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Ore Geology Reviews 22 (2003) 251–262
ORE GEOLOGY REVIEWS
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# Diamond economics of the Prairie Creek lamproite, Murfreesboro, AR, USA

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Received 20 October 2001; accepted 24 October 2002

**Abstract**

The Prairie Creek lamproite is the largest of seven ultramafic vents that make up the Prairie Creek lamproite province. Diamonds were first discovered in 1906, and commercial mining continued intermittently until about 1931. The evaluation program undertaken by the Arkansas State Parks Commission in the 1990s resulted in the mapping and evaluation of four major vent facies rock types: olivine lamproite, epiclastic sediments, phlogopite-rich tuff and olivine-rich tuff. Significant diamond contents were found only within the phlogopite-rich tuff (~ 0.11 carat/100 tonnes) and olivine-rich tuff (~ 1.1 carats/100 tonnes).

Stratigraphic relationships indicate that the diamondiferous tuffs have undergone < 50 m of erosion. Extrapolation of the surface rock units and their diamond contents to the pre-erosion surface suggests that ~ 93,000 carats of diamonds were liberated and then concentrated as a natural surface enrichment. Early commercial production focused on the natural surface concentrations, an assumption supported by historic mining records. Historical grades suggest that ~ 58,000 carats were contained in these surface deposits, about half of those diamonds being recovered during commercial operation. These relationships suggest that ~ 35,000 carats remain as eluvial and alluvial deposits adjacent to the existing tourist area. This erosion model minimizes the prospects for either primary or alluvial commercial mining; however, it does validate early historic mining records and suggests areas for further tourist development within existing park boundaries.


*Keywords:* Diamond economics; Prairie Creek; Lamproite

## 1. Introduction

The discovery of economic diamond deposits in the late 1970s within Western Australia lamproitic intrusions generated renewed interest in the Arkansas lamproite province and resulted in reevaluation of the diamond potential of the region. The purpose of this paper is to utilize the geologic setting and recent diamond evaluation results at the Prairie Creek lamproite within the Crater of Diamonds State Park in Pike County, AR, to constrain estimates of the post-erosion diamond distribution. This model is used to provide an estimation of the diamond distribution within and immediately adjacent to the diamondiferous lamproite. This model provides insight into the future economic potential of the intrusion both as a commercial mine and as a tourist attraction. In addition, the model helps explain and clarify past mining history that has been poorly documented in the literature.

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doi:10.1016/S0169-1368(02)00144-0

## 2. Mining history

Diamonds were first found on this property on August 1, 1906 by the owner John W. Huddleston. Immediately after confirmation of the diamond find, the majority of the property was optioned and eventually sold to a consortium that organized into the Arkansas Diamond Company. Arkansas Diamond production was initiated in 1907 and continued until the end of 1912. In 1919, the mining operation was reorganized as Arkansas Diamond Mining of Virginia, and a larger washing plant was constructed. Production in the 1920s appears to have been plagued by various problems, but production continued until 1927 when the property was sold under threat of foreclosure. Small-scale operations were reinitiated in 1928 and continued until stopped by the Great Depression in 1931 (Kidwell, 1990).

In 1944, the Bureau of Mines evaluated the property as a source of industrial diamonds. Their report published in 1949 indicated only low-grade diamond reserves (Thoenen et al., 1949). In 1948, Glenn Martin leased the property and erected a washing plant to test the recently consolidated diamond deposit. This test returned only 246 carats of diamonds from approximately 112,000 tonnes of material (St. Clair, 1956). The State of Arkansas purchased the land in 1972 and named it the "Crater of Diamonds State Park". Numerous improvements have been made on the property to facilitate its operation as a tourist attraction. Approximately 500 diamonds, with a total carat weight of nearly 50 carats, are recovered annually by tourists within the State Park.

## 3. Regional setting

Several occurrences of diamond-bearing olivine lamproite are located in Pike County, AR (Scott-Smith and Skinner, 1984). Pike County is located in the southwestern part of the state and straddles the geologic and physiographic boundary between the Gulf Coastal Plain and the Ouachita Mountains (Fig. 1). The Gulf Coastal Plain is characterized locally by gently south-dipping Cretaceous sedimentary rocks that onlap and lie unconformably over the intensely folded and faulted east–west trending Paleozoic sedimentary rocks of the Ouachita Mountains.

The existence of diamondiferous lamproites within such a young tectonic province located at the southern margin of the continental Craton is unique and enigmatic because most primary diamondiferous kimberlites are located within well-exposed stable Cratons of Precambrian age. A possible explanation for this occurrence is that the Ouachita Mountains may have been thrust onto and overlie the southern margin of the North American Craton which represents a preserved boundary between continental and oceanic crust (Lillie, 1985). A lithospheric transect model derived from seismic and gravity data is consistent with this interpretation (Mickus and Keller, 1992). The age of the Craton in this area is uncertain, although areas 300 km to the west (Oklahoma) and north (Missouri) contain rocks of the 1.3–1.5 Ga granite–rhyolite terrane of the mid-continental Craton (Van Schmus et al., 1986). Precambrian rocks exposed in the Llano uplift of central Texas, located about 500 km to the southwest, record ages from 1.38 to 1.07 Ga (Mosher, 1998). The Llano area lies south of the Llano deformation front, which is equivalent to the Grenville deformation front, and extends northeastward from central Texas towards southwestern Arkansas (Fig. 2). Locally recovered amphibolite xenoliths record K–Ar hornblende ages of ~ 1.42 Ga and are indicative of an association with the granite–rhyolite terrane (Dunn et al., 2000, Dunn, 2002).

The Prairie Creek lamproite province consists of seven known diamondiferous lamproite vents which extend for 5 km in a northeasterly direction from the largest of the vents, Prairie Creek (Fig. 3). The Prairie Creek lamproite is wholly enclosed within the "Crater of Diamonds" State Park and has been determined to have a K–Ar age of 97–106 Ma (Zartman, 1977; Gogineni et al., 1978). Cretaceous lamproite intrusions were apparently injected along a zone of structural weakness related to the Gulf Coast hinge line (Baksi, 1997). The northeast alignment is also subparallel to the northeast-trending Reelfoot Rift located approximately 100-km east of the intrusions. Numerous syenite intrusions also of Cretaceous age, at least one with a carbonatite core (Magnet Cove), were emplaced along the trace of the Reelfoot Rift. Other Cretaceous age intrusions are known to exist in south-

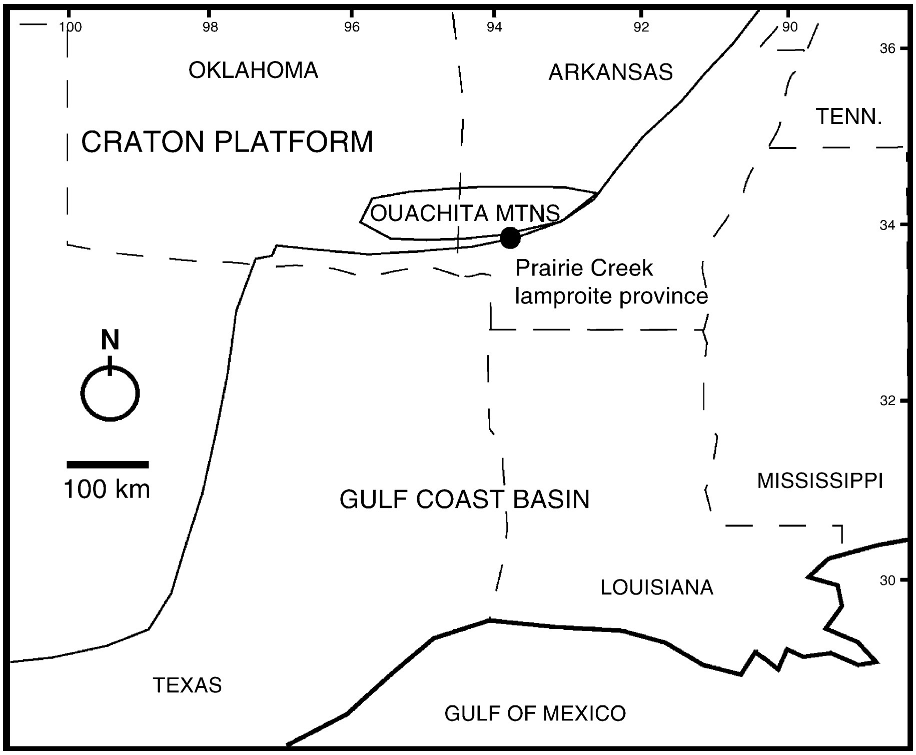


Fig. 1. Geographic map of south–central United States. The location of the Prairie Creek lamproite province is shown in relation to selected geologic elements.

eastern Arkansas beneath the Mississippi Embayment (Moody, 1949).

## 4. Prairie Creek geology

A review of the early mining history revealed that the only available subsurface information on the lamproite intrusion was from three holes described by Fuller (1909) and by Thoenen et al. (1949) in the US Bureau of Mines investigation of 1943–1944. This drilling was to a maximum depth of 63 m with an average depth of less than 10 m. Few if any of the borings intersected the intrusive contact at depth, and therefore, they provided no significant data on the size or shape of the diamond resource at depth. The Phase 1 evaluation of the vent was undertaken in 1990 by the State Parks Commission to provide this subsurface data.

The Phase 1 evaluation program involved vertical and angled diamond drilling in order to determine the subsurface shape of the lamproite intrusion. At various locations around the intrusion, both vertical and 45° diamond drill holes were drilled that, when used with the known surface outcrop location, provided a three point intrusive contact surface. The results of this drilling revealed that the sides of the intrusion dip inward with depth at an approximate 45° angle, mimicking the shape of a martini glass as indicated on cross-sections generated during the Phase 1 evaluation program (Morgan Mining and Environmental Consultants, 1993). This morphology is typical for high-level crater facies lamproitic vents (Mitchell and Bergman, 1991).

The Phase 1 evaluation program resulted in a clearer understanding of the surface geology and its three-dimensional projection into the subsurface. Four main rock types were identified and mapped (Fig. 4). The first rock type is hypabyssal magmatic olivine lamproite which forms nearly half of the surface vent exposure. It is a very hard, dense, greenish-black

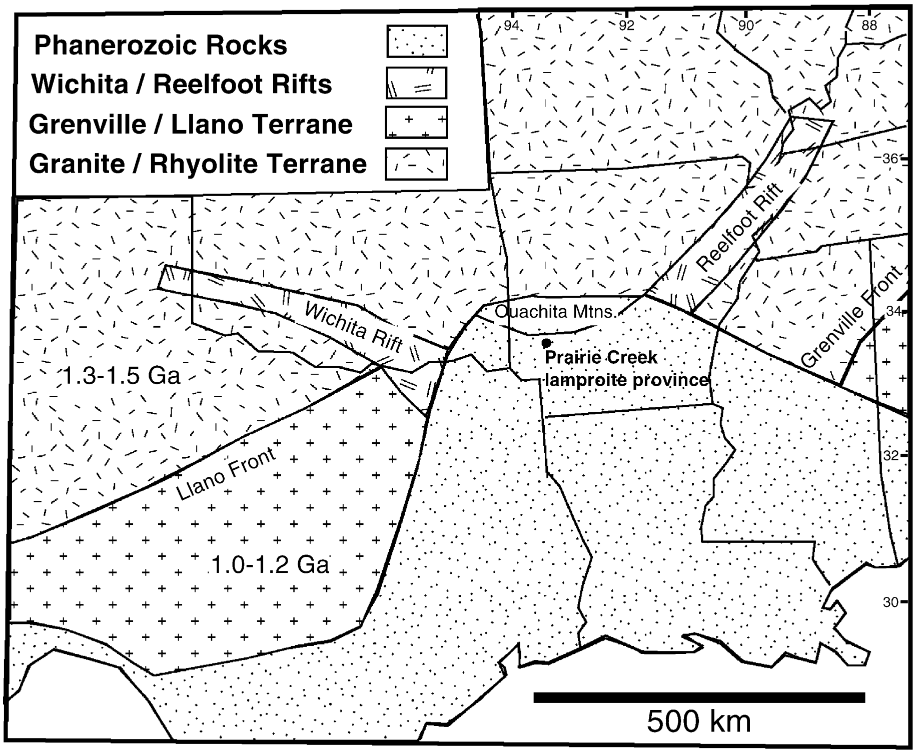


Fig. 2. Interpreted basement geology of south–central United States (Van Schmus et al., 1986). The Llano front separates 1.3–1.5 Ga granite–rhyolite terrane from 1.0–1.2 Ga Llano terrane. No known basement rocks exist beneath the Prairie Creek lamproite province.

olivine porphyry lamproite with contact-metamorphosed near-surface sedimentary xenoliths. This unit was previously described by Miser and Purdue (1929) as "magmatic". The second mapped unit was "maar epiclastics" which likely formed in shallow crater lakes during periods between eruptions. The epiclastics largely consist of medium-grained quartz sandstone and appear to have been preserved near the margins of the intrusion. The distribution of epiclastic rocks is erratic as the unit thickness changes rapidly over short distances. Estimated mapped surface exposure is about 5% of the area and total volume of the "epiclastics" within the vent is estimated as less than 10% (MMEC, 1993).

In addition, two types of pyroclastic lamproite were observed and mapped. The first type is a phlogopite-rich tuff that is generally finer-grained and was previously mapped by Miser and Purdue (1929) and subsequent workers as "tuffs". Although the geologic contact between the two types of lamproite tuff is not very well defined, due to a transitional nature, the phlogopite-rich tuffs are believed to make up approximately 20% of the surface outcrop. The second type olivine-rich lamproite tuff occupies much of the visitor search area and was previously mapped in 1929 as "breccia". The textures observed do not resemble "breccias" because clasts are not angular in nature, but rather coarse-grained tuffs and lapilli tuffs with rounded fragments. The surface extent of the olivine-rich tuffs can be estimated from the map of surface geology as approximately 30% of the 32-ha vent.

## 5. In situ diamond distribution

The four major rock types were bulk tested for diamond content as part of the Phase 2 evaluation program completed by the State Parks Commission in 1997. The purpose of the evaluation was to determine

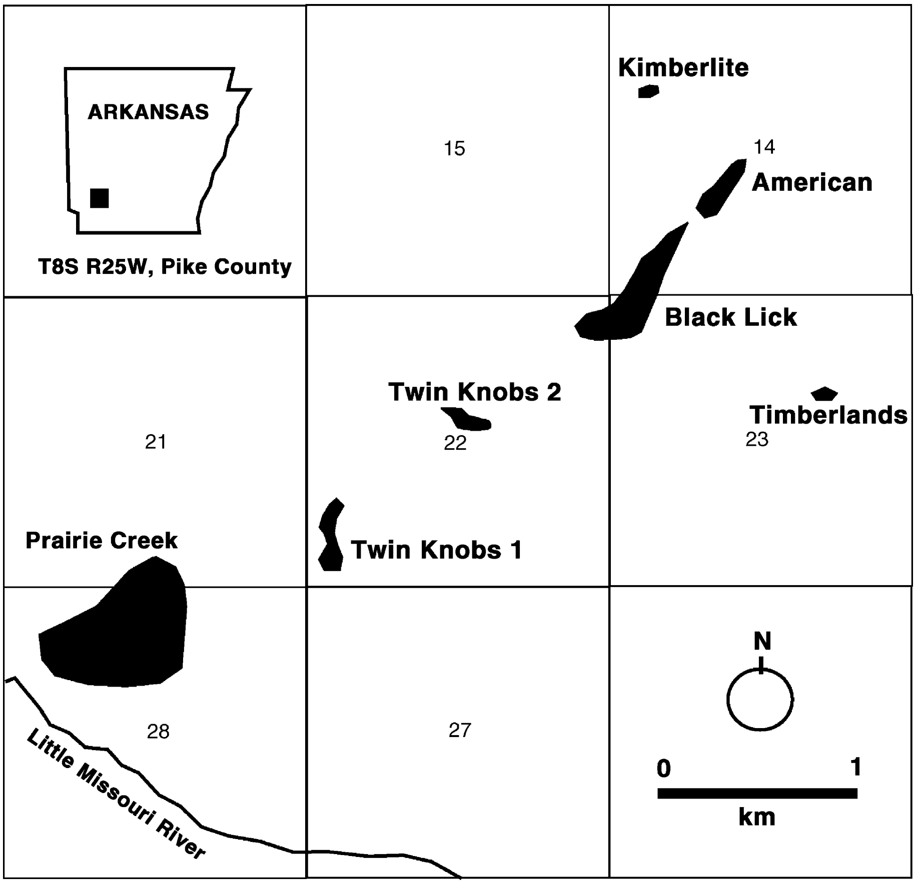


Fig. 3. Location of known Prairie Creek lamproite occurrences.

the diamond grade and value of the diamond-bearing lamproite. This evaluation utilized 14 trenches throughout the vent, each consisting of a 600 tonne bulk sample. Approximately 3 m of surface overburden was removed for backfill and the in situ lamproite was shipped to an off-site heavy media plant for diamond concentration and recovery (Morgan Worldwide Mining Consultants, 1997). It should be noted that some researchers question the validity of the 1990s evaluation (Howard, 2000); however, the reported diamond grades appear to be validated by the data comparison discussed below.

Estimated diamond grades can be applied to the four rock types based on results of the bulk diamond testing. The specific diamond content of the magmatic olivine lamproite that forms about 45% of the surface outcrop was never definitively determined. Miser and Purdue (1929) reported that only a few small diamonds have ever been found within this unit. Because the massive resistant rock is not conducive to rotary pan concentration or crushing and heavy media separation, the rock type has never been bulk tested economically. However, petrological observations by Roger Mitchell (MMEC, 1993) revealed reaction rims around the large olivine megacrysts and poikilitic phlogopite phenocrysts which indicate a relatively slow cooling. Mitchell suggested that few diamonds would survive this slow cooling event under conditions outside of the diamond stability field. Both of these lines of evidence suggest that the in situ diamond content of the magmatic olivine lamproite is insignificant.

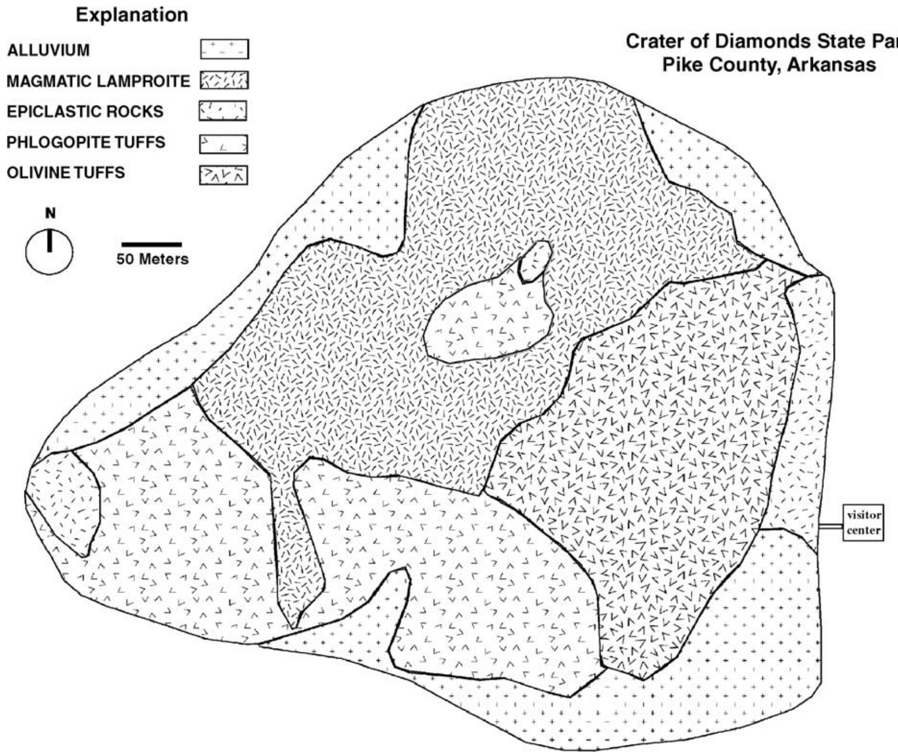

Fig. 4. Simplified surface geology of the Prairie Creek lamproite. The four mapped volcanic rock types are indicated. Modified from MWMC (1997).

The epiclastics are generally fine-grained clay to sandy sedimentary rocks that also have not been definitively sampled. Trench 3B was largely in the epiclastics of the border zone and although described as "sandy tuffs", it yielded no diamonds from a 240 tonne bulk sample. In contrast, the relatively fine-grained border facies described as sandy tuffs within the diamondiferous Australian lamproite province is described as having relatively high-grade diamond contents. Due to the barren epiclastic deposit sampled during the Phase 2 testing, the volumetrically small amount of "epiclastics" is considered barren of diamonds.

The phlogopite-rich tuffs commonly appear somewhat transitional between the border "epiclastics" and the central olivine-rich tuffs and are found interbedded with both units. Phlogopite-rich tuffs are mostly found on West Hill and the eastern flanks of Middle Hill adjacent to the western edge of the visitor search area. Four of the bulk sample trenches were at least in part fine-grained phlogopite-rich tuffs. Evaluation of the diamond-content of the in situ phlogopite-rich tuffs yielded two trenches barren of diamonds and two other trenches with less than 0.11 carat/100 tonnes (0.11 cpht). To estimate the maximum reasonable diamond contents, it is assumed that the fine-grained phlogopite-rich tuffs have an average diamond content of 0.11 cpht.

The olivine-rich tuffs tend to be coarse-grained due to the presence of rounded lamproite lapilli. The olivine-rich tuffs are found throughout most of the visitor search area and represent the source of most of the visitor diamonds. The majority of the diamond evaluation efforts were concentrated within its outcrop areas and the in situ diamond distribution is fairly well defined. Results from the Phase 2 evaluation show that the majority of the olivine-rich lapilli tuffs have a diamond grade of $\sim$ 1.1 cpht. Material from the northern and southern margins of the visitor search areas shows evidence of dilution by other rock types and

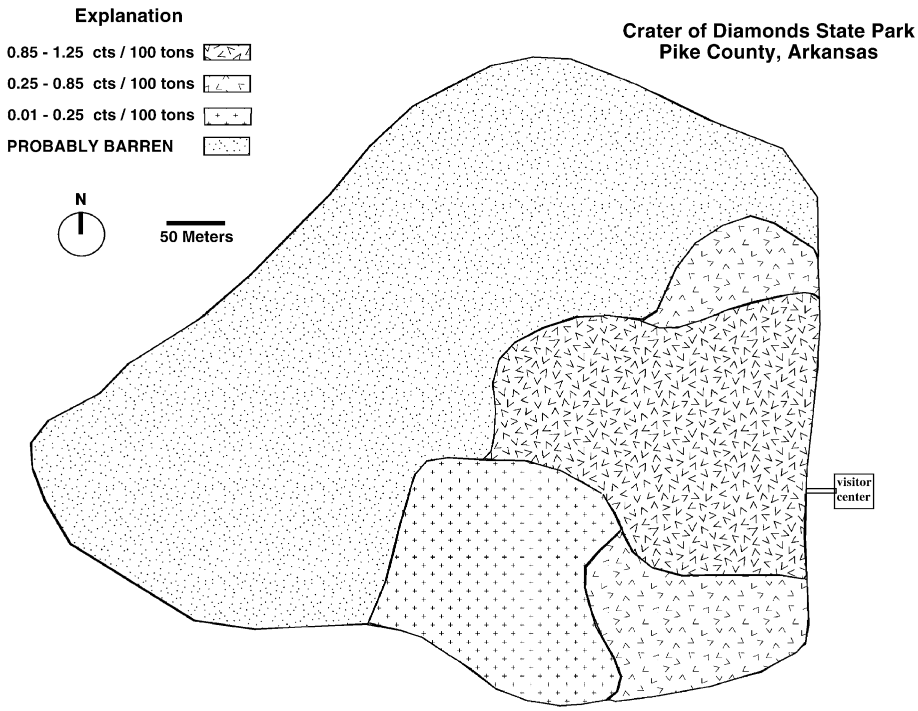


Fig. 5. Recovered diamond grade within the Prairie Creek lamproite. Modified from MWMC (1997).

yields average diamond grades of about 0.33 cpht (Fig. 5). In order to place an upper limit on the reasonable diamond content, the olivine-rich lapilli tuffs were assumed to have an average grade of 1.1 cpht.

## 6. Model and erosional history

The unique stratigraphic relationship in which the Arkansas lamproites were intruded into the Upper Early Cretaceous Trinity Group, eroded and then capped by the Lower Late Cretaceous Tokio Formation allows accurate estimation of the time of intrusion. Furthermore, the elevation of this regional unconformity permits an accurate determination of the amount of lamproite erosion since Late Cretaceous time. An adjacent lamproitic intrusion (Twin Knobs 2), located approximately 1.5 km northeast of the Prairie Creek vent, reveals the cross-cutting relationship of the lamproites with the host stratigraphy (Dunn and Taylor, 2001). The top of the intrusion is eroded and the basal gravel of the Tokio Formation was deposited nearly horizontally on the eroded surface. The elevation of this erosional surface is ~ 150 m above mean sea level. This erosional surface exists at similar elevations at both the Black Lick and American lamproite vents further northeast along the trend of the intrusions.

Extrapolation of this disconformity to the southwest reveals that the Prairie Creek pipe within the Crater of Diamonds State Park was probably buried by the Tokio Formation during the Late Cretaceous Period. It was only exhumed by erosion in recent geologic time by the action of the Little Missouri River at an elevation of 150 m above sea level (Fig. 6). The highest elevation within the park today is the East Hill (elevation of ~ 140 m) which is capped by erosion-resistant magmatic olivine lamproite. The elevation of this resistant topographic feature tends to reinforce the approximate exhumation elevation of 150 m for the Prairie Creek vent. The average elevation of the visitor search area at the Crater of Diamond State Park is just higher than 100 m above sea level, indicating that the average thickness removed by erosion of the diamond-

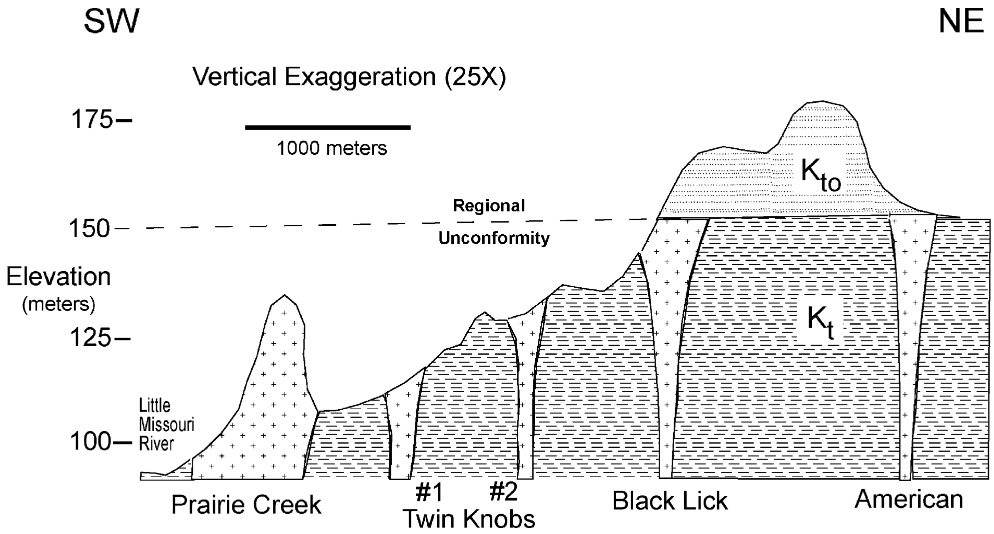


Fig. 6. Erosion profile across the Arkansas lamproite province. Estimated level of erosion of the Prairie Creek lamproite below the regional unconformity is indicated. $K_t$ indicates the Early Cretaceous Trinity Group and the $K_{to}$ indicates the Late Cretaceous Tokio Formation.

iferous intrusion in recent geologic time is less than 50 m (Dunn, 2000).

This erosion depth, the area of intrusion and the approximate diamond grade of the removed rock yield an estimate of the total volume of original diamonds liberated by erosion. The density of in situ weathered lamproite during the Phase 2 evaluation was found to be ~1.65 tonnes/m$^3$. The geologic mapping indicated about 20% of the surface area (6.4 ha or 64,000 m$^2$) to be phlogopite-rich lamproite with an average diamond content of 0.11 cpht. Assuming a maximum erosion depth of 50 m, the total eroded volume of phlogopite-rich tuffs is 3,200,000 m$^3$ or ~5,280,000 tonnes of material. If this material contained an average grade of 0.11 cpht, a total of ~5800 carats of diamond would have been liberated.

The same calculation for the olivine-rich pyroclastics that cover 30% of the mapped vent yields 9.6 ha of exposure or 96,000 m$^2$ of olivine-rich pyroclastics. This number multiplied by a maximum erosion depth of 50 m yields a total volume of 4,800,000 m$^3$ or ~7,920,000 tonnes. If this material contained an average grade of 1.1 cpht, a total of ~87,000 carats of diamond would have been liberated. All of the diamondiferous material eroded since exhumation of the deposit would yield an estimated 93,000 carats of diamond (Dunn, 2000, 2002).

## 7. Surface concentration

Southwestern Arkansas experiences warm and humid summers and cool to mild winters, with a sub-tropical climate and over 125 cm of rain/year. The local climate results in development of pedalfer to lateritic soil horizons with well-developed thick organic-rich residual black topsoil. The surface layer or organic-rich A-layer is known to contain mainly resistate minerals which are not easily weathered or eroded and have accumulated over time within the soil. These surface soils develop by extensive chemical weathering and dissolution of the underlying ultramafic rock (saprolite). This process is demonstrated by the deep leaching and extensive saprolite development (depths>30 m) found during drilling and by the low density of lamproite during the bulk testing.

Chemical weathering is expected to predominate over physical transport of material in a low-relief subtropical environment. Thoenen et al. (1949) stated that "The greatest concentration of diamonds appears to have been found in the black ground capping the brecciated peridotite. This averaged about 2.5 feet thickness and yielded a diamond concentration of approximately 0.844 carat per cubic yard" (~50 cpht). During the Phase 2 evaluation program, an absence of original organic-rich surface layer was observed over the entire intrusion, even in areas which overlay ''barren'' magmatic lamproite rock types. Earliest mining operations most probably removed and exploited the natural surface concentration of diamonds. Early recovery methods were designed for extremely soft weathered material, and large crushers were not utilized during these operations. A report by an employee of the Arkansas Diamond Company indicated that existing mining operations were recovering ~ 15 cpht with an average stone size of 0.35 carats (Fuller, 1931).

Rotary pan concentration techniques used in the old mining operations had relatively poor recovery rates especially for smaller stones because insignificant weight differences did not allow for gravity separation of small diamonds. A cumulative plot of actual diamond size distribution for the Phase 2 diamond evaluation reveals that nearly 50% of the diamond content by carat weight is in the size fraction of less than 0.3 carat (MWMC, 1997). The average size of recovered diamond was just over 0.2 carat. Reported diamond grades during the early mining years may have been underreported by as much as 50% due to non-recovery of smaller diamonds. Actual diamond contents within the surface soil concentration mined in the early stages of commercial operations may have had diamond grades in excess of 30 cpht. This hypothesis is borne out by the fact that in the 1980s, the majority of diamonds reported as finds at the Crater of Diamonds State Park was by artisan miners who were working the old tailings near the southern edge of the visitor search area. In additional, the majority of these stones was less than 0.3 carat in size. It is proposed that the vast majority of these diamonds were non-recoverable during early commercial production.

Records of the early diamond production are sparse, with the most complete review of diamond production and grades that of Fuller (1931). Fuller suggested that at least two grades of ore were processed. The first ore type was rich in diamonds and yielded recovered diamond grades of 15 cpht with actual total diamond contents possibly in excess of 30 cpht. The second reported ore grade encompassed over 50% of the material processed for the period 1919–1925. This material yielded 176 carats of diamonds from ~ 20,000 $m^3$ of material. The combination yields an average recovered ore grade of approximately 0.5 cpht. Compensating for a 50% loss of small stones yields an average ore grade of about 1.0 cpht.

The US Bureau of Mines' evaluation during the 1940s consisted of 54 large diameter holes drilled from the surface yielding ~ 240 $m^3$ or 395 tonnes of material. Processing of this material yielded 32 stones weighing a total of 8.41 carats for an average grade of 2.1 cpht and an average size of 0.25 carats (Thoenen et al., 1949). This ore grade is slightly higher than the Glenn Martin bulk test results where a large bulk sample from the consolidated mining properties produced about 246 carats from approximately 112,000 tonnes of material (St. Clair, 1956). The calculated ore grade during this evaluation is approximately 0.22 cpht. It has been noted that no small stones were recovered during this test so consideration for poor recovery during processing yields approximate diamond grades of up to 0.44 cpht.

Review of the Crater of Diamonds State Park mining history and the results of the 1996 Phase 2 evaluation suggest that two types of diamond resources were encountered at the Prairie Creek lamproite. The first ore type was relatively rich in diamonds with recovered ore grades in excess of 15 cpht and probable actual diamond contents near 30 cpht. This material constituted the bulk of the material washed in the earliest mining operations until 1912 and at least part of the material processed during the 1920s. During the 1920s, two ore grades can be distinguished. The higher-grade ore had grades comparable to those of earlier mined surface enrichments and was probably constituted from the same material. The lower grade ore processed appears to represent in situ pyroclastic lamproite and yielded diamond contents averaging < 1.0 cpht. By the late 1920s, nearly all of the surface-enriched material had been processed. The in situ material at that time was found to be too low grade and sub-economic, and the commercial operation failed and was abandoned by 1931.

Later economic evaluations at the Prairie Creek vent specifically evaluated the in situ lamproite as the enriched surface material had been depleted. The US Bureau of Mines test, which may have included some surface material, yielded average diamond contents of 2.1 cpht. Glenn Martin's large scale evaluation in

1948 yielded average grades of about 0.44 cpht, and the 1997 Phase 2 evaluation yielded an average grade of 0.57 cpht. When viewed in retrospect, the mining history and reported diamond grades appear consistent with the current geologic understanding and erosion processes at work in the area.

## 8. Economic considerations

The mining history and economic evaluation of the in situ Prairie Creek lamproite vent proves that it has limited commercial economic potential even utilizing modern large-scale bulk mining equipment. The Phase 2 evaluation proved that although the total resource size is significant, the in situ diamond grade is too low for economic consideration. However, a review of the results of the Phase 2 evaluation in conjunction with the sparse mining records suggests that early mining grades were significantly higher due to weathering and diamond concentration in the soil overburden. Diamond concentrations exceeded economic diamond ore grades for that time. Unfortunately, the natural high-grade concentration in the surface soil was volumetrically small for a commercial mining operation and was essentially depleted by the end of the 1920s.

The commercial alluvial potential of diamonds derived from the Prairie Creek lamproitic vent can be determined utilizing the erosional model. Erosion estimates for this vent indicate that a maximum of 50 m of erosion has occurred since the Cretaceous. Previous calculations have revealed that the pyroclastic lamproite eroded from the vent would have yielded approximately 93,000 carats of diamonds. Diamonds recovered from the surface lag concentrations, which were less than a meter thick and covered the 16 ha of the intrusion and had an estimated diamond grade of 30 cpht, would have yielded approximately 58,000 carats of diamonds. Of this amount of diamond, it is estimated that ~ 29,000 carats of the larger stones were recovered by early mining operations and another ~ 29,000 carats of the smaller stones were lost to the tailings.

This calculation reveals that approximately 35,000 carats of diamonds could have been removed from the vent area. These diamonds would be contained in adjacent eluvial deposits and small erosion channels, and they would ultimately be delivered to the Little Missouri River for transport and fluvial concentration. Using the average value of diamonds recovered during the Phase 2 evaluation (US $12.30/carat), the potential value of all the Prairie Creek intrusion alluvial diamonds is approximately US $430,000. Obviously, commercial alluvial diamond deposits along the Little Missouri River are not economically feasible. The lack of alluvial diamond potential is supported by two lines of evidence. The first is the near total lack of diamonds found immediately downstream of the vent. Furthermore, American Selection Trust (AMSELCO) is known to have evaluated the alluvial potential of the Little Missouri River approximately 10 km downstream. No diamonds were recovered from at least one large tonnage gravel sample (Doug Duskin, 1991, personal communication).

The diamond resource provided by eluvial diamonds adjacent to the vent can be estimated utilizing the erosion model. Approximately 35,000 carats of diamonds are estimated to have been removed from the surface of the vent. Of this value, many of these diamonds have probably not been transported far (due to lateritic soils) and may be contained in eluvial deposits adjacent to the vent. Artisan miners discovered two diamond-rich eluvial stream channels (east and west drains) during the late 1980s and extensively worked these channels until they were exhausted. The "drains" were essentially buried ephemeral streams that ran from the center of the vent to the Little Missouri River. Furthermore, Phase 2 evaluation tested some eluvial material formed by downslope creep off the southern margin of the vent in trench 3A. This material had small pebbles and gravel, and despite being of eluvial nature, yielded two diamonds from a relatively small sample. This sample demonstrates that the eluvial material and/or terrace alluvium mapped adjacent to the vent may still contain some surface concentrations of diamonds that were not previously recovered.

## 9. Conclusions

The recent economic evaluation has served to advance the understanding of both the geology and history of the Crater of Diamonds State Park.

Although the economic evaluations reveal that the in situ lamproite is not of significant grade to warrant large scale mining operations, they do reveal that the property was a viable economic diamond mine in its time. Commercial diamond grades were initially achieved due to extreme chemical weathering of the ultramafic rock in a subtropical environment. The unique erosion history allowed for development of economic lag deposits over the vent but also served to minimize downstream development of alluvial deposits. Even though the rich diamondiferous surface soils were rapidly depleted, there is evidence that soils with at least some natural enrichment of diamond remain in the form of small drainages radiating from the intrusion, and as eluvial and alluvial soils adjacent to the intrusion. These deposits adjacent to the intrusion may provide promising targets for further tourist development within the park (Dunn, 2000).

## Acknowledgements

I would like to acknowledge both the Arkansas State Parks Commission and the Arkansas Geological Commission for their enlightened support of the 1990s economic evaluation at the Crater of Diamonds State Park. I would like to recognize Arkansas Diamond Development and Texas Star Resources for funding the evaluation process and Morgan Worldwide Mining who worked diligently to keep the evaluation process from being untracked by competing interests. My personal gratitude is given to Mike Waldman, Doug Duskin and Larry Dusak for providing unpublished data and/or ideas which contributed to this paper. Special thanks to Steve Bergman and Mike Howard for their editorial reviews which improved the clarity of this publication.

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