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# Mineralogy and Osmium Isotope Composition of Placer Platinum Group Element and Gold Grains Recovered from Offshore Southern Namibia: Possible Source Rocks in the Gariep Belt?

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Platinum group element (PGE) and gold (Au) grains have been recovered from sediments located offshore of southern Namibia, northwest of the Orange River mouth. The grains were recovered from a placer deposit that hosts economic diamond mineralisation. The mineralogy of the grains was investigated through scanning electron microscope (SEM) imaging as well as through both qualitative and quantitative electron probe micro-analysis (EPMA). In addition, osmium isotope compositions were measured in several grains.

The PGE grains consist predominantly of Pt-Fe and Pt-Pd alloys. In addition, several Os-Ir-Ru alloy and Pt-Cu alloy grains were identified. The mineralogy of the PGE grains is generally similar to that observed at other PGE placers globally [1]. However, Pt-Cu alloy grains are somewhat rare, having been reported previously at only a few locations and generally associated with hydrothermal mineralisation [1, 2]. Overall, the mineralogy of the PGE grains is consistent with a combination of magmatic and hydrothermal primary PGE mineralisation.

The Au grains are primarily Au-Ag alloys, with the majority containing ~5-10 wt% Ag and some containing as much as ~30 wt% Ag. Notably, a proportion of the Au grains contain high Cu contents, with many grains containing several wt% Cu. High Cu concentrations are somewhat unusual for placer Au grains, which commonly originate from orogenic Au sources that generally have low Cu concentrations. A detailed study by Knight and Leitch [3] concluded that Au-Cu alloys are nearly always found in ore deposits associated with either differentiated mafic magmas or with altered ultramafic rocks in ophiolite complexes. Mineralogical data suggest that some Au and PGE grains may have formed or re-mobilized in similar hydrothermal environments.

Osmium isotopes were measured in several PGE and Au grains. While osmium isotopes have only been measured in a limited number of samples, the preliminary isotopic dataset is consistent with the hypothesis that the PGE grains were likely derived from both magmatic and hydrothermal source rocks while the Au grains were likely derived from hydrothermal source rocks. The PGE grains produced a range of Os model ages. Robust Re-Os isochrons could not be constructed for either the PGE or the Au grains.

Literature review and field studies have identified two potential source rocks for the PGE grains and possibly also the Au grains, particularly the Cu-rich grains: (1.) mafic-ultramafic rocks located in the Gariep Belt, which likely contains a dismembered ophiolite complex, e.g. [4], and (2.) mafic-ultramafic intrusions located along the boundary of the Richtersveld Subprovince, including along the Pofadder-Marshall Rocks Shear Zone. Due to its proximity and also the mineralogical and isotopic composition of the PGE and Au grains, the Gariep Belt is favoured as the dominant source for the offshore placer grains. Ophiolite complexes commonly host both magmatic and hydrothermal PGE and Au mineralisation. Reconnaissance onshore sediment sampling in the vicinity of altered mafic and ultramafic rocks in the Gariep Belt near Chameis recovered several small PGE and Au grains, strengthening the hypothesis that the Gariep Belt is a source for the offshore placer grains.

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