Geogr. Fis. Dinam. Quat.
36 (2013), 107-118, 12 figg.

DOI 10.4461/GFDQ.2013.36.8

YANNICK LAGEAT (*)

DISCORDANCE OF EROSIONAL TEMPOS: A NON-LINEAR AND SCALE DEPENDENT EVOLUTION IN THE ORANGE RIVER BASIN (SOUTHERN AFRICA)

ABSTRACT: LAGEAT Y., *Discordance of erosional tempos: a non-linear and scale dependent evolution in the Orange River basi (Southern Africa)*. (IT ISSN 0391-9838, 2013).

Various erosion rate monitors have been exploited to evaluate the denudational history of the Orange River basin from the Mesozoic to the present. Extrapolation back in time from contemporary sediment loads is hazardous, even throughout the Holocene, and low temperature thermochronometry is unable to provide constraints on the recent cooling history, so that a gap cannot be bridged between a Cretaceous period of significant post-rift denudation and a recent acceleration of the human impact. In the first period the role of tectonics may be viewed as the driving force whereas cropland soil losses have dramatically increased through gully erosion during the last century. This paper highlights the limitations of comparing denudations rates over a long period of time as measurements of current processes appear irrelevant for interpreting long-term landscape evolution. Two ways of acquiring an understanding of landforms are to be considered as they bear evidence of an irreducible disparity between the tectonic and anthropic imprints.

KEY WORDS: Erosion rates, Southern Africa, Passive margin, Fluvial discharge, Soil erosion.

INTRODUCTION

Over the past decades Earth scientists have expanded the range of methods used to infer erosion rates the application of which has spurred significant advances in quantifying the rhythms of geomorphic processes, a familiar approach for our colleague and yet friend Monique Fort. A quarter of century after a defence of a thesis about South Africa (Lageat, 1989), the following contribution to her «*Mélanges*» intends to assess the advancement of researches dealing with erosion tempos at various spatial and temporal scales, a fundamental topic in geomorphology. This paper reports average rates of denudation for various time intervals from the Mesozoic to the present, determined for the Orange drainage system, at areal scales ranging from the headwaters of the major tributaries to the whole catchment and over time scales varying from decades to millions of years. An opportunity is thus offered to aim at characterising and quantifying the terrigenous supply eroded in the drainage area, this set of data providing a rich information about erosion rates which extends along various time spans. The relevance of this knowledge for the modelling of landscape evolution remains a topic of considerable debate, allowing a critical approach of the methods applied to address this cardinal question.

THE ORANGE RIVER: A POWERFUL CONVEYOR

The Orange River originates in the north-eastern corner of Lesotho, in the Maloti Highlands, at Thaba Putsoa, 3350 m above sea level, at a distance of only 193 km from the Indian Ocean (fig. 1). After leaving Lesotho, where it is named Sanqu, the river flows westwards for 2092 km through regions of steadily increasing aridity, finally discharging its water and sediment in the South Atlantic Ocean at Alexander Bay.

The natural discharge

The Orange River Basin encompasses all of Lesotho, 48% of South Africa, 27% of Namibia and 12% of Botswana. It is by far the largest catchment in southern Africa, but the effective catchment area is difficult to de-

(*) *Géomer UMR 6554-LETG, Université de Bretanie Occidentale, Brest, France*. E-mail: yannick.lageat@univ-brest.fr

I thank the Guest Editor Prof. G. Arnaud-Fassetta for his invitation to prepare this paper. I am especially grateful to my sister Maryvonne Le Rouzic who improved the form of the original manuscript, to Laurence David who redrawned the figures, and I am deeply indebted to Prof. A. Goudie for his encouragements and comments. My thanks are also offered to two anonymous reviewers for their constructive suggestions.