ALLUVIAL DEPOSITS AND DIAMONDS OF
THE LOWER VAAL AND MIDDLE ORANGE RIVER,
NORTHERN CAPE PROVINCE, RSA

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ROCKWELL DIAMONDS
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Prelude
"After the passing of many moons, and when there was great sorrow in the land, a spirit, pitying the wants and difficulties of mankind, descended from Heaven with a huge basket filled with diamonds, The spirit flew over the Vaal River, starting beyond Delport's Hope, and dropping diamonds as it sped on; past Barkly West and Klipdam it few along towards a place now called Kimberley':-

- according to a native legend regarding the origin of diamonds in Griqualand West (now the Northern Cape Province of South Africa), from "The Romance and Reality of the Vaal Diamond Digging" by T L Terpend and George Beet (~ 1931)

Introduction
The first alluvial diamond found in South Africa was discovered near Hopetown in 1866. However it was the discovery of alluvial diamonds along the banks of the Vaal River near Barkly West (originally known as "KlipDrift") in 1868 which lead to the great South African diamond rush, the creation of the "Digger" fraternity (eternally optimistic individuals or groups, and most recently small private companies, who utilize simple and often primitive mining methods to seek out elusive big diamonds of the alluvial deposits), and the development of the southern African diamond industry as it is known today.

The Vaal River, and in particular the " horseshoe" section of river stretching between the small town of Windsorton in the east and Barkly West in the West, including the interfluves area between these two towns, and the fabulous gravel splay deposits at Riverview (Windsorton) and Longlands- Gong Gong downstream of Barkly West have over the course of about 130 years become famous for the mining of gemstone diamonds from alluvial deposits, These areas have generated a steady supply of large high quality alluvial stones since the 1860's and created entrepreneurs such as Cecil john Rhodes who would ultimately place a lasting imprint on the world diamond industry.

Diggers from the Barkly West diggings subsequently uncovered the "gravels" or yellow ground that became known as the 'dry-diggings' south of the Vaal River around present day Kimberley. Theses deposits contained high concentrations of diamonds within a localized area and in addition to being found around the site of present day Kimberley were also found at Jagersfontein, Koffiefontein, The "dry diggings" were later recognized as primary Kimberlite pipes, which led to the development of the Jagersfontein, Koffiefontein, Du Toitspan, Bultfontein, De Beers and Kimberley diamond mines in the 1870s. Later in 1891, Wesselton pipe was discovered. The primary source rock of diamond was named 'Kimberlite' after the town Kimberley.

The primary deposits or kimberlite pipes lead to the development of the famous Kimberley diamond mines that were to under-pin the South African diamond mining industry, and provide the entrepreneurs and capital to subsequently develop the Witwatersrand gold mines.

Distribution & Chronology of South African Alluvial Diamond Deposits
The Republic of South Africa ("RSA") and neighboring Namibia host some of the most prolific sources of large high quality gem diamonds in the world. These are found in ancient fluviatile and reworked glacio-fluvial gravels along the inland river courses of the sub-continent, together with once rich beach deposits along the west coasts of RSA and Namibia.

The Lower Vaal, Harts, Riet, and Middle Orange Rivers and their tributaries have been the focus of alluvial diamond mining operations for over 130 years. The diamonds from these deposits are of exceptional size and quality and have been derived from the many diamond bearing kimberlites which lie within the current and ancient watersheds of these drainages.
Subsequently alluvial diamond deposits were found in the Cullinan (Premier Mine), Lichtenburg, North West Province (previously the Western Transvaal) including the Schweitzer Reinecke-Wolmaranstad-Christian triangle, Ventersdorp, the west Coast, and Lower Orange River. Mining has taken place in most of these areas in the past and is still active in many today.

The sources of the alluvial diamond deposits were the numerous diamondiferous (but not necessarily economic) kimberlite pipes spread across the southern African hinterland. Emplacement of kimberlite pipes was followed by the liberation of diamonds by weathering, erosion and winnowing of the primary deposits and entrainment of diamonds by ice sheets and major drainages.

**Two prolonged periods of exposure and erosion, between:**
- The Archaean eruption of the Ventersdorp lavas (~2700Ma) and initial Karoo sedimentation at about 300Ma
- And later between the end of the major Karoo event at 150 Ma and the Orange and Vaal River sedimentation from late Cretaceous to about 5 Ma

Landsced the surface across which the palaeo- Vaal and Orange River and their tributaries flowed. Added to this, the super continent scale Permian glacial event that marked the onset of Karoo sedimentation exerted a strong shaping effect on the post-Ventersdorp surface and assisted in the planning-off, liberation, and transport of diamonds.

The surface over which the palaeo- Vaal and – Orange River (and their tributaries) flowed and on which the diamondiferous gravels were subsequently deposited, was irregular and provided trap sites for diamonds. Later river evolution was strongly influenced by the two periods of uplift known to have affected the eastern part of the interior of southern Africa:
- 1st uplift of 200 to 300 m probably had its onset in the late Cretaceous and continued into the Miocene
- 2nd period followed at 2.5 Ma with as much as 900m uplift.

Studies of the Lower Vaal, Harts and Middle Orange River alluvial deposits shown that there are five broad phases of prominent alluvial deposit development in these areas reflected by several deposit types.

**Cretaceous aged Nooitgedacht-Droogeveldt Terraces**-considered to be the oldest alluvial deposits and they occur between 80 – 120 meters above the modern Vaal River S-W of Barkly West. These deposits probably conform in age to the initial period of late-Cretaceous uplift which triggered a period of accelerated river incision and simultaneous lowering and peneplanation of the land surfaces, accompanied by the supply of detritus, including diamonds.

**Miocene-age Holpan and Klipdam Channel deposits**- these deposits occur at approximately 60 meters above the Vaal rive. Younger terraces include the Pliocene-age Proksch Koppie and Wedburg Terraces, which occur at 30-45 and 20-30 meters respectively.

Pliocene – Holocene deposits – these youngest terraces, which include the current Vaal River channel, occur between 0-20 meters and are collectively referred to as the Rietputs Terrace.

Younger deposits – through a process of progressive weathering, deflation and winnowing of the above deposits, ‘secondary’ deposits know as Rooikoppies developed over large areas of the landscape. Typically these deposits are found to be broadly associated with older terraces and buried channels, these readily accessible deflation deposits were extensively mined by the old timers and Diggers. In many cases the presence of Rooikoppie deposits was useful in respect of highlighting the presence of older buried deposits.

**Lower Vaal and Middle Orange River Alluvial Deposits**

The extensive diamondiferous gravels of the Lower Vaal, Harts, and Middle Orange River (“MOR”) valleys are associated with remnants of outwash deposits formed during the retreat of the ancient Ghaap (Kaap) Valley glacial system and subsequent reworking and alluvial deposition by major rivers. These rivers included the proto- Vaal, - Orange, - Harts, and –Riet Rivers and their modern antecedents.
These drainage events in large part utilized the structurally controlled south-west trending trough which is today flanked by the prominent Ghaap Plateau Escarpment. The glacial system is identified as a prominent ice lobe emanation from the central Dwyka (Carboniferous) ice sheet of central Gondwana which utilized the structurally controlled through flanking the Ghaap Escarpment. Subsequently this trough has also been utilized and resurrected by the erosive action of the Lower Vaal, Harts, Riet and Middle Orange River.

The geological settings of the diamondiferous gravel deposits vary from thick remnant palaeo-river terraces and channels of late-Cretaceous age through to young surface deflation or Rooikoppie deposits of 1-2 meters thick. The river deposits, which in part reworked glacial outwash deposits, all appear to have a common or similar origin as seasonal ephemeral flood deposits. Large elongated channels containing gravel sequences were probably created initially by glacial scouring (as for example on Holpan and Klipdam).

Locally, bedrock features including large boulders (glacial erratics) protruding from and released by the Dwyka diamictites of the floor rocks, and fractures and potholes found on Ventersdorp bedrock played an important role in diamond concentration of the older alluvial deposits. Well developed splays (e.g. Windsorton and Waldecks Plant on the Vaal River), dyked, faults and contrasting rock competencies also lead to grade enhancement in younger deposits. Locally plunge and scour pools lead to high concentration of diamonds.

Through geological time, erosion and deflation of the very extensive primary gravel deposits lead to the formation of extensive lag deposits or Rooikoppie which in places were particularly rich. These deposits are generally associated with underlying primary gravels but mass weathering, material creep and movement of the heavier lag deposits down slopes has resulted in deposits which may be far more extensive than the underlying primary deposits.

In the Lower Vaal and Middle Orange River area dry periods lead to the precipitation of an extensive hard calcrete horizon which effectively defines the "interface" between the surface Rooikoppies and lower primary gravel deposits in many areas. The calcrete prevented old time diggers from mining below the Rooikoppies and consequently large areas of primary gravel are being mined in areas such as the MOR by drilling, blasting and stripping the hard 1 to 2 meter calcrete layer and mining and processing the underlying preserved primary gravels.

**Holpan-Klipdam Alluvial Diamond Deposits**

The Holpan-Klipdam properties are located on the interfluve in the central part of the Vaal River 'horseshoe' referred to above, roughly midway between Barkly West and Windsorton. Holpan and Klipdam have been mined at different periods from the late 1800's and are famous for yielding large (>100 carats) diamonds. There are regular references to his in old records of the Barkly West-Windsorton alluvial diamond deposits.

George Beet (1931) writing in the "The Grand Old Days of the Diamond Fields" makes reference to the Burgess Diamond- "a square block of fine white cleavage, found at Kipdam No. 1, in September 1907 which weighted 220 carats and was valued a GBP2 420", and the "Broderick" diamond- a perfect Cape white, weighing 412.5 carats in the rough which was found a Scholtz's Prospect near Klipdam, which was bought for about GBP5000.

Because of the regular yield of large diamonds, Holpan and Klipdam have been the site of digging and mining of surface deflation deposits known as Rooikoppies since the discovery of the Barkly West diamond fields. In line with the rest of the country, digging in this area was particularly active in the late-1800's and into the early 1900's with large stones (often exceeding 100 carats) regularly recovered on these and adjacent properties.

Diamond bearing deposits found at Holpan and Klipdam include remnants of well developed palaeochannel deposits, and extensive Rooikoppie surface deflation deposits broadly associated with the palaeochannel deposits. Though extensively dug over in the past, it is only since about 1995 that they have been subjected
to systematic drilling, evaluation and mining by the Van Wyk Diamonds (Pty) Limited ("Van Wyk") which is now owned by Rockwell Diamonds Inc. Mining of these deposits has shown them to comprise two well developed palaeochannel features, Holpan (trending approximately N-S) and Klipdam to the north (trending approximately E-W) containing buried basal gravel deposits.

Geologically the palaeochannels comprise the following

- Surface Rooikoppie deposits (1-3m)
- Soft to hard calcrite (1-3m)
- Overlying coarse calcretised sand (1-3m)
- Coarse basal gravel assemblage typically 2-5m thick.

On average the composite sequence varies from about 3-8 meters. Venterdorp lavas and Carboniferous diamictites and shale’s form the bedrock. Irregularities including bedrock highs and lows, scour pools and pothole features have been noted in the bedrock. These two channel features are considered to originally represent original glacial scours.

The Van Wyk operations were initially small but with the discovery of larger diamonds and the purchase of larger earth moving equipment they were able to sustain and expand their operations. Key to their ongoing success was the purchase of a large bulldozer which was used to rip and bulldoze the calcretised layer overlying the buried gravels on Holpan.

These private operations grew steadily on Holpan, while an adjacent venture of Sonora Diamonds collapsed largely due to operation problems, shrinkage and lack of capital. Records show that by the early 2000’s Van Wyk had grown to a sizable operation on Holpan and they subsequently acquired Sonora Diamonds, thereby expanding their activities over the Holpan and Klipdam deposits. Success of the Van Wyk operation lay in the hands-on management, the use of large and efficient earth moving equipment, processing of increasing volumes of gravel to recover diamonds, good security, and the regular recovery of large, high value diamonds.

These deposits are typically of other alluvial deposits found throughout the area in respect of grade and diamond values. Rooikoppies from Holpan and Klipdam average about 0.3 - 0.5 carats per hundred tonnes ("cpht"), whereas grades in the basal gravels tend to be higher with a range of about 0.4 – 1 cpht. Diamond qualities from these deposits are exceptional and average about US$1000 per carat.

**Middle Orange River Alluvial Diamond Deposits**

The first diamond to be discovered in South Africa was the Eureka diamond (a 21-carat stone) found in 1868 on the farm De Kalk, located on the left bank of the MOR between Hopetown and Douglas. This discovery led to the rapid proliferation of small-scale artisanal mining along the MOR.

Surface deflation Rooikoppie gravels were mined extensively between Douglas and Prieska on the MOR, particularly on Brakfontein and Saxendrift from 1926 to 1936 and again during 1943 to 1945. In places the Rooikoppie were particularly rich. Table 1 below summarizes historic diamond production, estimated grade and stone size information with respect to the Rooikoppie gravels mined at different locations along the MOR prior to 1965.
Subsequently the MOR was largely ignored, unlike the intense prospecting and mining activities more typical of the Vaal and Lower Orange Rivers. The reasons for this include:

- Large areas are covered by a very hard layer of calcrete, 0.5m-3m thick, which limits access to the underlying gravel horizons. Modern mining methods and equipment have changed this and it is now possible to mine these deposits economically.
- Approximately 30km downstream of Douglas, the nature of the alluvial deposits changes notably in that the gravels contain a high percentage of banded ironstone ("BIF") clasts. This makes the treatment and concentration of the gravels technically difficult from a metallurgical perspective when using the traditional Rotary-pan which is especially the case at Saxendrift, Kwartelspan, Nuwejaarskraal and White waters. However metallurgical processing methods have improved notably since the introduction of magnetic scalping to remove a portion of high density (the BIF clasts may have an SG>4) and effectively clog the pan plants due to their weight.

Through the application of modern treatment methods and equipment, recoveries have improved to the extent that these deposits can now be mined efficiently. The introduction of large modern earth moving equipment and drilling and blasting of the calcrete caps, and other technological improvements have resulted in the area being effectively explored since about 1996 by several Companies including Northern Cape Diamond Mining, Moonstone Diamonds (Australian), Pioneer Minerals, and the Gem Diamond Mining Corporation. Gem was the first listed Company to mine at Saxendrift and was subsequently taken over by Mvelaphanda Diamonds and then the Trans Hex Group.

Table 1: Historic diamond production, primarily for Rooikoppie deposits from the MOR (pre-1965).

In terms of geological setting the alluvial deposits of the MOR comprise large remnant terraces (some of which contain resources in excess of 100m tones) which are preserved at a number of elevations between Douglas and Prieska along both banks of the present Orange River. These terraces are represented by a set of 'stepped terraces' showing the strongest preservation at the following elevations:

- 0-20m: low level terrace
- 30-60m: intermediate terrace
- 75-105m: high level terrace

As a general rule, it has been found that the diamond content of the higher level terraces of the Vaal and Orange Rivers exceeds that of the lower, younger terraces (as has been reported by Cooke, 2005). The most pronounced examples of such terraces are as follows:

- **Right (or north bank)** terraces of the MOR include Vaalkrans, Gewonne, Brakkies, Thornley, Beatrys, Wouterspan, and Hospital. On most of these terraces from Wouterspan eastwards, surface Rooikoppie gravel horizons were mined by old timers.
- **Left (or south bank)** deposits occur on the MOR at Banghoek, Rietsdrift, Kransfontein, Saxendrift, Annex Saxes Drift, Brakfontein, Niewejaarskraal, Swemkuil, Mooidraai, Remhoogte, Mooidrai, and Uitdraai.
In general MOR terraces comprise a sedimentary package of:

- Rooikoppie (0.5-3m)
- Calcrete capping (1-3m)
- Fine gravel and sandy gravel Coarse basal gravel (1-5m)
- Fine to coarse sandy gravel (2-8m)
- Coarse basal gravels (1-5m)

The combined succession of gravels and Rooikoppies varies from about 5-15m and is thicker than sequences found in the Holpan and Klipdam area. It varies from about ed, oxidized surface of loose lag gravel dominated by banded ironstone clasts, underlain by a hard layer (0.5-3m thick) of calcrete, which is in turn underlain by a sandy, fine grained silcrete-cemented, gravel horizon. The latter horizon is in turn generally underlain by an extensive, coarse and loosely cemented boulder bed hosting intercalated gravels and sandy lenses. The coarseness of the boulder beds indicate that they were deposited during periods of high-energy river flow.

Basal gravel sequences consist of rapidly aggraded or dumped material, ranging in size from large boulders (over 1.5m in places) to sand. The gravels are compacted and frequently cemented with secondary lime to form calcritised cobble and boulder deposits.

Thick gravel deposits found in high (older) terrace remnants generally conform to large gravel bars, with interbedded sand lenses deposited in channel and sheet wash deposits belonging to large braided river systems which carried large bed loads of material in high energy flow periods associated with wet cycles in the geological record.

Younger (lower) terrace gravels represent re-working of earlier deposits by late stage erosion and re-deposition as sheet wash flood gravels in low level terraces often associated with river damming situation and spays.

Rooikoppie deposits represent a ‘lag’ or deflation deposit, and consist mainly of well-rounded and polished siliceous pebbles and reddish coloured sand. The clastic material originates primarily from the basal gravels and consists of most resistant component thereof, in particular chert, agate, jasper, quartzite and vein quartz. Due to the decomposition and winnowing of the less resistant clastic and matrix material, there has been a substantial concentration of the more durable components in the original gravel, including diamonds. Iron has stained the entire assemblage, giving it a reddish colour and hence the name ‘Rooikoppie’. As noted above the Rooikoppie was mined throughout the region by small-scale prospectors using unsophisticated mining and diamond recovery techniques.

The Rooikoppie deposits typically rests on sand, gravel or in places a hard, semi-continuous layer of calcrete and silcrete. Solution cavities up to 2m deep in the calcritised material form sharp, discontinuous depressions that are filled with the overlying Rooikoppie gravel. Such cavities have a very high diamond trapping potential. Given the high incidence of these solution features in the palaeo-land surface underlying the Rooikoppie (as observed in workings at Wouterspan), this is of high interest with regard to its exploration potential.

The basal gravels comprise a poorly sorted assemblage of large boulders (up to 45 cm in diameter at the base of the unit), cobbles and pebbles set in a sandy matrix that is considered to have been deposited by a large, and high-energy braided system that would be readily capable of transporting diamonds.

The Middle Orange River alluvial deposits have regularly yielded exceptional large diamonds including the following:

- 1997 211 carat stone recovered by a Digger from a terrace on Thornley (upstream from Wouterspan); sold for 28 million
- 1997 (October)- 181ct stone recovered from Terrace Bon Saxendrift
- 1999 205 ct stone recovered by Trans Hex Group from Terrace A on Saxendrift
- 2005 175 ct stone from Trans Hex Middle Orange River mines.
- 2006-2007 156 ct (US$5.7m), 152 ct (US$3.4m), and 134ct yellow diamond recovered from Wouterspan

Lower Vaal River and MOR Diamond Populations
Diamond populations from the various alluvial diamond deposits located across southern Africa show important population characteristics. Among these characteristics are the grade, size range and quality of the diamond population, and average diamond values of run of mine ("ROM") production.

Like kimberlites, each alluvial diamond deposit has a characteristic population of diamonds which relates primarily to the depositional environment, the sorting history during transport and deposition, and the source from which the diamonds have originated. Effectively each deposit has its own 'DNA' signature which can be represented by size frequency curves ("SFC") based on a statistically valid parcel of stones from individual deposits.

The size characteristics of each diamond population effectively determine the average value (price) of the diamonds recovered from each alluvial deposit. In current market conditions ROM diamond parcels from different deposits yield the following long term (12 month) average prices or values:

- Holpan and Klipdam and Schutsebama (Riet River)- US$900-1000 per carat
- MOR->US$1500 per carat,
  (1- Deflation being the removal of fine material by aeolian processes, the remaining residue being termed "lag")
- Lower Vaal River-US$500-600 per carat
- Ventersdorp-US$450-550 per carat

SFC's allow characterization and comparison of individual deposits, provide insight into the overall size distribution and proportion of large stones (hence providing insight into diamond values or prices), and are particularly useful in respect of monitoring metallurgical plant efficiencies and shrinkage.

SFC's from four alluvial deposits are presented in the figure 1 below. This graph shows a series of curves for diamond populations indicated in the key. The flattest curve (orange) is for the Wouterspan deposit in the MOR. This deposit (as well as the surrounding deposits) yields amongst the highest value (expressed as a ROM) diamond in the world and this is reflected by this population having the flattest slope of the four curves plotted.

![Figure 1: Size frequency plots for South African alluvial diamond deposits](image-url)
The Wouterspan curve (orange) shows that the majority (70%) of diamonds recovered from this deposit is +2 carats in size, and moreover that 1-2% of stones from this deposit will be larger than 100 carats in size. These figures thus predict a high average diamond value and indicate that the deposit will yield stones of over 100 carats on a regular case as has been shown by recent and historical mining.

The green curve on Figure 1 is for Holpan+Klipdam located north of Kimberley between Barkly West and Windsorton. This area is also known for the occurrence of large diamonds. Diamonds of over 100 carats have been founding this area for over 130 years and average price from mine production for the past 18 months have been US$1000 per carat.

For comparative purposes SFC’s are also shown for the Riverton deposit on the Lower Vaal River adjacent to Windsorton, and for Venterdsorp alluvial diamond deposits. Both these curves are steeper than the Wouterspan and Holpan- Klipdam curves. At Riverview average diamond prices for this Vaal River average about US$500-600 per carat, whereas as in the Venterdsorp deposits the average price is in the range of US$450-550 per carat. In this respect the steeping trend of the SFC’s indicates that the diamond populations are smaller in average size, and that large stones are far less frequent, hence the lower average price achieved for these diamonds.

Sources of Alluvial Diamonds

A critical rider in respect of the origin of the extensive alluvial diamond deposits found in South Africa and Namibia are the numerous diamond bearing kimberlites, very few of which are economic, located across the Kaapvaal Craton in the hinterland of southern Africa. Added to this is the unique geomorphological, geological and gradient aspects of the Vaal and Orange River (which rise close to the eastern boundary of RSA and exit to the ocean on its western boundary), and weather aspects, including the temperate/tropical nature of historical climatic periods – space does not allow elaboration of these aspects here.

Over 1000 kimberlite pipes, blows and fissures have been recorded on the Kaapvaal craton across South Africa, Lesotho, Swaziland, Botswana and Zimbabwe. These intrusions show cyclicity in intrusion age, spanning at least 1700 million years.

Table 2: Ages and patterns of southern African kimberlites and related rocks

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<th>Kimberlite emplacement ages (my)</th>
<th>1700</th>
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Steady erosion of these kimberlites over at least 1700 million years, and probably longer given that the Witwatersrand Sediments (>2700 my) have also been known to produce alluvial diamonds which must in turn have originated from older sources, provided a substantial budget of alluvial diamonds. Some of the kimberlites, including famous localities like Letseng, Jagersfontein, Leicester and some others yielded unique populations of very large value diamonds.

Erosion assisted by extensive Carboniferous glacial planning o these numerous, multiple aged kimberlites, released diamond into the glacio- alluvial systems described above, providing a budget of diamonds which is unmatched on other continents. As diamonds entered these aggressive secondary milling systems, a natural attrition process lead to destruction of poor quality stones and rounding and preservation of high quality gemstones. This enhanced the average values of diamonds populations recovered from the alluvial deposits. By way of example whereas run of mine values diamonds from the Kimberley mines may have averaged US$100 per carat, diamonds recovered from nearby alluvial deposits on the adjacent Vaal River may average US$500 to 600 per carat.

The In-land South African Alluvial Diamond Industry
‘High’ grade and ‘easily’ to mine alluvial deposits, primarily Rooikoppie, were extensively though inefficiently mined in the late 1800’s and early 1900’s. The Great Depression and Government legislation imposed in the early 1900’s subsequently restricted the flow of diamonds to world markets.

The repeal of legislation applying to mining of precious stones opened up the industry and saw growing activity from the 1960’s. This activity fluctuated in intensity into the early-1990 with South Africa’s artificially strong currency ensuring that mining of low grade; dollar based commodities such as alluvial diamonds were expensive to mine.

With the strong decline of the Rand against the Dollar through the 1990’s, abundant cheap electrical power, and ample water supply from the Vaal and Orange Rivers, alluvial diamond mining regained its appeal and activity along these large drainage systems, and elsewhere in the hinterland. Small scale mining or digging operations became common in the Kimberley region along the Vaal River and Riet Rivers (including Skutsekama), further into the interior (Christiana, Bloemhof, Schweitzer Reynecke, Lechtenburg and Ventersdorp), downstream on the middle and lower stretches of the Orange River.

In the 1990’s main areas of activity in the Kimberley region were again concentrated around Windsorton, Riverview, Riverton, Holpan and Kipdam, Barkly West (including Nooitgedacht, Pniel and the Droogeveldt), Delportshoop (Waldeck’s plant gravel splay), the Orange River between Hopetown and Prieska, and the Riet River (Skutsekama).

Revitalized digging and mining activities concentrated on re-exploiting surface deflation deposits known as Rooikoppie, and Vaal River deposits during the 1990’s. Even though the Rooikoppie had been mined in the past the old diggers had worked inefficiently and because of the system of mining 15 x 15 meter claims, portions of the Rooikoppie were sterilized (and hence untouched) due to the dispersal of discards and tailings onto portions of the adjacent claims. Re-mining of the Rooikoppie with modern plant on a larger scale thus still proved profitable. Mining of the Vaal River deposits was driven by the presence of soft overburden, and unconsolidated gravel sequences.

Over time, re-exploitation of the Rooikoppie and Vaal River deposits again lead to diminishing returns and a decline in the extent of digging activity. It had however been recognized that there were buried gravel in the diamond fields that contained good diamonds. As noted above hard calcrite and silcrete layers formed an impenetrable capping which prevented small scale diggers from reaching the buried diamond bearing gravel deposits.

This occurs on the lower Orange River at localities such as Octa and Baken, and gravel sequences covered by hard calcretised capping were known of in the MOR (e.g. Brakfontein and Saxendrift), as well as in the lower Vaal River section at Riverview, Holpan and Kipdam, and adjoining properties such as Snake Hill. Large earth moving plant was needed to uncover and mine these gravels but few of the early attempts in the late 1980’s succeeded in establishing sustainable operations on these buried deposits.

In the 1990’s renewed efforts were being made to excavate buried diamond bearing gravel deposits which up until this period had remained un-exploited. The Trans Hex Group was by now well established on the lower Orange River and had shown that low grade diamond bearing gravels under thick cover could be mined successfully, provided large earth moving equipment was utilized to ensure that high tonnages and economies of scale were achieved.

In 1994 the Van Wyk family began operations on claims on the Holpan property and the Pienaar Brothers (Eddie and Vic) also successfully began exploiting MOR deposits at Saxendrift. The Pienaars achieved success by ripping the calcrete layers overlying buried gravels with large Fiat-Allis bulldozers left over from the engineering works that build several of South Africa’s large dams on the Vaal and Orange River. Aiding the new drive to mine alluvial deposits in the 1990’s was the strongly depreciation Rand- Dollar exchange rate, coupled with relatively low costs of electricity and water in South Africa. As a consequence many small scale and larger private operators re-entered the business.
With the change of Government in 1994, significant changes to mineral title, the introduction of a Black Economic Empowerment Charter to the mining sector, and the strengthening of the Rand against the US Dollar this situation changed significantly in the late 1990’s and into the early 2000’s.

Coupled with political and mineral title changes, readily exploitable “high” grade deposits were becoming scarce and consequently the industry has changed character substantially. Today deposits suitable for mining with small scale plant by small scale private operators are scarce. However extensive very low grade deposits remain and are increasingly becoming the domain of large scale operators with large earth moving fleets, and processing and recovery plants (all of a capital intensive nature).

Looking Forward

Alluvial diamond deposits present higher risk in respect of continuity, grade and price consistency, and resource evaluation. Technically it is almost impossible to achieve bankable feasibility studies for these deposits and investors have in the past been disinclined to invest in alluvial diamond companies.

The Trans Hex Group, a listed company which has very successfully mined alluvial diamonds for over 40 years, and other private operators have shown that alluvial mining can be successfully pursued. World diamond supplies are also in short supply, particularly in respect of gemstones of +2 carats.

Alluvial diamond mining also provides:

- Rapid start-up in respect of time to production,
- Quick cash flow
- Capital and operating costs that are far lower than the costs of establishing kimberlite mines
- Mining equipment (earth moving fleets) and recovery plant that is almost all portable and mobile,
- Diamond quality that is with few exceptions orders of magnitude higher than kimberlite diamond values.

As a consequence of the above, there has been heightened interest in recent years in support and investment for properly managed alluvial diamond producing companies. As the number of successful alluvial companies increases interest in this sector is likely to grow. By application of diligent geological, economic, and mining approaches the evaluation and development of these deposits can be successfully undertaken. These approaches include (but are not limited to) the following:

- Rigorous geological evaluation
- Well devised and supervised Reverse Circulation drilling programmes
- Pitting and trenching to confirm and correlate drilling results
- 3D modeling to delineate gravel thicknesses, bedrock geology, overburden thicknesses, and resource volumes
- Mini-bulk sampling and trial mining at an appropriate scale- typically multiples of +100 000 tones of gravel over adequately representative portions of a deposit
- Size frequency studies of diamond populations
- Metallurgical evaluation of each deposit
- Appropriate earth moving, processing plant, and recovery equipment matching and selection
- Diligent capital and operating cost analysis
- Implementation of properly scaled mining operations
- Achieving proper economies of scale
- Maintaining low costs
- Keeping it simple

Conclusions

In 2007, low grades, strong Rand, and increasingly more challenging geology, mining and metallurgical conditions have driven the South African business to be increasingly about large scale bulk earth moving
and high security. This scenario (namely large scale capital intensive mining) is likely to grow, as is the case for almost every other commodity that is mined around the world today.

Well capitalized, “large scale” operations on diligently delineated and mined deposits provide and opportunity to provide economic returns that will support “lean and mean” junior and mid-tier Companies, economic empowerment, and creating job opportunities in remote and poor areas such as the Northern Cape and ensuring that unique and extensive low grade diamond resources are professionally exploited. Consolidation of the more successful proponents of this business will occur and the challenge will be to incorporate small miners and artesian groups and address their expectation along with that of Government.

Footnote

Here lies a digger, all his hips departed-
A splint of Nature bright, and ne’er downhearted;
He worked in many claims, but now, though stumped,
He’s got a claim above that can’t be jumped.
May he turn out a pure and spotless ‘white’,
When the Great judge shall sift the wrong from right,
And may his soul, released from this low Babel,
Be found a precious soul on God’s great sorting table.

By Albert Broderick, a pioneer, early 1900’s