Some Preliminary Descriptive Aspects of Ballroom Mineralization at the Stillwater Palladium-Platinum Mine, Stillwater Mining Company, Nye, Montana

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The J-M Reef is typically 2 to 5 meters thick and occurs immediately below the hanging-wall of a distinctive package of rocks known as the Reef Package. Abrupt extensions of J-M Reef mineralization below the usual position of the reef at the Stillwater Mine range in size from centimeters to tens of meters in diameter. We propose the term ballroom to refer to the larger of these extensions of J-M Reef mineralization as defined below.

Typically the J-M Reef occurs immediately below the contact of a poikilitic anorthosite (or more rarely, troctolite) within olivine-bearing member 5 (O_{5B}) as defined by LeRoy (1985), within the olivine-bearing Anorthosite 1 Subzone (A_1SZ) of Troctolite-Anothosite Zone I (TAZ-I) as defined by Todd and others (1982). Corson and others (2002, in press, this volume) have described the terms J-M Reef and Reef Package to indicate the PGE mineralized zone and the rocks that typically host the mineralized zone, respectively. We adopt the same terminology for the present paper, recognizing that by a strict definition, the ballroom mineralization is a sub-type of the J-M Reef extending into the footwall (FW) stratigraphy below its usual position in the Reef Package. Because the Reef Package has an unconformable relationship with the underlying FW stratigraphy the Ballroom mineralization that is below the Reef Package of rocks can extend downward into the lower portion of TAZ-I, Gabbro Zone I (GZ-I) or Norite Zone I (NZ-I) depending on location along strike.

The term "Ballroom" has been used informally as a mining term at the Stillwater Mine to refer to abrupt thickening of economic PGE sulfide mineralization immediately below the main Reef. These thickened zones are sometimes associated with a sag in the hanging-wall rocks.

Ballrooms are abruptly thickened zones that extend for approximately 10 meters below the main zone of the J-M Reef. For descriptive purposes, we propose that the term ballroom be used to refer to ore-grade sulfide mineralization that: 1) thickens abruptly to a minimum of approximately 6 meters in horizontal thickness, as measured perpendicular to the strike of the magmatic layers; and 2) has a length of at least 6 meters as measured along the strike of the magmatic layers. Using this definition, the smallest ballroom, when viewed in a longitudinal section would be roughly 6 meters on a side and extend like a keel below the usual stratigraphic position of the main J-M Reef. Dimensions of the ballrooms up and down the dip of the reef are quite variable. Contacts of ballroom mineralization in the footwall rocks below the Reef Package are typically sharp but irregular in detail, and are characterized by a decrease in sulfide content from 0.5-3.0% to only trace amounts across a distance of one to two meters.

Three general types of ballrooms are recognized to date depending on the host rocks in which they occur. The first and most common type consists of thickened economic mineralization extending from the hanging-wall of the Reef Package into footwall lithologies of the Gabbro Subzone (GSZ) of TAZ-I and locally into GZ-I and NZ-I depending on location along strike. The second type of ballroom consists of thickened mineralization within a thickened Reef Package where it is hosted predominantly by troctolite and dunite of O_{5B}. The third, and least common, type consists of mineralization isolated below the Reef Package within the footwall lithologies. This third type occurs up to approximately 10 meters below the base of the Reef Package, and lacks obvious continuity with the overlying main J-M Reef. Ballroom mineralization in the footwall rocks ranges from strata-bound pods to zones that are sharply discordant with respect to magmatic stratigraphy. Ballrooms include mineralization referred to by Raedeke and Vian (1986) as Footwall zone, Basal zone, and Main zone. However, it is hoped that the abrupt boundaries, keel-like shape, lateral continuity, and rich grade of the ballroom features developed in more recent mining will justify use of the new term.

Little information has been published previously regarding ballroom mineralization. Langston (1995) constructed grade/thickness contours from stope data and demonstrated that both features have a pronounced alignment down dip to the east. Zientek (1990) found systematic differences in trace elements in footwall versus Reef Package mineralization. He attributed these differences to a greater likelihood that the footwall mineralization formed from trapped intercumulate melt than the mineralization that occurs in the main J-M Reef. However, no recent studies like that of Zientek (1990) have been done that would allow a more general characterization of the ballroom mineralization.

J-M Reef sulfide mineralization in both the Reef Package and in the ballrooms is interpreted to have formed late in the paragenetic sequence either by concentration in the last sites to crystallize, or in sites occupied by an immiscible sulfide melt. Sulfide typically occurs in intercumulate sites or occasionally as rounded grains embaying the enclosing intercumulate and/or cumulate silicates. Ballroom sulfide textures are generally similar to those found in the main J-M Reef although coarse sulfide clots with irregular radial veinlets extending out from them for up to 5 cm appear to be an especially common feature of gabbro- and/or norite-hosted ballroom mineralization.

We anticipate that the definition of ballrooms will have to be modified as we learn more about them. It is hoped that the definition provided above and the descriptive aspects of ballrooms presented in this paper will provide a preliminary understanding of these important thickened ore zones and will spur additional research on their origin. A better understanding of ballroom mineralization is important since these features contribute a significant portion of the high-grade ore currently being produced at the Stillwater Mine. These features are present in the westernmost workings of the Stillwater Mine, and have the potential for similar contributions elsewhere along the J-M Reef.

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