THE COMPOSITION AND STATE OF GOLD TAILINGS

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DIE SAMESTELLING EN TOESTAND VAN GOUDSLIK

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THESIS SUMMARY

THE COMPOSITION AND STATE OF GOLD TAILINGS

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Tailings dams are generally not designed with the same conservatism as conventional water-retention dams for economical reasons. The safe design, construction, operation and reclamation of these structures require an understanding of the nature and behaviour of tailings as a construction material. The composition of this man-made material and its influence on the in-situ state of tailings is of particular importance. A research program was therefore initiated at the University of Pretoria, to investigate the composition and state of South African gold tailings on the far West Rand gold reefs. Samples for this project were collected from the pond areas of two impoundments, and from the tailings delivery slurry.

Individual layers in a tailings deposit, whether fine or coarse, are made up of mixtures of tailings sands (particles larger than 63 μm) and tailings slimes (particles smaller than 63 μm). Tailings sands are shown to be almost pure silica quartz with approximately 10% illite. Tailings slimes, on the other hand, contain considerable amounts of clay minerals (20% muscovite, 15% illite and 20% pyrophyllite, kaolin and clinochlore) and traces of pyrite and other sulphides in addition to the quartz. Tailings, consequently, have a significant amount of clay fines, which can be expected to have a major effect on the mechanical behaviour of the material. Tailings sands are highly angular to sub-rounded, bulky, but flattened particles, whereas the finer slimes are made-up of thin and plate-like particles characteristic of clay minerals. Particle surface textures can range from smooth to rough on a micro scale.

The material considered in this study had an abundance of slimes in both fine and coarse samples, which controlled its behaviour. Fully dispersed gradings were uniformly distributed in the fine sand

SAMEVATTING VAN PROEFSKRIF

DIE SAMESTELLING EN TOESTAND VAN GOUDSLIK

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Slikdamme word as gevolg van ekonomiese oorwegings, nie ontwerp volgens dieselfde konserwatiewe benadering waarmee konvensionele damme ontwerp word nie. Die veilige ontwerp, konstruksie, bedryf en herwinning van slikdamme vereis 'n deeglike kennis van die aard en gedrag van slik as 'n boumateriaal. Die samestelling van goudslik en die invloed daarvan op die toestand en meganiese gedrag van die materiaal is van besondere belang. Ten einde hierdie eienskappe te ondersoek is 'n navorsingsprojek gestig by die Universiteit van Pretoria. Vir die doel is slikmateriaal gemonster vanaf twee slikdamme in die verre Wesrand.

Individuele lae in 'n slikdam bestaan uit mengsels van sliksande (greine groter as 63 μm) en slikslym (greine kleiner as 63 μm). In hierdie studie word getoon dat die sliksand hoofsaaklik bestaan uit suiwer silika kwarts met 'n klein persentasie (ongeveer 10%) klei-minerale. In teenstelling daarmee bevat slikslym aansienlik meer klei-minerale (ongeveer 45%), sowel as klein hoeveelhede piriet en ander sulfiede. Dit is dus duidelik dat goudslik genoeg klei-minerale bevat om die meganiese gedrag daarvan te beïnvloed. Sliksande het 'n hoekige vorm, alhoewel die korrels meer plat as kubies of rond is. In teenstellings hiermee bestaan slikslym uit dun plaatjies soos tipiese klei-minerale. Die oppervlak van individuele greine wissel van glad tot grof op 'n mikroskaal.

Die materiaal wat bestudeer is het 'n oormaat fyn materiaal gehad in beide die fyn en growwe slikmonsters. Die gedrag van hierdie slikke word dus beheer deur die fyn materiaal. In 'n gedispergeerde toestand, lê die graderings univorm verprei in die slik- en fynsand-areas met min greine kleiner as 2 μm of groter as 200 μm. Die verskil tussen fyn en growwe graderings is hoofsaaklik geleë in die medium greingrootte wat wissel tussen 6 en 60 μm. Wanneer monsters nie

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