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HOLOGENE GEOMORPHODYNAMICS OBSERVATIONS FROM NIGERIA AND MOROCCO

by

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RESUME

Dans le Sud Marocain, un sol rouge avec des lamelles calcaires dans l'horizon C s'est formé pendant la fin de la dernière période glaciaire ou au début de l'Holocène. Au cours de la période suivante, le Rharbien, il n'existait qu'une faible activité morphodynamique sur les pentes alors que l'accumulation du matériel fin prédominait dans le fond des vallées. Pendant l'Holocène moyen et récent, se sont produites plusieurs alternances de périodes caractérisées par une forte pédogenèse (formation de sols noirs) associée quelquefois à une nappe phréatique beaucoup plus haute (= périodes de stabilité morphodynamique) d'une part, et, d'autre part, des périodes de transport déplaçant le matériel grossier sur les pentes et dans le fond des vallées- (= périodes d'activité morphodynamique). Les conditions de climat actuelles sont potentiellement favorables à la pédogenèse lorsque la végétation est dense. Cependant, on remarque souvent une prédominance du transport de matériel fin et partiellement aussi de matériel grossier sur les pentes et dans le fond des vallées, par suite des modifications importantes de l'écosystème par l'homme. Mais l'érosion des sols et le transport de matériel grossier pendant les périodes d'activité géomorphodynamique conditionnées par le climat étaient plus marqués que les processus que l'on peut observer actuellement.

Au Nigéria méridional et septentrional, on peut également observer actuellement une érosion assez forte du sol bien que l'activité géomorphodynamique soit relativement plus faible lorsque le milieu naturel n'est pas perturbé par l'homme. Des études stratigraphiques le montrent clairement. On constate, en effet, au début de l'Holocène puis au cours de l'Holocène moyen, dans les deux ensembles régionaux, au moins deux périodes caractérisées par une activité morphodynamique nettement plus forte, provoquée probablement par le climat.

Après que la signification de l'érosion des sols par l'homme ait été comparée à l'érosion naturelle pour différentes périodes climatiques, il serait erroné de sous-estimer ses dangers potentiels. En effet, sous des conditions climatiques moins favorables par rapport aux condtions actuelles (distribution irrégulière des pluies, pourcentage élevé des fortes pluies), conditions qui se sont présentées déjà plusieurs fois pendant l'Holocène et qui peuvent se reproduire dans le futur, l'érosion anthropique pourrait avoir des conséquences catastrophiques.

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ABSTRACT

During the Late Glacial or Early Holocene a reddish-brown soil with irregular layers of calcareous induration in the C-horizon was formed in Southern Morocco. This period was followed by the Rharbien, during which there was little geomorphic activity on the slopes, with the accumulation of predominantly fine material in the valleys. In the Middle and Upper Holocene there were recurring changes involving periods marked by intensive soil formation (black soils) and a significantly higher groundwater table on the one hand (= periods of geomorphodynamic stability) and periods characterized by the transportation of coarse material on the slopes and along the valley floors on the other (periods of geomorphodynamic activity). Given a sufficiently dense vegetation the climatic conditions obtaining at present would favor soil formation (= very little geomorphodynamics on the slopes). However, owing to man's disruption of the ecosystem the prevailing feature to-day is the transportation of predominantly fine material on the slopes and along the valley floors. The soil erosion and transportation of coarse material which occured during the climatically induced periods of geomorphic activity were much more intense than those under the present man-modified morpho-climatic regime.

A high degree of soil erosion is also found in Northern and Southern Nigeria, even though under natural conditions there would be little geomorphic activity. Stratigraphical research in these areas has revealed conclusive evidence for the assumption that during the Early and Middle Holocene there were at least two - presumably climatically-induced periods characterised by a siginificantly higher degree of geomorphodynamics.

Having thus qualified the relevance of man-induced soil erosion, it would be wrong, however, to underestimate its potential impact. Compared with the conditions prevailing to-day it might reach catastrophic proportions under the type of unfavorable climatic conditions (irregular distribution of rainfall, high percentage of heavy rain) which occured at various times during the Holocene and may recur at any time in the future.

DISCUSSION

L.K. Jeje : In forested parts of southwestern Nigeria, there are areas of high rural population density with more than 500 people per km² with no noticeable anthropogenetic or any other type of erosion. How can you explain this in the light of your assertion about human factors in soil erosion ?

H. Rohdenburg : In Southern Nigeria, gully erosion and severe soil losses are confined to the areas with specific soil conditions, especially such deep sandy soils as those of the falsebedded sandstone in the Enugu-Nsukka area.

M.F. Thomas : If interference between climatically induced soil erosion and anthropogenic erosion is likely, how is it possible to be sure that the climatic effects led to more intense erosion and sedimentation as componed with the effects of man during the Holocene Period during which anthropogenic effects on vegetation may have been important ?

H. Rohdenburg : In many cases, present-day processes on intensively grazed slopes do not create much soil erosion. It might be concluded therefore that debris transportation down these slopes requires more frequent heavy storm rains than those of to-day.

O. Slaymaker : What is meant by the statement that "under natural conditions there would be little geomorphodynamics" either in Northern or in Southern Nigeria. As your argument rests so heavily on climatic change in the past, y would have thought that contemporary climates as those of Northern and Southern Nigeria would show variable geomorphodynamics.

H. Rohdenburg : The ecological conditions of the pleistocene pedimentation periods must have been different from those of the Holocene when accumulation was dominant but may have alternated with periods of quasi-stability on the pediments. The differences of the present-day climatic conditions between Southern and Northern Nigeria are not as great as the differences of the Holocene and Pleistocene climatic conditions.

J. Dresch : Je ne crois pas qu'une comparaison entre le Maroc méridional et le Nigeria Nord et Sud soit pleinement légitime pendant l'Holocene. Les conditions climatiques et leur succession ont été trop différentes. On ne peut parler de période glaciaire au Nigeria ou même au Maroc méridional. Le Maroc méridional et le Nigeria Nord sont caractérisés par de forts contrastes saisonniers. C'est dans ces conditions que les débuts de l'élevage et de l'agriculture ont pu jouer un rôle, il est vrai tardif, dans l'Holocène.

H. Rohdenburg : I did not try to make a detailed stratigraphic comparison between North and West Africa, because until now there has not been enough data. But it is possible to conclude that in both areas the effects of climatic fluctuations have been more pronounced than those of human interference, not only in the Pleistocene but also in the Holocene.

H. Mensching : Although the effects of human activity on the landscape may be extremely marked, they are in fact but an accentuation of climatically controlled morphogenetic processes. Such effects act in markedly different ways in climatic zones as contrasted as Southern Morocco, Northern and, especially, Southern Nigeria. We must therefore be cautious about the conclusions we make.