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Anatomy of a Witwatersrand Conglomerate Reef

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Classic Witwatersrand gold reefs occur in quartz pebble conglomerates deposited on braided fluvial plains. Most occur in the Central Rand Group, in seven main goldfields. Similarities in the vertical profiles of these reefs are noted across the goldfields and through the stratigraphic column of the Witwatersrand. The most important reefs lie on distinct unconformities. It follows that the footwall stratigraphy of the reefs will be highly variable, yet these reefs commonly lie on a greenish yellow-grey (typically 5GY7/3) quartzwacke (a). Microscopic and geochemical studies reveal significant sericite clay in the footwall. In contrast, the overlying reef and its immediate hanging wall are usually very siliceous, mostly devoid of sericite. The footwall rocks are thought to represent primitive palaeosols, developed during the unconformity hiatus, the yellowish colour being a response to a process rather than simply to the stratigraphy.

Many conglomerate "reefs" comprise two distinct units, sometimes referred to as a "composite" reef", such as the Composite Reef on Cooke Section of Randfontein Estates Gold Mine (Figure 1).

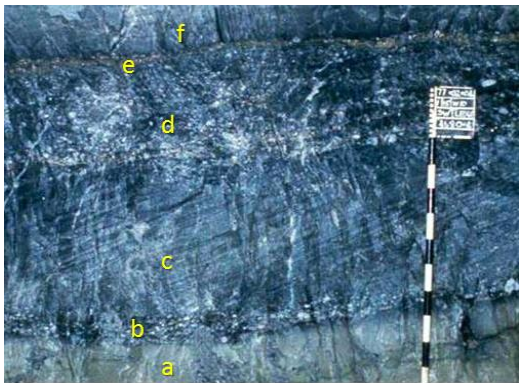

Figure 1: Composite Reef, Cooke Section R.E.G.M.

The lower unit commonly has a basal gravel lag (b) with an attendant coarse grained accumulation of pyrite and other placer minerals. This is followed by a 50 to 100 cm cross-stratified arenite (c), interpreted to be the product of a high-discharge flood stage during which clastic sediments were flushed into the system by a fluvial placer process. The clay component was flushed away as suspension load. The sand advanced down the river as cross-bedded arenites where the clay was washed out, the remaining sand developing cross-bedded units. Gravel clasts either made it over the crest of the dune ahead, to avalanche down the lee side and come to rest in the trough ahead, or get caught up in the trough behind. The dune then advanced over the gravel lag, sealing it. Either way, the net result was the development of a basal conglomerate with attendant heavy minerals.

The flood stage would subside quickly and be followed by a protracted period of degradation and winnowing when further sand was flushed out, especially in the higher-energy proximal areas. The remaining gravel became trapped in a series of thin gravel bars (d).

The final even lower stage is a thin terminal concentration of heavy minerals (e), often forming an armoured cap preventing further erosion of the underlying conglomerate. The immediate hanging wall of the reef is usually a clean cross-stratified quartzite (f), again devoid of clay content. The colour is consequently a neutral pale to medium grey (N5 to N7).

Examples of this profile include the Commonage Reef (Klerksdorp Goldfield), the Composite Reef of Cooke Section (Randfontein Estates) and the May Reef on Winkelhaak Mine (Evander Goldfield).

The recurrence of this profile is a response to a process, not the provenance. Witwatersrand conglomerates are reminiscent of Miall's (1978) Donjek Model. This strongly supports placer concentration, both during depositional and degradational stages. However this does not negate a later hydrothermal event which is believed to have modified the World's greatest placer deposit.

Reference:

[1] Miall, A (1978) Can Soc Petrol Geol Spec Pub 5: 597-604