Economic Geology
Vol. 97, 2002, pp. 1037–1049

A New Occurrence of Merensky Reef on the Flanks of the Zaaikloof Dome, Northeastern Bushveld Complex: Relationship between Diapirism and Magma Replenishment

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Abstract

Exploration for platinum-group elements has resulted in the discovery of an occurrence of Merensky reef in the eastern limb of the Bushveld Complex, South Africa. The new discovery was made on the Dwarsrand property in the poorly known boundary area between the intensively explored western and central sectors of the eastern limb. This boundary area is largely composed of domes and basins that may, in part, be aligned along a regional lineament, the Wonderkop fault. Transvaal Supergroup metasediments in the core parts of the domes form prominent hills, whereas the Bushveld Complex in the intervening basins is restricted to areas of poor outcrop. The formation of domes is attributed to diapirism triggered by gravitational loading and heating of the Transvaal Supergroup in response to intrusion of the Bushveld Complex. Merensky reef was located beneath cover rocks in an area where the Critical and Main zones are uplifted and attenuated against the southern flank of the Zaaikloof dome. Drill holes, although collared in Upper zone, intersected the Critical and Main zones at relatively shallow depths. As a result of the uplift, the Critical and Main zones, including the Merensky reef, are steeply dipping. The base of the Upper zone forms an intrusive unconformity and the layering in this zone has a much shallower dip. Economically significant grades were obtained on the Dwarsrand property, but exploration was terminated because of poor strike continuity.

The new findings suggest that uplift and attenuation of the Bushveld Complex on the flanks of domes in the northeastern part of the Complex are both more extensive and more severe than previously realized. A complex history of intrusion and uplift is implied. Some domes even penetrate into the overlying Bushveld granite. The occurrence of markedly angular unconformities may be contrasted with the layercake sequences typically associated with the Bushveld Complex. Diapirism, in response to crustal loading and heating by ultramafic sequences, occurred in the early stages of magma emplacement. Episodic intrusion and uplift are consistent with multiple replenishment models, in which each of the many dozens of cycles that comprise the Critical and Main zones corresponds to a new magma pulse, with the oldest layers being dragged to higher structural levels in response to the uplift. Periodic reactivation of doming is indicated by the lowermost layers within the Critical and Main zones abutting against the southern flank of the Zaaikloof dome at progressively higher levels. The transgressive nature of the Upper zone and Bushveld granite, relative to the Critical and Main zones, may indicate that the Upper zone formed by new intrusions of magma rather than the generally accepted model of differentiation within the chamber. The discovery of "hidden" Merensky reef at relatively shallow depths beneath transgressive Upper zone and granite could provide the impetus for further exploration possibilities within the Bushveld Complex, particularly on the flanks of regionally extensive domal structures.