

Post-Gondwana Drainage and the Development of Diamond Placers in Western South Africa

M. C. J. DE WIT

De Beers Consolidated Mines, Geology Division, P.O. Box 7383, Centurion 0046, South Africa

Abstract

The post-Gondwana history of the major rivers in the western part of South Africa is important because these rivers were instrumental in the development of diamond placers along the west coast of southern Africa. The evolution of the drainage systems that developed after breakup of west Gondwana can be viewed in three time-slots: the middle to Late Cretaceous, the early to middle Cenozoic, and the late Cenozoic periods.

During the middle to Late Cretaceous there were two main river systems draining the interior. The one in the south, also referred to as the Karoo River, had its source in the present upper Orange/Vaal drainage basin and its outlet was at the present Olifants River mouth. The second and more northerly system, also known as the Kalahari River, drained southern Botswana and Namibia and entered the Atlantic Ocean via the lower Orange River. Erosion dominated the period immediately after breakup of west Gondwana and most of the diamonds released during erosion of Cretaceous kimberlites in central South Africa were transported by the Karoo River to the coast.

By early Cenozoic times, the lower Kalahari River had captured the upper part of the Karoo River and the broad configuration of the present Orange River network was established. This capture and northerly shift of the Orange River, on the newly exhumed pre-Karoo surface, was the result of an accelerated uplift of the southern and eastern subcontinental margins ca. 100 to 80 Ma. During the early and middle Cenozoic, the climate was arid to semiarid. This resulted in a substantial reduction in erosion rates and hence few diamonds were released from the primary bodies during that time.

Late Cenozoic fluvial gravels, however, dated as either middle Miocene or Plio-Pleistocene, contain diamonds that were reworked out of older Tertiary fluvial deposits. Sediments at the base of the Koa Valley and in the upper terraces in the Sak Valley formed the Koa River, a major tributary of the Orange River during the Miocene, and drained most of the area previously occupied by the lower Karoo River. The Koa River thus reworked diamonds trapped in the Cretaceous Karoo River deposits or terraces.

Younger sediments of the Carnarvon Leegte were never part of the Koa system. In fact, the Sak River captured the upper Koa River by late Pliocene times and the Plio-Pleistocene lower terraces in the Sak Valley and the paleo-Carnarvon Leegte joined as the paleo-Hartbees River, another major tributary of the Orange in the Plio-Pleistocene.

Although climatic changes were the major controls that initiated the alluvial pulses during the Cenozoic, asymmetric uplift of the subcontinent was ultimately responsible for the northwesterly shift of the Orange River.