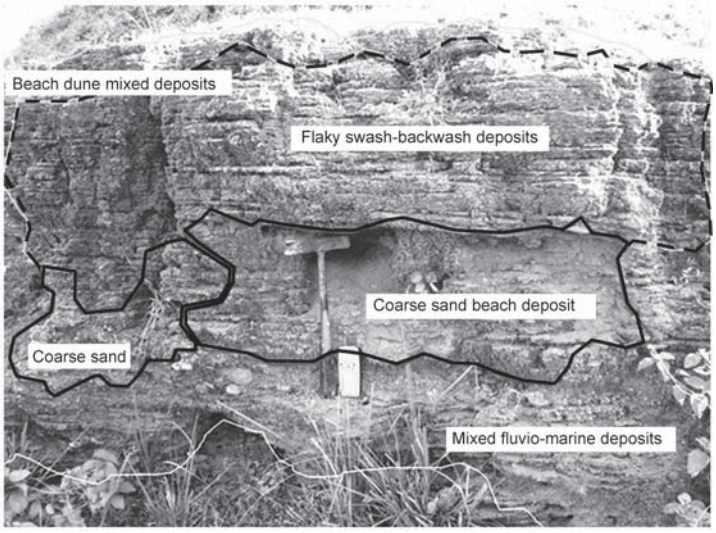

Plate 1. Discriminant analysis providing discrimination between fossil beach dune deoosits.

coastal aquatic environments
- Contamination of sediments in estuaries and coastal systems
- Removal of physical resources from the systems
- Recreational, cultural, and aesthetic service effects
- Restoration of geomorphic systems

The study of such issues essentially requires an interdisciplinary or multidisciplinary approach. If we take a look at the world scenario in geomorphological research, we will see that at the close of 20th century, well-cited geomorphological research is highly multidisciplinary and interdisciplinary, with the dominant fields being biology, civil engineering, geology, soil science and social geography. Among the various fields of geomorphology, papers on fluvial processes and landforms, riparian and wetland studies, coastal processes and forms receive the maximum citations.

This however is not the scenario in Indian geomorphology. It appears from various cited papers in India that we are seldom considering other branches of science in our research apart from geology and geography. It is time we change this situation and reorient our geomorphology research in multidisciplinary and interdisciplinary context making it more relevant and applicable. Techniques like discriminant analysis can be effectively used in differentiating and mapping depositional facies (Plate 1) and first and second order directional derivatives to extract hidden complex features like creek bedforms (Fig. 3). Dear friends, I have tried to put before you, my ideas on research and training in geomorphology. I am sure you have your own ideas and notions on these issues which can also be discussed and implemented.

With these few words, I like to thank you for listening to me patiently. I wish you an excellent seminar and a conference with very rewarding participation. I once again thank the members of the executive council of IGI, Prof. Savindra Singh, secretary of IGI and Dr. Sunil Kumar De, the convener of this meet for giving me this opportunity to share my thoughts and views with you on this occasion.