INTRODUCTION

Geomorphology is primarily a science of the study of landforms and the processes that create them (D.R. Coates, 1976). In fact the study of land forms necessitates some knowledge of the processes which have operated in the past and indeed are operating at present in order to understand as to how these landforms have come to be, what they are in reality, which are comprised of non-regular, non-random systems and which arise from the multicomplexity of processes and inherit ance (Ruxton, 1968). Such discipline though passing through several stages of variable concepts and approaches since its birth is continuosly undergoing rapid changes. The conceptual approach towards central theme of geomorphology, blossomed with the dawn of W.M. Davis, the influence of whose work on geomorphology was, without doubt, greater and longer than that of any other individual despite greater criticism of his model of landscape development, has now got its shape in the practical use for the solution of problems, where man wishes to transform landforms or to use and change surficial processes (Coates, 1971). In its long history of methodological development, this discipline has been assisted through the application of quantitative techniques since 1930 (Krumebein, 1930, Horton, 1932 and 1945, Strahler, 1950 etc.) which opened a new vista of awakening in the thinking of the lanform study. It is frequently said that statistics, remote sensing, aerial photographs and computer induced results have no doubt enhanced the interpretative and explanatory spectrum of land scape science and it has tried to fill up the conceptual vacuum created by decline in the popularity of Davisian School of Geomorphology (Savindra Singh, 1978) but mere application of quantitative techniques without knowing their suitability and desirability may not lead to fecundity and productivity of the subject but some times this application may be lead to sterility and trivility (Savindra Singh, 1978) because geomorphology is primarily a field science where observations and interpretations play a vital role in portraying morphology of macro, meso and micro units (Singh, R.P., 1977). Though field study is painstaking yet it enables us to swift the local details in order to reveal more clearly the fundamental principles of landform development (M.F. Thomas, 1974). The present investigator is of the opinion that meaningful quantification may produce fruitful results in the study of drainage basins which has been recently accepted as an ideal areal unit in terms of open system though sucessful integration between empirically identified relationships and process-related explanations is as yet incomplete and is hindered by an incomplete and spatially uneven availability of data and observation (Gardiner, 1982).

The variation of landforms no doubt do not arise from the operation of different processes alone but also from the manner in which universal processes operate under different environmental conditons. No doubt water flow obeys universal laws but it will be false to argue that all fluvially eroded landforms are identical. Thus the complexity of litho, topo, climo, pedo-functions in the development of landforms leaves no alternative but to adopt composite theory which envisage detailed objective description of landforms through field observations and morphometric details, their classification into genetic/non-genetic categories and highlighting their development whether they may be result of progressive change through time or they may be the outcome of the balance between continuing uplift and erosion as a case of open system, steady state model of landform development or they may be the product of interactions between diastrophic activity and climate or they may be due to parallel retreat etc. (Savindra Singh, 1985).

A critical evaluation of Davision, Penckian and Hackian Models of landforms also leads to the acceptence of composite model of landform including the basic tenets of these three models together. Beginning in 1899, Davis produced a genetic system of landform description in which he explained that during erosion of a highland, the landscape involves systematically through distinctive stages of youth, maturity and old. This entire sequence of stage he (Davis) called geographic cycle and the end product was supposed to be a surface of low relief or peneplain. Though Davis' genetic concept of landform development was a brilliant synthesis, which grew directly out of the works of Powell, Gilbert and Dutton and also from the controversial ideas of organic evolution which were prevalant at the time (Leopold et al, 1969). The most serious challenge came during the 1920's, from Walther Penck who tried to present a direct causal relation between tectonics and the properties of landforms. But Penck's model is still being tested and debated despite the dawn of Hack (1960) who has offered a camparable view of landform development (dynamic equilibrium theory or model), thus challenging the basic tenets of Davis's concept of the cycle of erosion. But, in fact, all these three theorists (Davis, Penck and Hack) are known more for their respective models rather than their reference systems which have aroused a lot of misconceptions about their views. As pointed out by Palmquist (1975) and already sensed by Savindra Singh in 1974 (Savindra Singh, 1974) all these three systems (Models) are compitable as regards the adjustment of landforms to structure and lithology. The critics of Davisian model of landform development and exponents of dynamic equilibrium model have also a tinge of sequential change of landforms through time though not consciously done in their writings (Savindra Singh, 1985). As observed by Savindra Singh (1985) these three models of landscape development reveal some common aspect in them as (i) there is adjustment of landforms to structure-lithology controls, (ii) with environmental changes the landforms register time dependent variations, (iii) long period of environmental stability causes progressive reduction of topographic reliefs and (iv) there are some sort of equilibrium phases in landform development.

Thus conclusively no conflict between the models (Those of Davis and Hack) exists when dynamic equilibrium is limited to short durations and small areas such as a hill slope during present times while Davisian model is considered to describe the landform evolution through long intervals of time characterised by stable external conditions and progessivily changing internal conditions. The Davisian model is thus a series of dynamic equilibrium states which develop in response to progressive shift to the equilibrium constant through time (Palmquist, 1975). Similarly, Penckian model merges with the equilibrium model during uniform development, when there is balance between the rate of upliftment and rate of denudation.

Some serious attempts have also been made apart from these models for the analysis of landscape develpment viz.. Lester King's geomorphic system including the landscape cycle, the epigene cycle of erosion, the pediplanation cycle, the hill slope cycle, etc. (King 1953, 1962 and 1963), Schumm's episodic model, incorporating geomorphic thresholds and complex response (Schumm, 1975), Crickmay's model of unequal activity (1959), Peltier's general landform equation model

(1975), Palmquist's composite model (1975), Morisawa's tectono-geomorphic model, etc. In fact these few models have come out as the modification in the Davisian model but the conceptual vacuum created after the fading glory of Davisian model has yet to be filled up. Following Savindra Singh it may be forwarded that inspiteof conscious and serious attempts in rejecting Davisian, model of landscape development, the imprints of Davis could not be written-off from the mind and writtings of most theorists and critics (1985) as is apparent from the writings of Judson "His (Davis) grasp of time, space and change, his command of detail and his ability to order his information and frame his argument remind us again that we are in the presence of gaint (Judson, 1975).

In reality description without explanation is geomorphologically insignificant. A note of caution must be sounded here that there may be no definite theory or geomorphic system that can fit all land scapes (Higgins, 1975, 1980) because uplift by delayed isostatic feed back causing renewed erosion, supports the Davisian model where intermittent upward movement results in erosion levels at different elevations. Continuous isostatic feedback supports the Penckian model of continuously changing ratios of uplift to denudation. Thus both models may be expected in the geomorphic history of a region (Morisawa, 1975). The studies of Savindra Singh (1985), Agnihotri (1983), Preeti Singh (1993), Chhaya Mishra (1996), Ajit Prakash (1993) and R.S. Pandey (1983) on Bhander plateau and Rewa scarps reveal the fact that over the Bhander plateau the co-existence of the drainage net with graded profile of equilibrium over the higher plateau and lower uplands, significant breaks in slope in their middle courses and above all steep slopes having freeface element of scarp-faces in no case can be explained on the basis of Davisian model and thus his model miserably fails. But in the same region "SHARDAPOLE" has undergone the reduction of relief of at least 72 M. whereas the tops of central plateau and flat-toped mesas are least affected by down-wasting, though they have undergone parallel retreat and the process is still continuing. Such conditions support Davisian model of landscape evolution and Hack's equilibrium model and corroborates the slope replacement model of Penck due to backwasting and hill slope cycle model of L.C. King (Savindra Singh, 1985, Chhaya Mishra, 1996). Further eastward and northeast ward from Bhander plateau (Say towards Rewa plateau) tectono-geomorphic model of Morisawa (1974-1975) becomes valid in explaining the landscape characteristics (Savindra Singh, 1985). Such examples nullify the authenticity of a single theory of land scape development all over the planet earth and convince the present investigator to adopt multiple theories for different purposes. In fact if natural world is irrational no internally complete and substantive theory or system would work (Schumm, 1975). Thus after sensing the possibility of the applicability of more than one theories in a single region, the present authoress has no bias of a paticular theory in the explanation of the landforms but has viewed the region with open mind taking into account the consideration of adjustment of landforms to lithology, to geologic history and to climatic conditions of the region, 'Shahdol Region'. The present investigator having full agreement with Palmquist (1975) and Savindra Singh (1985) has emphasised and applied the composite and multiple approaches in the present dissertation for deciphering the landform suites and has tried to enjoy the academic fun of trying out a variety of ideas but she could not get rid off from quantitative flavour as she is of the opinion that thoughtful and meaningful quantification may produce fruitful results and may strengthen the mixed approaches. In this study the present investigator has attempted to relate the present fluvially eroded landforms to typical geological structures having Gondwanas, granites and basalts for the explanation of landforms and has tried to explore the possibility to solve some environmental problems viz. soil erosion, ravination and wastelands.

As regards the selection of the present study region (Shahdol Region) it is one of the conveniently divided physiographic regions of the peninsular India which is the basic unit of Geomorphic study. The investigator has selected Shahdol Region of India for the detailed study, interpretation and explanation of polycyclic landforms developed during different stages of cycle of erosion over varied structural zones, so that a common theory of landform evolution and intensity of denudational processes might be presented.

The whole study has been divided into six chapters. Chapter first is concerned with the study of physical background of the region wherein location, geology, geocycles and geomaterials, climate, natural vegetation and soils have been discussed briefly so that it may assist in understanding the nature of geomorphic mossaic of the region.

General physiographic features, physiographic regions, drainage pattern, drainage density, stream frequency, drainage texture with their controlling factors are analysed in second chapter.

The third chapter is related, with the study and interpretation of topological, geometric and areal properties of drainage network wherein stream ordering, number of stream segments, bifuracation ratio, law of stream number, law of stream length, law of stream area, law of allometric growth, sinuosity indices, angular properties of open links and geometric properties of closed links (basin shape) have been diccussed and interpretted in detail.

The fourth chapter is devoted to the slope analysis including average slope of the region, clinographic analysis, measurement of slope profiles, analysis of slope profiles and evolution of slope profiles.

The fifth chapter deals with relief analysis including hypsometric analysis, altimetric analysis, absolute relief, relative relief, dissection index, profile analysis, correlation analysis among various morphometric attributes and morpho-units.

Morphodynamics, morphogenesis, denudation chronology, erosion surfaces evolutional pattern of landforms and geo-environmental problems with suggestions, have been treated in sixth chapter.

Finally the summary and conclusion of the present study has been presented at the end of the thesis which is followed by exaustive list of references and field photographs.

The present study has passed through the following stages :

i. The informations regarding geology of the study region have been collected from the Memoires of Geological Survey of India (Medlicott 1859, vol.2, part I, Mallet 1969, vol.7, part I, Mallet, 1971, vol.7, part II, Oldham 1901, vol.31, part I, Auden 1933, vol.62, part II, Dunn 1939, vol.73 and Krishnan 1953, vol.81), Records of G.S.I. (Datta 1895, vol.28, part IV, Dunn 1931, vol.65, part III, Oldham 1895, vol.28, part IV, Ahmad, 1959, vol.81, part III, Shahni 1963, vol.91, part II and denburg 1906, vol.33, part IV) and other published materials (Mache and Peshwa, 1937-38, Pascoe, 1950, Wadia, 1961, West, 1962, West and Chaubey, 1964, Dubey 1968, Dutt, 1968, Krishanan, 1982 etc.).

ii. The climatological data have been collected from Indian Institute of Meterology; Pune and Records of national observatory at District headquater of Shahdol whereas the data of pedological, edaphic and floral informations have been obtained from Soil Survey and Soil Conservation Departments and Forest Departments of Shahdol District.

iii. The morphometric variables have been derived through appropriate techniques from the Topographical sheets of Survey of India viz. 64 E and 64 I (1 : 250,000) and 64 E/2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16, and 64 I/2.

iv. Samples of rocks have been collected from relevant localities and these have been analysed in the laboratory for the chemical and mineral composition of geomaterials so that the process of interactions between exogenous geomorphic processes and geomaterials can be properly understood and interpreted.

v. Extensive field work has been under taken several times (4 times) and the typical morphological features have been photographed to interpret the mechanism of morphodynamic processes and resultant landforms.

vi. The slope profiles were measured during the period of intensive field work with the help of Abney level, Tape and Ranging rods.

vii. The data derived through published literatures related to the study area, topographical sheets of Survey of India,l intensive field work, field measurement and laboratory analysis have been analysed, interpreted and elaborated through appropriate statical and mapping techniques and systematic regional geomorphology of the region has been presented.