EVALUATION OF ALLUVIAL DIAMONDS

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ABSTRACT

Evaluation of alluvial diamond deposits is a topic fraught with difficulties. Controversies arise primarily when the individuals responsible for the evaluation try to take shortcuts with the resource estimation process, whether due to lack of knowledge/understanding of either the process or of the deposit itself.

A number of prospecting methods are available that are useful in evaluating an alluvial diamond deposit. Not all of the methods will be directly applicable to every prospect, but they should at least be considered. Each one involves an increase in the expenditure of resources. At each stage a decision can be made to continue if positive results are obtained. It must be recognised from the start, however, that not all deposits prospected will convert to a commercial mine and no amount of prospecting will improve the commerciality of some deposits.

The SAMREC Resource-Reserve estimation code forms the basis (in RSA) for geological and financial evaluations. The higher up the classification system a project is located the higher the confidence in the tonnage/volume estimation and the associated diamond grades and qualities. In order to proclaim a Proven Reserve a full feasibility study must have been carried out on a Measured resource. This involves detailed geological studies combined with comprehensive economic evaluations. On alluvial diamond deposits, such studies will overcapitalise the project. Far more realistic for alluvial diamond deposits of all types are inferred and indicated resources, even a probable reserve, if absolutely required.

1. INTRODUCTION

Evaluation of alluvial diamond deposits is a topic fraught with difficulties. Controversies arise primarily due to the variable nature of the geology and grade of the gravels as well as the manner in which these deposits have historically been mined and reported upon. In truth, alluvial diamond deposits are among the more difficult deposits to evaluate geologically and also to value commercially.

One of the reasons for this difficulty has to do with the fact that alluvial diamond deposits have historically been the preserve of the artisanal digger or, more recently, the professional operator who simply mines through the property without doing much in the way of
exploration and who does not compile a resource statement either prior to mining or at any
time during the life of mine. However, with the arrival of junior exploration and mining
companies who may wish to joint venture or purchase exploration or mining properties, as
well as the requirement for BEE partners, diggers and private landowners have had to come
to terms with putting a value on their properties, and this has meant estimating the potential
resource. The problem is, of course, that due to the nature of such operations, very little real
data exists that can be compiled into an acceptable (SAMREC compliant) document.

This problem has, historically, been compounded by a variety of factors. The owner often
does not want to spend the money (nor, indeed, may have the money) required to estimate the
resources on the property, and alluvial deposits are often small or marginal, and large
amounts of exploration may simply overcapitalise the project. Since many of the property
owners have spent many years either as part-time or professional diggers, they have
developed a blasé attitude to resource estimation, claiming that they “know its there, so why
must they spend time and money prospecting the property”. At the same time as not wanting
to spend money on resource evaluation, the owner wants to attract the highest price for his
property and this has resulted in the proliferation of irresponsible reporting.

Another second problem arises as a result of the long history of mining in South Africa that
has dealt mainly with major mining houses with large precious and base metal deposits that
have been relatively straightforward (although costly) to evaluate. Very few financial
institutions have had much exposure to alluvial deposits and this has caused many (if not all)
of them to look for the comfort of a bankable feasibility study before lending money.

For the most part, the expense of such a bankable feasibility study is prohibitive, especially
for the individual, the small mining consortium or the BEE operator and so they look for an
investor, typically a Junior exploration company (listed or private) for assistance. The Junior
company, in turn, is very conscious of the need to raise money on a reputable Stock Exchange
requiring acceptable resource estimation standards. There are, however, a small number of
Juniors (and getting fewer) who simply want to re-package the property and pass it on at a
premium without significant increase in value.

Consequently, when dealing with the evaluation of an alluvial diamond deposit some of the
issues that have to be dealt with are:

* both real and perceived concerns of geological variability;
* misgivings about the quality of resource reports;
* lack of exposure to alluvial diamond geology and mining on the part of many analysts and
  financiers;
* lack of appreciation of the major improvements that have taken place in the industry as a
  result of education and exposure to international standards and requirements; and
* the “I know it’s there” attitude of many of the current owners of alluvial properties.

All of this has led to the difficult situation that exists today when trying to evaluate, and then
value, an alluvial diamond deposit. Notwithstanding these difficulties, it is possible to
evaluate an alluvial diamond deposit in a manner that is both financially reasonable and
geologically realistic.
2. EVALUATION METHODS

A number of standard techniques are available for the evaluation of alluvial diamond deposits. Not all of these will be directly applicable to every prospect, but they should at least be considered. At the very beginning, it must be recognised that not every deposit prospected will convert to a commercial mine – typically only some 1% of diamond prospects initiated may become an operating mine. As a result, many prospects will turn out to be sub-economic or marginal, despite early promise. Unless the geology of the deposit has been misinterpreted previously, or there have been major advances in prospecting methods or mining and processing technologies that can be applied, some projects will never be economic ventures and no amount of re-packaging can improve them.

2.1. Geological Model

Fundamental to the evaluation of any project is a complete understanding of the geological model. It is vitally important to understand the depositional environment and, consequently the stratigraphy and sedimentology of the deposit, the effects of climatic and tectonic events, any structural controls as well as the effects of post-depositional evolution of the local landscape. Especially important for geological evaluation are the expected physical parameters of the deposit – shape, size and controls on mineralisation, for example.

2.2. Historical/Anecdotal Information

Typically, part of any desk top study is to gather all information available for both the project and the area in general. However, historical/anecdotal information, especially that referring to diamond grade and value, is often incomplete and unreliable, and may even be inaccurate and should not be viewed as necessarily representative of what might exist on the prospect under consideration.

2.3. Remotely Sensed Data

One of the great benefits of these kinds of surveys is that they cut down on the amount of area that has to be physically prospected. However, in using any of these tools, it is vital to remember that they are simply just tools and not an end in themselves. One must be sure to chose methods that are appropriate to the deposit – be aware of both the potential and the limitations of the method. The appearance of an anomaly does not guarantee the presence of diamondiferous gravel – anomalies are based on physical properties and clays, water, and weathered bedrock often have similar geophysical responses to gravel.

Some of the more useful remote sensing methodologies are listed below:

- Satellite data and aerial photographs – LANDSAT, Aster, SPOT, Ikonos, Kwikbird, RadarSat, standard black & white aerial photographs, ortho-photographs, where available as well as colour- and colour Infra-Red photographs;
• Ground and airborne geophysics – Magnetic and Electro-Magnetic methods, Gravity, Ground Penetrating Radar

In addition, there are a wide variety of general and specialised computer programmes commercially available, where both satellite and geophysical data can be combined with geological data in digital format to highlight subtle features.

2.4. Drilling

The ultimate goal of the drilling programme is to determine the volume of gravel present on the property. Depending on a whole host of issues, auger, percussion and RC drilling can all be used successfully. Drill line and hole spacing, particularly, is often a contentious issue. Again a solid understanding of the geological model is necessary before this question can be answered satisfactorily.

2.5. Bulk Sampling

This is where the details regarding diamond grade & value are obtained, as well as necessary information on mining and processing methods as well as associated costs. Grade (average grades and grade variation) is the single most important parameter to consider in alluvial diamond deposits. Because grades in these deposits are very low (typically parts per billion), samples generally have to be large and representative of all the different facies that are expected to be mined. Often, grade variability will determine whether the deposit is mined as a low-grade bulk operation, or whether only selective horizons are targeted.

3. RESOURCE ESTIMATION

The whole point of the drilling and the bulk-sampling is to be able to identify the diamond resource that exists on the property. All resources mentioned in public documents (or, indeed, in any document that is used for the promotion of a project) have to conform to one or other of the internationally recognised resource/reserve estimation codes. In South Africa the standard is the SAMREC code of 2000 (and updated in 2006). As with all the codes, the higher up the classification system a project is located the higher the confidence in the tonnage/volume estimation and the associated diamond grades and qualities (Fig. 1).

It is obvious that the more confident one can be regarding the resources/reserves on the project, the higher the price that can be put on the project or the easier it should be to raise the requisite finance. Financiers, and financial institutions in particular, generally prefer the comfort of a bankable feasibility study (based on a Proved Minerals Reserve) and, as a result, most projects will try and squeeze into this category, whether the data support the conclusions or not.
Increasing level of geoscientific knowledge and confidence

Exploration Results

Mineral Resources
- Reported as in situ mineralisation estimates

Inferred

Indicated

Measured

Consideration of mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (the 'modifying factors')

Ore Reserves
- Reported as mineable production estimates

Figure 1: Relationship between Exploration Results, Mineral Resources and Mineral Reserves (SAMREC, 2006 exposure draft)

3.1. Proven Mineral Reserve

In order to proclaim a Proven Diamond Reserve a full feasibility study must have been carried out on a Measured resource. This is a fair bit of work and involves detailed geological studies combined with comprehensive economic evaluations. On alluvial diamond deposits, such studies will, most often, overcapitalise the project – they can, indeed, be done, but more money will be spent on delineating the reserve than is likely to be recovered from mining the deposit. Far more realistic are inferred and indicated resource estimations, even a probable reserve.

3.2. Inferred Resources

According to SAMREC (2006 Exposure draft) an ‘Inferred Diamond Mineral Resource’ is:

"that part of a Diamond Resource for which tonnage or volume, grade and average diamond value can be estimated with a low level of confidence. It is inferred from geological evidence"
and assumed, but not verified geological and grade continuity and a sufficiently large diamond parcel is not available to ensure a reasonable representation of the diamond assortment. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes that may be limited or of uncertain quality and reliability”.

This category is intended to cover situations where a mineral concentration or occurrence has been identified and limited measurements and sampling completed, but where the data are insufficient to allow the geological and/or grade continuity to be confidently interpreted. Due to the uncertainty which may be attached to some Inferred Mineral Resources, it cannot be assumed that all or part of an Inferred Mineral Resource will necessarily be upgraded to an Indicated or Measured Mineral Resource as a result of continued exploration.

The assumptions of this definition implies that some reasonable and verifiable geological prospecting must have been done on the property under consideration and that the results are not just based on regional data, historical information, or even a satellite/geophysical anomaly. There is, further, an assumption that a parcel of diamonds must exist from the property, the sale of which can supply some information for valuation purposes.

3.3. Indicated Resources

An ‘Indicated Diamond Resource (2006 SAMREC Exposure Draft), however, is that part of a Diamond Resource for which tonnage and volume, densities, shape, physical characteristics, grade and average diamond value can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes. The locations are too widely or inappropriately spaced to confirm geological and grade continuity but are spaced closely enough for continuity to be assumed and sufficient diamonds have been recovered to allow a reasonable estimate of average diamond value”.

The level of confidence of the indicated resource is sufficient for global mine design, mine planning, and/or economic studies.

Although the SAMREC code indicates that a reasonable level of geological confidence is required and that a sufficient parcel of diamonds is required to estimate diamond value, it is not prescriptive regarding the amount of drilling necessary to estimate gravel volume, nor does it detail the volume/tonnage that has to be processed, or number of carats recovered to determine average diamond grade and value.

For comparison, Canadian standards (NAPEGG, 1997) require that a minimum parcel of 2,000 carats be recovered to estimate average diamond value to an indicated level. Whether or not that is strictly relevant for South African alluvial diamond deposits is a topic of much debate. The issue to be resolved, however, is the confidence that can be placed on both the value of the stones and the average grade of the deposit – the more stones recovered, the greater is the level of confidence.
3.4. Probable Reserves

A key criterion for classifying anything as a Reserve is the application of economic parameters. Notably this would include studies of the proposed mining and processing methods. The comprehensive economic study would also include a financial model based on a whole range of issues from technical and corporate, all the way though to environmental factors. It is important to note that unless these economic studies have been completed on the specific property under consideration there is no reserve present. The term “reserve” may not even be used, irrespective of how it may be re-defined in the document—SAMREC has defined what the words mean, and they may only be used in this context.

4. CONCLUSION

It is neither impossible, nor simple, to evaluate an alluvial diamond deposit. But it is possible to do so in a financially responsible and geologically realistic manner. Fundamental to the whole exercise is a knowledge and understanding of the geology of the deposit. Such appreciation will be useful in determining the correct prospecting procedures and in selecting appropriate evaluation methodologies. It is necessary to use all the relevant prospecting tools that are available, being aware of their possibilities, but even more so of their limitations.

Once the prospecting results have been obtained then one can proceed to the resource estimation phase. Beware of trying to push the project higher up the classification code than the data allow. Inferred and Indicated Resources can easily be determined, Probable Reserves can also be identified, but be cautious of Proved Reserves.

5. REFERENCES


NAPEGG (1997): Reporting of Diamond Exploration Results, Identified Mineral Resources and Ore Reserves. Published by the Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories (Canada).