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The role of regional tectonics in determining paleoenvironments of human evolution in the Dikika Research Project area, Ethiopia

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Geological mapping of the Dikika Research Project (DRP) area has revealed a well-defined stratigraphic framework and extensive sediments from 3.8 Ma to present. From this, we are able to reconstruct a regional geological and tectonic history, which sheds light on regional environmental changes resulting from tectonics in the Afar Depression. The sedimentary sequence begins with the Hadar Formation, deposited on a faulted and deeply weathered surface of Dahla Series Basalt (8-4 Ma) in a sedimentary basin that was actively extending along faults parallel to the Red Sea Rift. Sedimentary facies at the base of the Hadar Formation indicate a shallow fluctuating lake which is progressive infilled as the shoreline migrated northwards towards the axial depocenter. Following 2.9 Ma, during development of the Yangudi Basin of the main Ethiopian Rift System (ERS), the DRP area was uplifted and eroded on the margins of this rift-axial basin. Following 2.7 Ma, local sedimentation returns to the DRP in the Busidima Half-graben, although the sedimentary basin changes both in character and position. This basin was formed by the rotation of an asymmetric marginal half-graben around an identifiable border fault parallel to the western escarpment of the ERS, consistent with the current tectonic regime. Sediments thicken towards the border fault and record the migration of the paleo-Awash River in response to this new tectonic setting. Spatial patterns of depositional environments of the Hadar Basin and Busidima Half-graben are markedly different. Other paleoenvironmental variables such as the proportion of C4 grasses recorded by stable isotopes in paleosol carbonates reflect these changes in basin tectonics. These findings highlight the fact that greater understanding of both the tectonic and climatic controls on hominin paleoenvironments will be required to understand the role of the environment in human evolution.