The Reef Package Stratigraphy that Contains the J-M Platinum-Palladium Reef of the Stillwater Complex, Montana

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The Stillwater Complex in south central Montana, USA is the host of platinum/palladium mineralization commonly referred to as the J-M Reef. While mining the J-M Reef, additional information has been gained about the rock layers associated with the J-M Reef and olivine-bearing member 5. This texturally-distinct unit associated with cyclic unit O_5 and the J-M Reef is defined as the Reef Package.

The J-M Reef is defined as the platinum and palladium-rich stratigraphic interval that is distinguished by concentrations (0.25-3%) of chalcopyrite, pyrrhotite, and pentlandite with tiny grains of various platinum-group minerals (PGMs) associated with the base metal sulfides (Todd and others, 1982). This mineralized interval is contained within one of the stratigraphic subdivisions of the Lower Banded series. Depending on which stratigraphic subdivision is used, the J-M Reef is associated with Olivine-bearing I subzone (OB I) as defined by McCallum and others (1980) or Troctolite-Anorthosite Zone I (TAZ-I) as described by Todd and others (1982). Both of these zones describe almost the same stratigraphic interval within the Banded series and represent the first occurrence of cumulus olivine stratigraphically above the Ultramafic series.

Prior to the start of palladium and platinum production at the Stillwater Mine near Nye, Montana, the J-M Reef was known to be associated with the olivine unit shown on the stratigraphic columns published by Todd and others (1982) and LeRoy (1985) as olivine-bearing member 5 (O_{5B}). The O_{5B} member is a cyclic unit located in the bottom portion of the anorthosite 1 subzone (A_1SZ) as described by Todd and others (1982). The rock sequence in O_{5B} consists of anorthosite-peridotite/dunite, grading upward through troctolite to leuco-troctolite. With the experience gained by mining the J-M Reef over the last 15 years, the rock layers associated with O_{5B} and the J-M Reef have been further defined and are currently referred to as the Reef Package. The sequence of layers comprising the Reef Package consists of varying thicknesses of troctolite, anorthosite, peridotite/dunite and norite; the most common rock type being troctolite. This definition of the Reef Package differs from the one previously described by Turner and others (1985) based on the selection and definition of the top of the Reef Package. Turner and others (1985) define the top of the Reef Package as a gradational contact between "ragged textured" norite (RTN) and hanging-wall norite. This 1985 Reef Package would be equivalent to the A_1SZ of TAZ-I.

The bottom of the Reef Package usually corresponds with the base of olivine-rich pegmatoidal rocks with coarse-grained postcumulus pyroxenes. These pegmatoidal rocks are part of the O_5 olivine member and commonly overlie a two-pyroxene gabbro. The top of the Reef Package (Hanging-Wall) cannot be identified based on lithology alone, because the hanging-wall (HW) commonly cuts across lithologic contacts along strike or occurs within a single lithologic unit. However, the (HW) contact can always be identified by a change in texture. This change is described using modifers that supplement the rock classification. Typical HW textures are: rounded cumulus olivines, oikocrysts, and fine to medium grained intercumulus pyroxene. Reef Package textures include: pegmatoidal pyroxene, adcumulus pyroxene rims around anhedral olivines, and the presence of coarse grained intercumulus pyroxene.

The HW contact is usually also the hanging-wall of the J-M Reef mineralization, but this is not always the case. For this reason, production geologists typically use the HW textural contact as the primary reference in marking up an ore heading. The HW contact is used because the J-M Reef mineralization is highly variable in thickness and grade but the HW contact is always present. By staying within the Reef Package and following the textural HW contact along strike, the ore heading will be in the correct stratigraphic position to follow J-M Reef mineralization.

References

LeRoy, L.W., 1985, Troctolite-Anorthosite zone I and the J-M Reef: Frog Pond adit to the

Graham Creek area, *in* Czamanske, G.K., and Zientek, M.L., eds., The Stillwater Complex, Montana: Geology and guide: Montana Bureau of Mines and Geology Special Publication 92, p. 325-333.

McCallum, I.S., Raedeke, L.D., and Mathez, E.A., 1980, Investigations of the Stillwater Complex: Part I. Stratigraphy and structure of the Banded zone: American Journal of Science, v. 280-A, p. 59-87.

Todd, S.G., Keith, D.W., LeRoy, L.W., Shissel, D.J., Mann, E.L., and Irvine, T.N., 1982, The J-M platinum-palladium Reef of the Stillwater Complex, Montana: I. Stratigraphy and petrology: Economic Geology, v. 77, p. 1454-1480.

Turner, A.R., Wolfgram, Diane, and Barnes, S.J., 1985, Geology of the Stillwater County sector of the J-M Reef, including the Minneapolis adit, *in* Czamanske, G.K., and Zientek, M.L., eds., The Stillwater Complex, Montana: Geology and guide: Montana Bureau of Mines and Geology Special Publication 92, p. 210-230.

Zientek, M.L., Czamanske, G.K., and Irvine, T.N., 1985, Stratigraphy and nomenclature for the Stillwater Complex, *in* Czamanske, G.K., and Zientek, M.L., eds., The Stillwater Complex, Montana: Geology and Guide: Montana Bureau of Mines and Geology Special Publication 92, p. 21-32.