

ALLUVIAL GOLD MINING, OFFIN RIVER AREA, GHANA
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Sunergy's Nyinahin Prospecting Concession

Sunergy's Nyinahin concession is located in Ghana's Ashanti Region, ca. 50 km southwest of Kumasi. The Kumasi-Bibiani road cuts NE-SW across the northwest part of the concession. The concession is irregularly shaped and is approximately bounded by 6°29' and 6°37' North Latitude and 2°01' and 2°12' West Longitude. The boundaries of the Nyinahin Concession are shown in Figure 1. The concession consists of 150 km² of gently rolling secondary forest and slash-and-burn farming areas containing some cocoa farms and oil-palm plantations. The Offin River valley follows a roughly 10 km meandering NE-SW course through the southeastern part of the concession (Figure 1), approximately 60 km upstream from the Central Region town of Dunkwa-on-Offin (also known as Dunkwa).

Nyinahin lies 20 km northeast of the Bibiani mines, 50 km northwest of Anglo Gold-Ashanti's Obuasi mines, and 45 km southeast of Newmont's Kenyasi mine. Directly adjacent to the east side of the Nyinahin prospecting concession are the two mining concessions from which Bonte Gold recovered gold-bearing alluvial gravels along the Jeni and Bonte tributaries. A 2008 map published by Ghana's Minerals Commission, indicates that a Newmont concession lies adjacent to the western side of the Nyinahin property.

The geology of the Nyinahin concession (the Geologic Map appears as Figure 1 and the Explanation for the Geologic Map as Figure 2) is typical of much of the mineralized portions of the Proterozoic shield of Ghana. Most of the bedrocks underlying the concession are metasedimentary rocks of the Birrimian System of Proterozoic age, which trend NE-SW across the concession. The Birrimian metasedimentary rocks have been metamorphosed to the lower greenschist (chlorite-sericite) facies, and are intruded on the west and north by biotite-quartz-rich foliated granitic rocks of the basin-type or Cape Coast granitoid complex, and in the south central and southeast by several small plutons of hornblende-rich granitic rocks of the belt-type or Dix Cove granites. Both the basin-type (Cape Coast complex) and belt-type (Dix Cove granite) intrusive rocks have also been dated as Proterozoic in age.

The following information is largely derived from: Griffis, R.J., Barning, Kwesi, Agezo, F.L., and Akosah, F.K., 2002, Gold Deposits of Ghana, Minerals Commission, 432 p., plus the author's own geologic studies of the West African Precambrian shield.

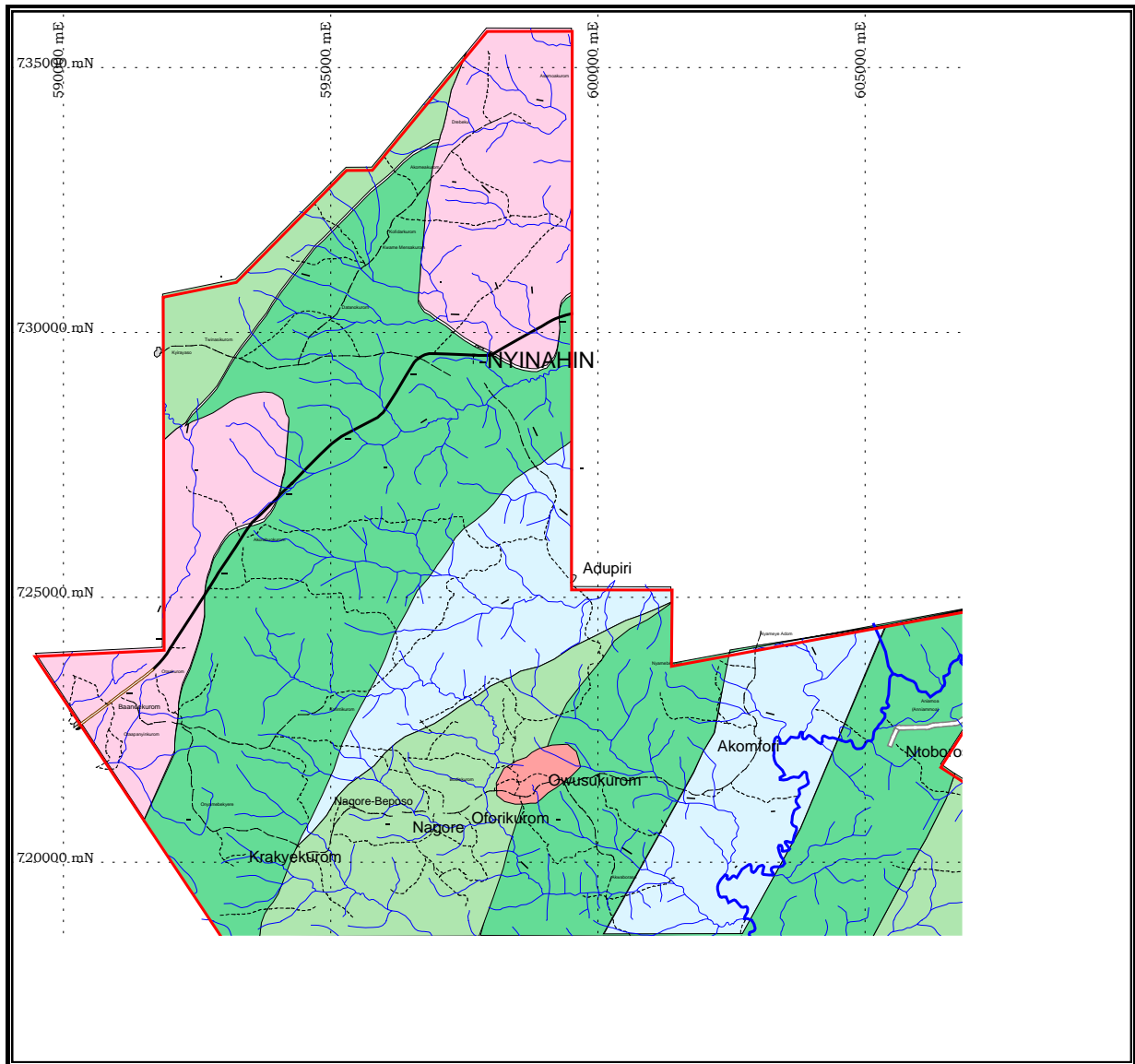





Figure 1. Geologic Map of Sunergy's Nyinahin Concession , Ashanti Region, Ghana (Explantion of Geologic Map is contained as Figure 2)

Late Quaternary Alluvial Gravels

Most of the pre-1900 gold production in present-day Ghana derived from alluvial gravels deposited in rivers and stream channels draining areas underlain by mineralized rocks containing primary gold deposits. In the first decade of the 20th Century, large alluvial mining operations were begun on several major river systems of the Gold Coast Colony, notably including the Offin, Pra, Tano, and Ankobra rivers. Southern Ghana's alluvial terraces and river sediments were most likely deposited during the Late Quaternary (Holocene) epoch. Alluvial gold is primarily found in the basal gravels of river systems draining underlying weathered metasedimentary and metavolcanic bedrocks of the Birrimian and Tarkwaian Systems of Proterozoic age.

Explanation for Geologic Map of Nyinahin Concession

BIRIMIAN METASEDIMENTARY ROCKS

-  Arenaceous metasedimentary formation
-  Argillaceous metasedimentary formation
-  Clasto-tuffaceous metasedimentary formation

INTRUSIVE ROCKS



-  Hornblende-rich granitic rocks (Belt-type/Dixcove Granites)
-  Biotite-quartz rich granitic rocks (Basin-type/Cape Coast Granitic Complex)

Figure 2. Explanation for Figure 1, Geologic Map of Nyinahin Concession, Ashanti Region, Ghana

Offin River Dredging

Banka drilling along the Offin River, north of Dunkwa, indicates that the valley is at least 1 km in width. The lower gold-bearing gravel lying on top of weathered Birrimian rocks, ranges between 2 and 6 m thick, and is capped by a similar thickness of barren overburden consisting of silt and clay. Zones of gravels, 300 to 600 m wide, grade over 175 mg/m³ and have good continuity along the valley. Reworked gravels form high-grade zones.

During much of the 20th Century, dredging operations were conducted along several sections of the Offin River Valley, from ca. 20 km downstream from Dunkwa to ca. 60 km upstream. Dredging of the Offin River first began in 1904. A view of the Offin River Valley following dredging operations appears as Figure 3. Total gold production during this period was 100,000 ozs, and the highest recorded annual production was 14,000 ozs in 1909.



Fig. 3 Offin River Valley in 1963, during dredging operations



Figure 4. Bremang dredge operating on Offin River during 1963

The Gold Coast Selection Trust acquired mining leases during the 1930s and 1940s, however, major mining operations by its subsidiary, the Bremang Gold Dredging Company, did not begin until the 1950s. During the 1950s and 1960s, Bremang placed four dredges along different sections of the Offin River valley. Figures 4, 5, 6, and 7 illustrate the Bremang Gold Dredging Company's operations during 1963. Bremang produced ca. 50,000 ozs annually during the 1950s and early 1960s, achieving a peak annual production of ca. 70,000 ozs. After the early 1970s, annual production dropped from 30,000 ozs to 10,000 ozs. It continued to fall to 4,000 ozs by the early 1990s, despite the acquisition new dredges and redesign of both the dredges and the dredging operations. In 1995, production fell to under 1,700 ozs, and gold mining ceased. During the 20th Century, a total of 295 million cubic yards of gravels were processed and 1.45 million ozs of gold were recovered.

The following 6 items summarize the characteristics of the Offin River deposits:

- a. The Offin River is ca. 25 m wide, and flows on a floodplain between 0.5 km and 1 km in width. The Offin River Valley is 1.5 to 3 km wide and the valley floor tends to lie between 15 and 20 m above the river.
- b. Birrimian metasedimentary rocks form a weathered surface ca. 6 to 8 m below the current surface. Several major broad channels cut an additional 1 – 2 m into the bedrock. A few narrow channels cut into the bedrock to 18 m below the present surface.
- c. Unconsolidated basal gravels varying in thickness from 0.5 to 8 m lie across the Offin River valley. The gravels contain large pebble to cobble size clasts, up to 15 cm in diameter, in a matrix of quartz and heavy minerals. Essentially, all gold is contained in these basal gravels.
- d. Overburden, from bottom to top, consists of 2 – 8 m of coarse sands containing plant fragments, silt, and silty clay. The modern channel of the Offin River has cut ca. 5 m through the overburden, however the channel has not reached the gold-bearing basal gravels.
- e. Gravel layers 3 – 7 m thick generally contain gold. However, gravels layers, 7 – 10 m thick are generally barren. Along the northern part of the Offin, gold is concentrated in a band, 300 to 600 m wide, which contains gold values above 0.13 gm/yd³. High-grade sections are scattered and isolated.
- f. Banka drills were used to collect samples and develop several estimates of Offin River alluvial gold reserves. These reserves range between 110 and 220 million yd³ at a grade of 0.11 – 0.12 g/yd³ that contain, roughly, between 400,000 and 800,000 fine ozs.



Figure 5. Bremang Gold Dredge excavating gravels from Offin River during 1963 operations



Figure 6. Gravels excavated from Offin River Valley are lifted onto Bremang Gold Dredge using large steel scoops attached to a conveyor, during 1963 operations



Figure 7. Steel scoop containing gravels excavated from Offin River Valley by Bremang Gold Dredge is lifted onto dredge during 1963 operations

Bonte Alluvial Placers

Extensive historical alluvial workings, probably dating back several centuries to the Ashanti Kingdom, are found along the Jeni (Gyeni) and Bonte drainages. Beginning in the early 1990s, alluvial materials were mined from the Jeni and Bonte tributaries on the left bank of the Offin. The modern river channel contains high-grade zones of gold-bearing gravels and sands (800 - >1000 mg/m³). Additional gravel deposits, 1 – 2 m thick lie along the channel margins and grade 400 – 800 mg/m³. These gravels are overlain by a clayey overburden, 1 – 3 m thick. The gravel deposit is 200 – 500 m in width and at least 14 km in length. Older terrace gravels are located along the edges of the river valleys.

Throughout the 1990s, the Bonte mining operation was the only successful major alluvial gold producer in Ghana. The Bonte lies at the north end of the Manso Nkwanta district, and the deposits occur in the valleys of the Jeni River and its Bonte River tributary. The project consisted of two concessions: the Esaase license (upper Bonte River valley) and the Jeni River license, which, together, include 76 km², from the upper Bonte valley to the Jeni River's confluence with the Offin River.

Studies during the 1960s by the Ghana Geological Survey indicated 22 million m³ at a grade of 0.24 g/m³ and included zones of high-grade gravels. Starting in the 1980s, several companies were attracted to the area. In 1990, Bonte Gold defined 2.5 million m³ of gravels that averaged 0.6 g/m³, plus an additional 2 million m³ averaging 0.5 g/m³. Bonte Gold commenced mining in 1991 and continued into the 21st Century. Total estimated production is in excess of 200,000 ozs, and in 2000 alone, was in excess of 70,000 ozs. Despite six years of mining, in 1997, gold reserves for the Bonte and upper Jeni floodplains and terraces were newly estimated at 6.83 million m³ at 0.92 g/m³, and totaled over 200,000 ozs.

Alluvial resources extend for 14 km in the Bonte and Jeni valleys, as narrow zones along the modern stream channels. The lower gravels, which contain most of the alluvial gold, lie above weathered Birrimian metasedimentary rocks. Along the valley sides, 5 – 10 m of clays and silts overlie two gravel layers. On the Bonte floodplain, units of clay, silt, and gravel of variable thickness total 4 – 5 m. The lower gravels generally range between 1 and 2 m thick, and the upper gravels are 0.5 – 1 m. in thickness. All units contain some gold, however the lowest gravels have the highest grades, commonly above 1 g/m³. In addition, the 0.2 – 0.3 m of weathered bedrock, immediately below the gravels, contain significant gold values. The Bonte river terraces, preserved along the valley sides, are also gold-bearing. The upper Jeni River floodplain contains a similar distribution of both sedimentary units and gold, as does the Bonte. Size distribution of gold grains fine as one progresses downstream.

After 2000, alluvial mining continued for several additional years. However, it is reported that the property owners have currently ceased mining alluvial gold, and are attempting to develop the hard rock gold potential of the properties.

Conclusion

Downstream from Nyinahin, 1.45 million ozs of gold have been produced from the Offin River valley, more than from any other river system in Ghana. The Bonte-Jeni tributary system, which has produced more than 200,000 ozs of alluvial gold, and is the Offin's most productive tributary, enters the Offin River valley at the eastern edge of the concession. Below this confluence, the Offin River continues for ca. 10 km through the southeastern area of Sunergy's Nyinahin concession. In summary, there is excellent potential for economic recovery of gold from the alluvial deposits in the Offin River Valley within Sunergy's Nyinahin concession.