

The ‘Spotted Dog’ – Still an Issue in Mineral Resource Classification

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Despite progress being made by professional organisations towards the worldwide standardization of Mineral Resource Standards and Definitions, Micon continues to encounter poorly classified mineral resource estimates. Such classifications often resemble a ‘Spotted Dog’, as noted by P.R. Stephenson et al., in a paper presented at the 6th International Mining Geology Conference in August, 2006 .

In his paper Stephenson defined ‘Spotted Dog’ outputs, as those “in which blocks of inferred resources or unclassified material separate blocks of measured and/or indicated resources, or individual drill holes are surrounded by annuli of measured and indicated resource blocks”. Micon would include in this definition “isolated blocks of mineral resources surrounded by unclassified material, those based upon a single drill hole, and/or those based solely on distance from a sample point”.

In addition to preparing a mineral resource estimate that is appropriate for the geology and deposit type, one of the primary responsibilities of the Qualified Person (QP) is the classification of those mineral resources. The use of geostatistical estimation methods has become accepted as normal practice for resource estimation, but frequently it appears the QP has relied solely on the extent of a search ellipse or distance from a sample point to classify the resources, without then conducting a secondary review to ensure that the resulting classification is sufficiently continuous or smoothed to avoid the ‘Spotted Dog’ effect.

Mineral resource estimates that are classified using only the various geostatistical interpolation passes, or the distance from a sample point, to classify the mineral resources, and that have not been subjected to a secondary review which takes into account the QP’s knowledge of the continuity of the geology and mineralization between drill holes based on the deposit style, as well as the inexact nature of any resource estimation, can produce outputs that are potentially misleading. Mis-classified resource estimates can subsequently cause substantial problems for engineers undertaking a mine design and applying modifying factors to the resource estimates to produce mineral reserve estimates.

Investors rely on QPs not only to have the knowledge and experience to properly undertake their estimation work but to be able to recognize within the resource estimation process the technical issues that can lead to the ‘Spotted Dog’ effect and to avoid or correct them. Publishing a poorly conducted mineral resource estimate which exhibits the ‘Spotted Dog’ effect can lead to significant financial and/or legal issues for the project or the company in the event there are subsequent reductions to or downgrading of the mineral resources. In such instances, the impact is felt not only by the company, but it can shake investors’ confidence in the whole process as well.

Unfortunately, Technical Reports seldom contain a longitudinal section illustrating the classification of the mineral resources. Instead, they rely solely on tabulating the estimate, classified by resource category, when disclosing their estimate to the investing public and shareholders.

Perhaps, in addition to the accepted practice of disclosing a mineral resource estimate as a tabulation of the classified material, QPs should be required to provide a clear illustration of where each class of material lies within a deposit. This would allow investors and shareholders to see whether the QP has adequately classified the material to eliminate the ‘Spotted Dog’ effect.

Figure 1 is a longitudinal section of Deposit A and Figure 2 is a plan view of Deposit B. Even though they both clearly demonstrate the ‘Spotted Dog’ effects contained in the mineral resource estimates, that is not evident in the tables of the classified mineral resources for these deposits.

In each case, a review of the estimation output would have allowed the QP to apply past experience and judgement regarding the deposit to avoid or smooth out the ‘Spotted Dog’ effects seen in the illustrations. As discussed, this review of the output should be carried out prior to tabulation of the mineral resource estimates.

Figure 1
Longitudinal Section of 'Spotted Dog' Deposit A

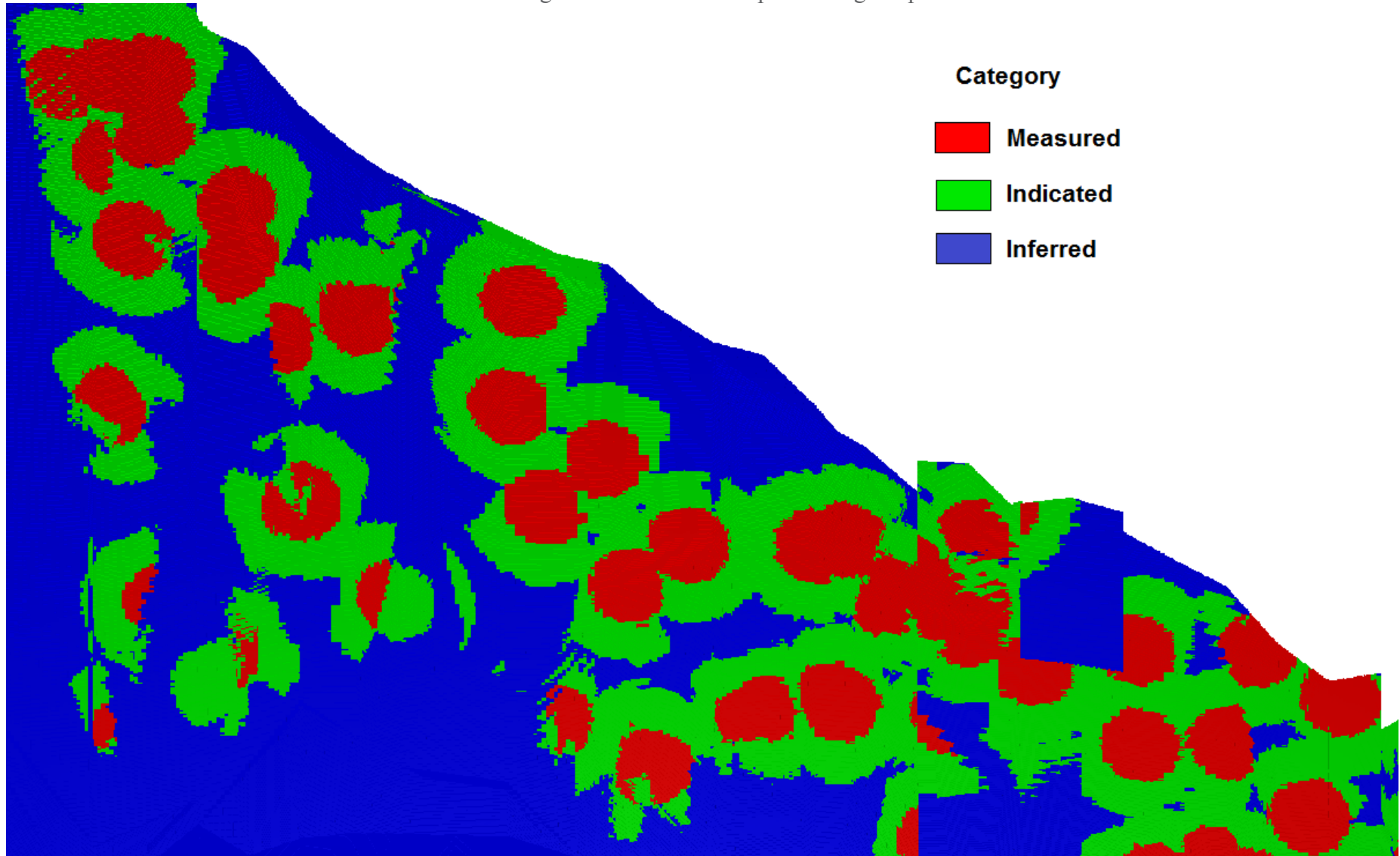
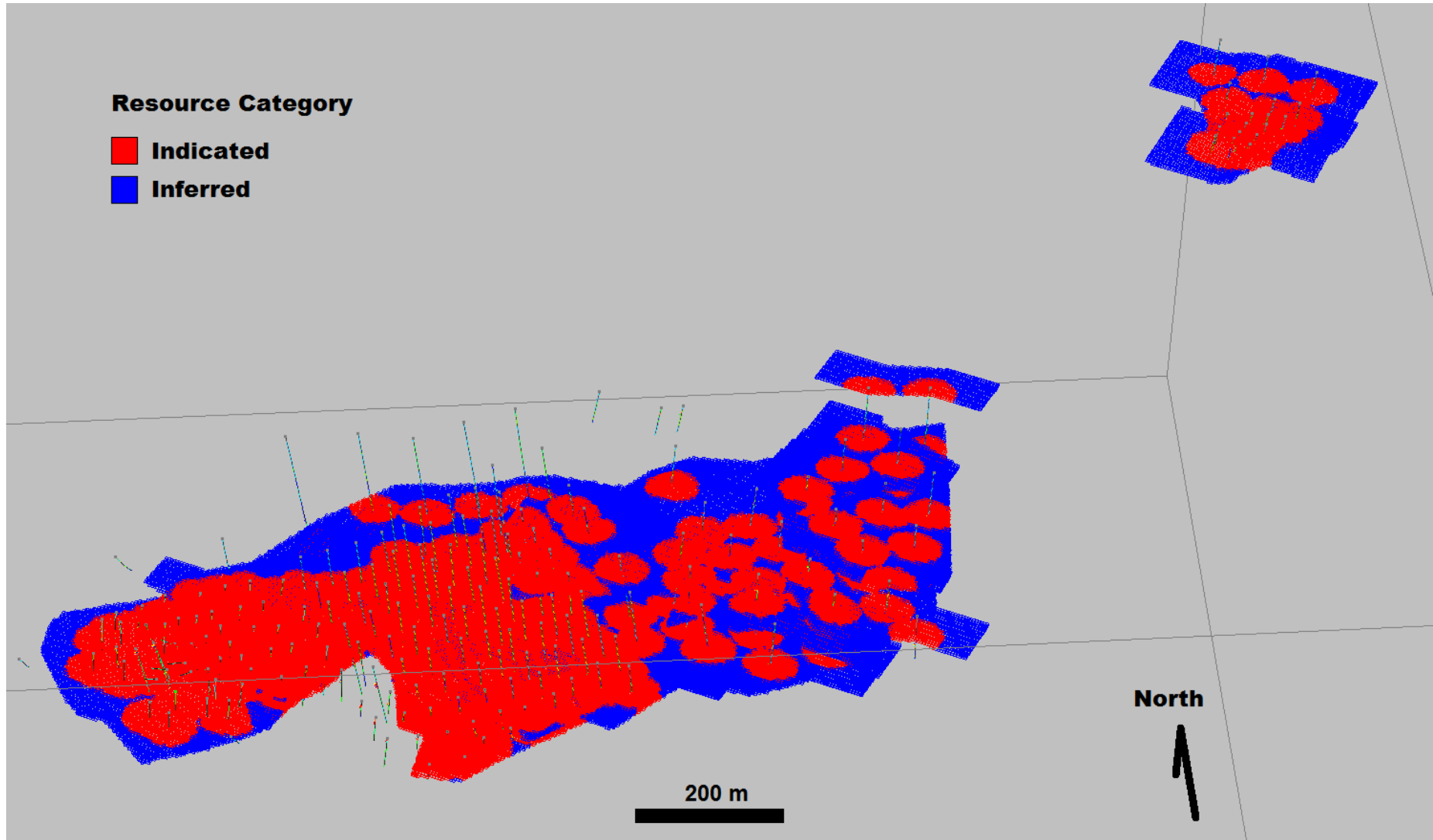


Figure 2
Plan View of 'Spotted Dog' Deposit B



In Figure 1, it is apparent that the majority of the measured resources consist of a circle around a single drill hole intercept. This cannot meet the CIM definition for Measured Resources, which requires geological evidence "...sufficient to confirm geological and grade or quality continuity between points of observation". The potential failure of further work to confirm the continuity of the 'measured' resources in subsequent estimates would lead to many questions not only for the company but for the original QP as well. Ideally, a secondary check should have resulted in the declaration of indicated and inferred mineral resources, with it noted that any declaration of measured resources would need further work to demonstrate continuity.

In the case of Figure 2, a secondary check would have identified that about half of the deposit had sufficient information to confirm continuity of the indicated resources in this area. However, the other half of the deposit lacks the data needed to support the indicated resource classification, and these should have been downgraded to the inferred category pending further work. Conversely, in areas where there was sufficiently close drilling, the QP could have determined that the evidence was "sufficient to assume continuity" and, therefore, that part of the inferred resources might have been reclassified to produce a larger block of indicated material.

These examples illustrate that when geostatistical estimation methods are used for mineral resources, reliance on the extent of search ellipses, or distance from a sample point, does not always provide adequate information to ensure that the QP can assume or confirm geological and grade or quality continuity between points of observation for the purposes of resource classification. Therefore, secondary reviews should always be conducted to ensure that resource classifications are consistent with the level of geological and resource estimation confidence attributable to the information available at the time of the estimate.

Figure 3 is a longitudinal section of Deposit C and Figure 4 is a plan view of Deposit D. Both these cases initially demonstrated the 'Spotted Dog' effects when using geostatistical methodology to determine the classification of the mineral resources (A). However, the QPs then used their experience and judgement to eliminate the 'Spotted Dog' effects of the geostatistical estimate and determine classifications based upon the geological and grade or quality continuity that could be assumed or confirmed between the points of observation (B).

In Figure 3, the geostatistical classification methodology had resulted in a classification comprised of measured, indicated and inferred material (A) but, upon a review by the QP, it was determined that the continuity of the geology or mineralization was insufficiently demonstrated to support this classification, which was reduced to just indicated and inferred (B) in the final resource tabulation.

In Figure 4, the original classification of measured, indicated and inferred (A) was retained (B) upon the review by the QP. . Nevertheless, it was determined that areas of the deposit needed to be smoothed out to account for continuity of the geology or mineralization in those areas where the data supported a higher classification or, in some cases, a lower classification because of a lack of demonstrated continuity.

Figure 3
Longitudinal Section of Deposit C, (A) 'Spotted Dog' Version and (B) Revised Version

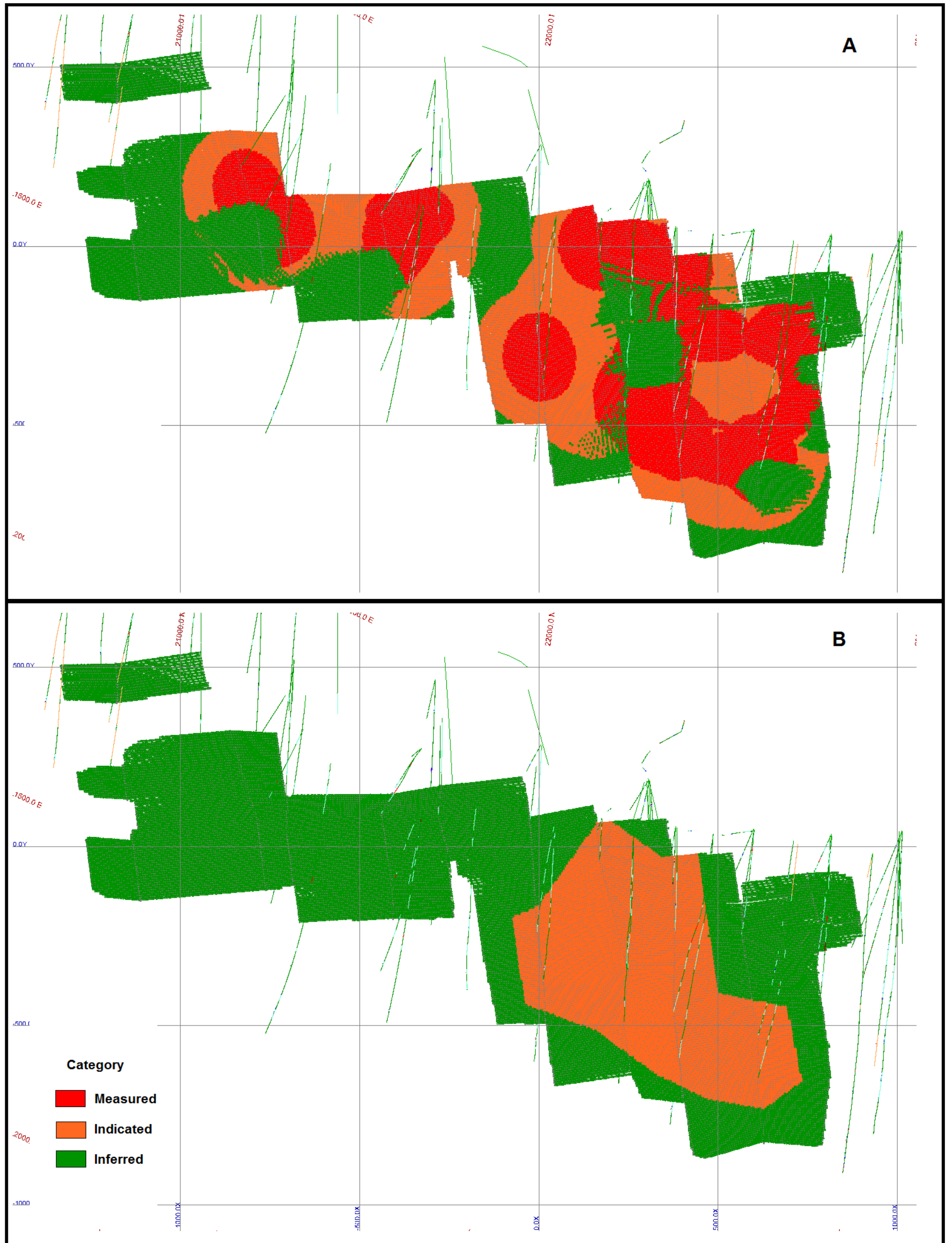
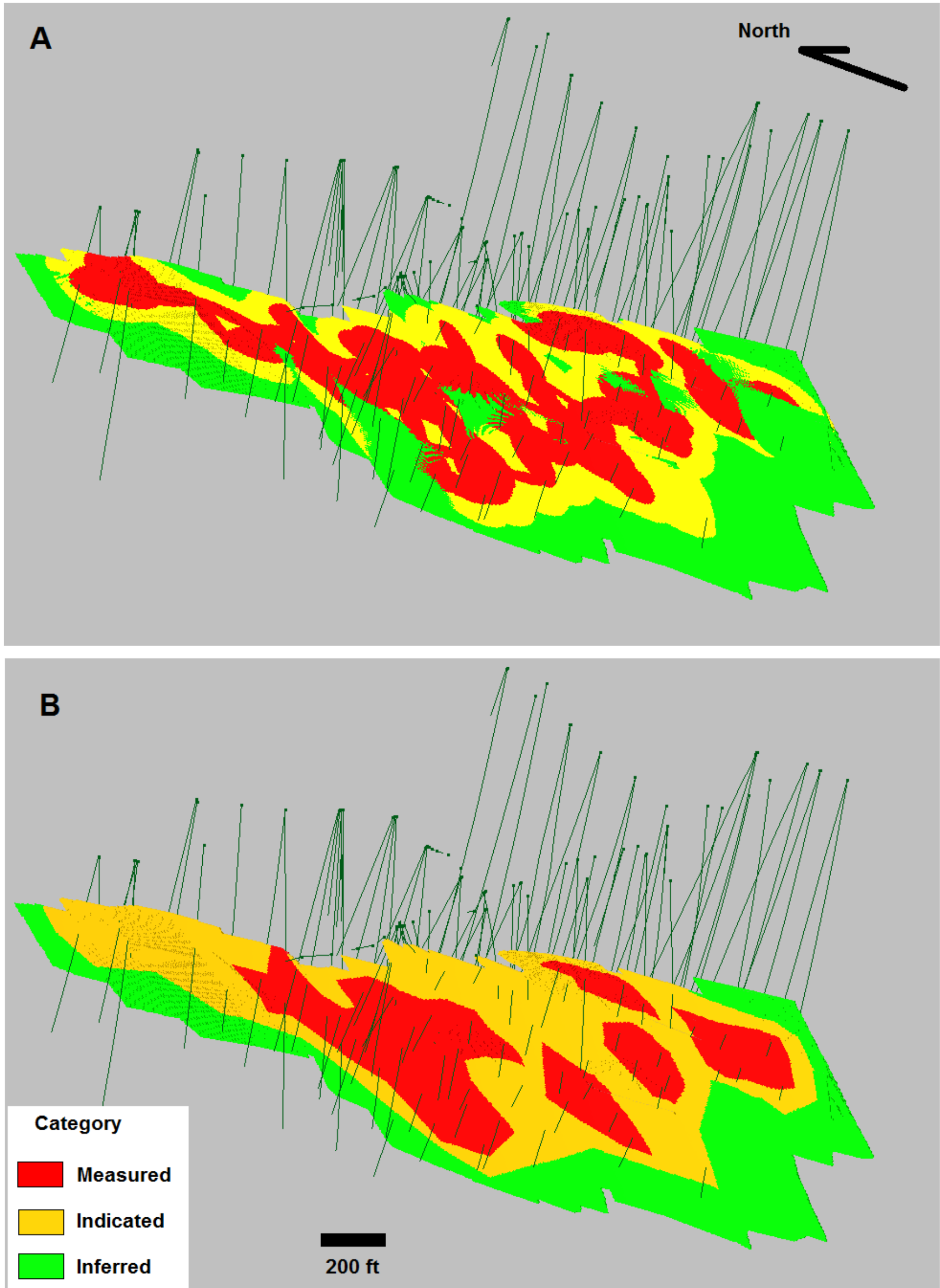


Figure 4
Plan View of Deposit D, (A) 'Spotted Dog' Version and (B) Revised Version



The CIM notes that:

- 1) The Qualified Person(s) should be clearly satisfied that they could face their peers and demonstrate competence and relevant experience in the commodity, type of deposit and situation under consideration. If doubt exists, the person must either seek or obtain opinions from other colleagues or demonstrate that he or she has obtained assistance from experts in areas where he or she lacked the necessary expertise.

- 2) In addition to experience in the style of mineralization, a Qualified Person preparing or taking responsibility for Mineral Resource estimates must have sufficient experience in the sampling, assaying, or other property testing techniques that are relevant to the deposit under consideration in order to be aware of problems that could affect the reliability of the data. Some appreciation of extraction and processing techniques applicable to that deposit type might also be important.

Therefore, a QP must understand that any estimate which produces a 'Spotted Dog' effect with respect to classification needs to be reviewed. A 'Spotted Dog' output is potentially misleading since fundamental requirements, such as continuity of geology and mineralization between drill holes, and the imprecise nature resource estimation, have been ignored. As such, it undermines the credibility of the responsible QP's claim to competence and relevant experience in the commodity or type of deposit.

All QPs have a stake in ensuring not only the quality of their own work but also that of others. Poor practice not only affects the issuing company and the QP conducting the work, but impacts confidence in the industry among investors, shareholders and the general public.

As P.R. Stephenson, et al. noted in the title of their August, 2006 paper "Mineral Resource Classification, "It's Time to Shoot the 'Spotted Dog'!", to which Micon would add the phrase "and Bury it for Good!"