Geophysical Signatures of a +5.4Moz gold deposit, NE Bankan, Guinea, West Africa.

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SUMMARY

A suite of geophysical techniques were completed over the +5.4Moz NE Bankan (NEB) gold deposit in Guinea, W Africa. Petrophysics on core indicate a correlation of low magnetic susceptibility and high chargeability with increasing gold grade. Gradient Array IP (GAIP), Pole Dipole IP (PDP IP), ground gravity, ground and airborne magnetics and radiometrics were collected. IP surveys were most effective in mapping high chargeability and resistivity responses, related to sulphide and silica alteration, respectively, associated with the gold mineralised rock volume. Extending the deposit footprint, 3D modelling of chargeability and resistivity shells indicate considerable depth (+400m) and along strike (+500m) continuity of the mineralised system. Gravity data help map intrusive bodies and structural contacts. NEB is associated with a low order ~1-2mgal density feature, an interpreted mafic body, slightly off set from the deposit. A NE-SW trending gravity gradient, sub-parallel to the plunge of the high-grade core of the deposit, indicates a cross-fault control on localisation of high-grade gold. At the regional scale, both gravity and aeromagnetics show a major N-S trending structural corridor crosscut by NE-SW faults that appear to facilitate gold mineralisation.

Key words: Orogenic gold deposit, petrophysics, gravity, IP, aeromagnetics, Siguiri Basin, West Africa.

INTRODUCTION

NE Bankan (NEB) in the Siguiri Basin, Guinea (Figure 1), is an emerging Tier 1 gold discovery found by Predictive Discovery Ltd (ASX:PDI; Roberts et al. 2021), comprising a +5.4Moz Au JORC resource estimate (ASX release 7th August 2023). Its discovery was through regional scale geophysics and fault analysis as area selection inputs in the first instance. Country-wide gravity data from Bureau Gravimétrique International (BRG), with an average station spacing of 13km, was processed using automated edge detection ("worming"; Hornby et al. 1999) which revealed a deep-seated, N-S trending gradient that appeared aligned with the depositional edge of the Siguiri Basin (Roberts et al. 2021). The deposit is overlain by 20m of laterite cover. Power auger drilling revealed a coherent Au bedrock/saprolite anomaly at NEB. Subsequent AC and DD drilling located the gold deposit immediately beneath and along a N-S trending, west dipping mylonite zone termed the Bankan Shear Zone (BSZ). The Bankan Shear Zone is interpreted as a subsidiary structure to a more extensive structure to the east, called the Kaninko Shear Zone (KSZ) as shown in Figure 1. At NEB, gold mineralisation is within a chlorite/sericite/sulphide altered tonalite host rock in contact with a mafic volcanic and metasedimentary sequence in the immediate hanging wall. Based on drilling, the gold mineralised zone contains a steeply plunging NE-SW high grade core (+5g/t Au), open at depth (below 600m). There is little exposed geology, regionally, with laterite and alluvium masking the prospective Proterozoic rocks of greenstones and granitic tracts.

PDI collected several geophysical surveys to characterise the geophysical signature of the NEB deposit so as to guide near-deposit and regional targeting. Results are presented here, for the first time, and include airborne magnetics and radiometrics, ground gravity and magnetics, induced polarisation and petrophysical data.

DATA ACQUISITION, PROCESSING AND RESULTS

Petrophysics

Determinations of physical properties from 31 drill core samples of major rock types were made by Terra Petrophysics. The most important results indicate a correlation of low magnetic susceptibility and high chargeability with increasing gold grade. The implication is that magnetic and induced polarization/ resistivity would be most applicable to targeting at Bankan. Additional results include P-wave velocity data supports detection of the Bankan Shear Zone via seismic methods, inductive conductivity data do not support acquisition of ground or downhole EM, and that gravity and airborne electromagnetic surveys are most useful for geological mapping but not as direct targeting tools.

Ground Gravity

SAGAX collected gravity surveys during 2022 and 2023 over NEB and regional tenements. In total, 707 stations were collected along tracks and roads at 250m and 500m spacings. Data was collected using 30 second readings on a Scintrex CG5 gravimeter and a Trimble DGPS for topographic control. Standard gridding and imaging techniques were applied, as well as 3D unconstrained modelling and worm processing.

The N-S gradient, identified from the 13km spaced BRG data, resolves as a complex boundary, with intrusives, greenstone remnants and linear, fault-related contacts with a range of orientations. Two elements of geological significance are identified at Bankan. One is a high gravity response (~1-2 mgal) to the SE of the deposit. This is interpreted to be a deep mafic intrusive body. Its relevance to the gold deposit remains obscure. The second element is a strong NE-SW trending gravity gradient that cuts through the deposit. This gradient corresponds in orientation and position with the down dip plunge of the high-grade ore shoot in the core of the deposit. It is inferred that the gradient represents the response of a cross-fault structure that controls the focus of mineralisation.

Magnetics and Radiometrics

A heliborne mag-spec survey was completed by New Resolution Geophysics (NRG) in 2021. It was flown on 100m spaced east-west transverse lines at 20m sensor height for 3884 line km. Standard gridding and imaging techniques were applied, as well as 3D unconstrained modelling, worm processing and vectorisation of residuals.

On a regional scale there is a moderate dynamic range in responses (~200nT), indicative of complex geology, with a spread of structural trends and interpreted intrusive bodies, as depicted by the solid geological interpretation (Figure 1). A major N-S trending fault corridor is interpreted that passes within 2km of the NEB deposit and continues southwards along a regional NW-SE trend termed the Kaninko Shear Zone (KSZ; Figure 1). A prominent positive magnetic body (150nT) is located within the proposed NEB pit. Various processing's indicate this body has a significant remnant component. Based on drilling and magnetitic susceptibility measurements, this anomaly is interpreted as related to magnetite altered meta conglomerates in the hanging wall of the deposit. It appears unrelated to the gold deposit and its alteration halo. Evaluation of airborne magnetic data on a regional scale indicates subtle magnetic depletion zones at NEB and satellite deposits.

A ground magnetic survey over NEB was completed by SAGAX in 2022. The survey was collected using a Caesium vapour magnetometer continuously sampling along 20m and 40m spaced east-west transverse lines for 105 line km. Results confirmed the high intensity, shallow response in the southern part deposit. However, the ground survey did not image a significant magnetic depletion zone or provide improvement in definition of local geological structure at NEB. It is suggested that mitigating factors were the strong lateritic cover response and the low susceptibility contrasts within the basement.

Induced Polarisation (IP)

A program consisting of gradient array (GAIP) followed by 2D lines of pole-dipole (PDP) induced polarisation surveys was acquired by SAGAX in 2022. It was anticipated that the IP method would be potentially the most effective targeting tool, based on the relationship of high gold grades with +3-5% sulphide content in chlorite/sericite altered tonalite host rock.

Gradient Array (GAIP)

GAIP data was collected on 50m spaced east west orientated receiver lines with 50m receiver dipoles and 25m station move-up, across 16 continuous blocks for 150.7 line km, using a 10ch Elrec receiver and IRIS VIP10000 transmitter. The chargeability and resistivity data were gridded, filtered and output as a standard suite of images and contours for interpretation.

The resistivity data has a dynamic range of ~400 to 4000 ohm.m and best defines the structure of the survey area. The chargeability data has a dynamic range of 1 to 10 mV/V. The highest resistivity and chargeability values occur in the central part of the survey area coincident with and along strike of known near-surface ore zones at NEB. These responses are interpreted to be caused by disseminated sulphide and silica alteration. A strong linear resistivity response is evident on the eastern side of the deposit. The absence of a positive response over the high-grade core at depth is inferred to be due to limited depth penetration of the gradient method. Decimation testing indicates that a maximum spacing of 200x100m would be required to detect the near-surface extents of the NEB deposit.

Pole-Dipole Array (PDP IP)

Based on evaluation of the GAIP results, 2D PDP IP profiling was collected along sixteen 100m and 200m spaced east west lines for 37.05 line km. Data was collected using 50m and 100m receiver dipoles, 100m station move-up and recording to n=10 with the same equipment as the gradient survey. Modelling of the data was completed using the Zonge 2D, UBC 2D and UBC 3D algorithms.

Results indicate the pole-dipole IP method proved successful at mapping both the known extents of near-surface mineralisation and, importantly, the high-grade core of the deposit (Figure 2A). The subsurface appears electrically similar to that defined in gradient data, with the background being moderately resistive and only weakly chargeable. Comparison against geological sections from drilling suggest a good correlation between the major lithological units and the geoelectric models. Within the survey extents, the deposit displays the strongest response of modelled chargeability, appearing as a prominent 10 to 15mV/V (two to four times background) west dipping feature. The elevated chargeability is attributed to disseminated sulphide alteration. The signature of the ore body is best defined in 2D models across lines 5340N, 5220N and 5100N. However, the ore deposit response is still well imaged by the 3D models further south across lines 4980N and 4860N, for a total of ~500m strike extent. The chargeability models appear to be detecting the higher-grade core mineralization to the maximum depth of investigation ~400m (Figure 2B). The resistivity response of the ore deposit is more complex. Nonetheless, the best mineralization occurs where chargeability and resistivity isosurfaces, generated from 3D UBC modelling, overlap. The high-grade core appears to be anomalously resistive and connected to a poorly defined shallow west dipping source spatially coincident with known mineralization. The resistivity models are most effective at mapping a west dipping fault spatially coincident with the known BSZ. These new data have successfully mapped the shear zone structure along kilometres of highly prospective strike.

CONCLUSIONS

PDI completed a suite of geophysical programs aimed at characterising the signature and structural setting of the +5MOz NEB orogenic gold deposit. Petrophysical measurements on core were completed prior to the field program and helped to de-risk decisions as to which geophysical methods may be of greatest effect to aid the geological interpretation. Airborne and ground magnetic and radiometric surveys proved most useful on a regional scale by enabling solid geological interpretations and detection of magnetic depletion zones. Gravity was effective at a range of scales for defining structural and intrusive architecture, on the country-scale for locating basin edges; at the regional permit scale for delineating granitic and greenstone domains and major fault contacts, and at the deposit scale with the association of a transverse gravity gradient with the plunging high grade ore shoot in the core of NEB. The IP method proved the most effective at targeting on the deposit scale. The known depth extent of the ore deposit is well represented in 3D inversion shells of chargeability, which are depth limited due to the method used; as, in reality, the deposit remains open at depth. Future geophysical surveys recommended at the deposit scale include seismic reflection based upon the interpreted structural architecture and petrophysical data.

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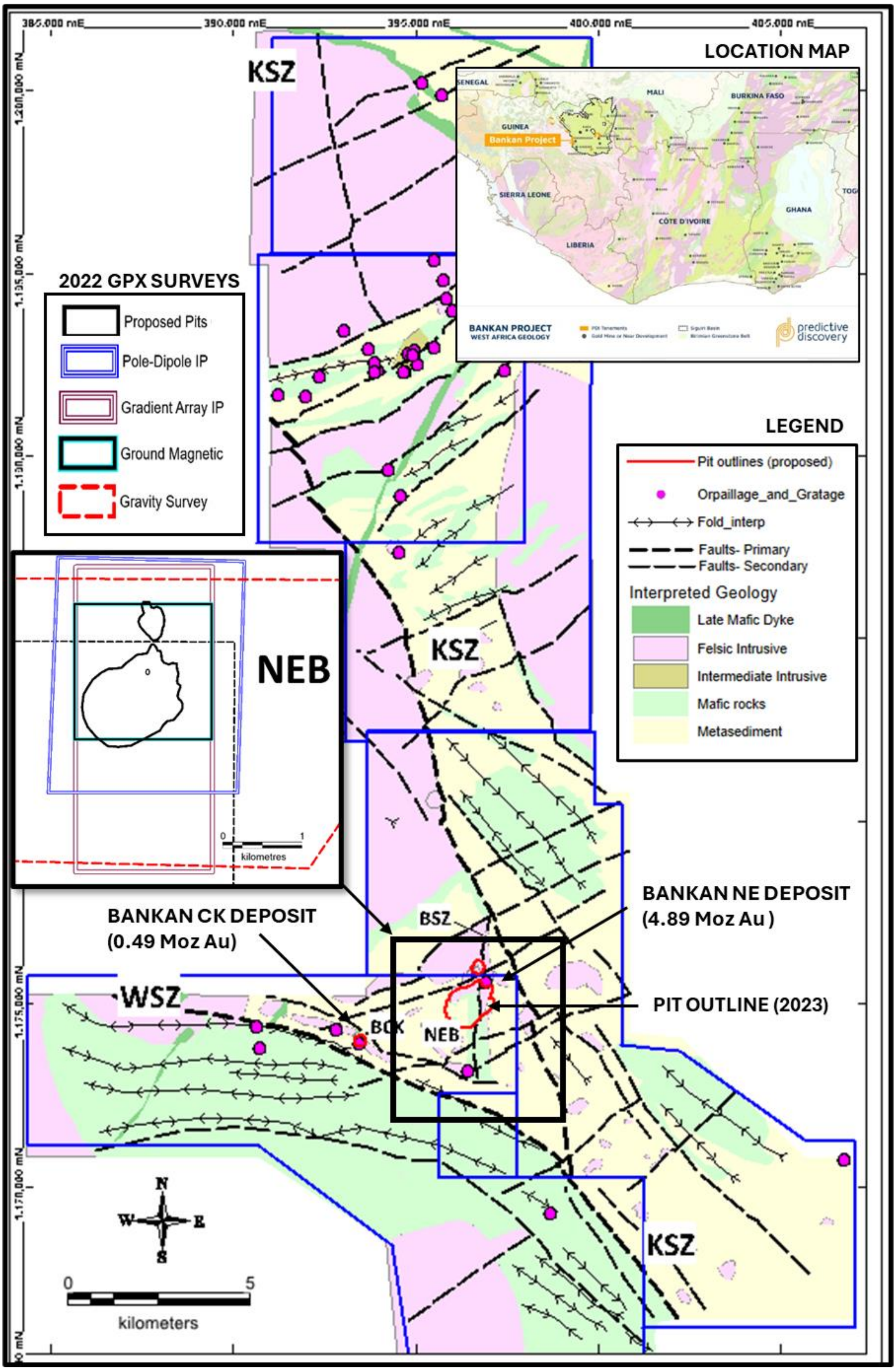

Figure 1. Solid geology interpretation of Bankan region, Location map and local geophysical surveys coverage. BSZ – Bankan Shear Zone, KSZ- Kaninko Shear Zone, WSZ – Western Shear Zone. NEB- NE Bankan, BCK – Bankan Creek.

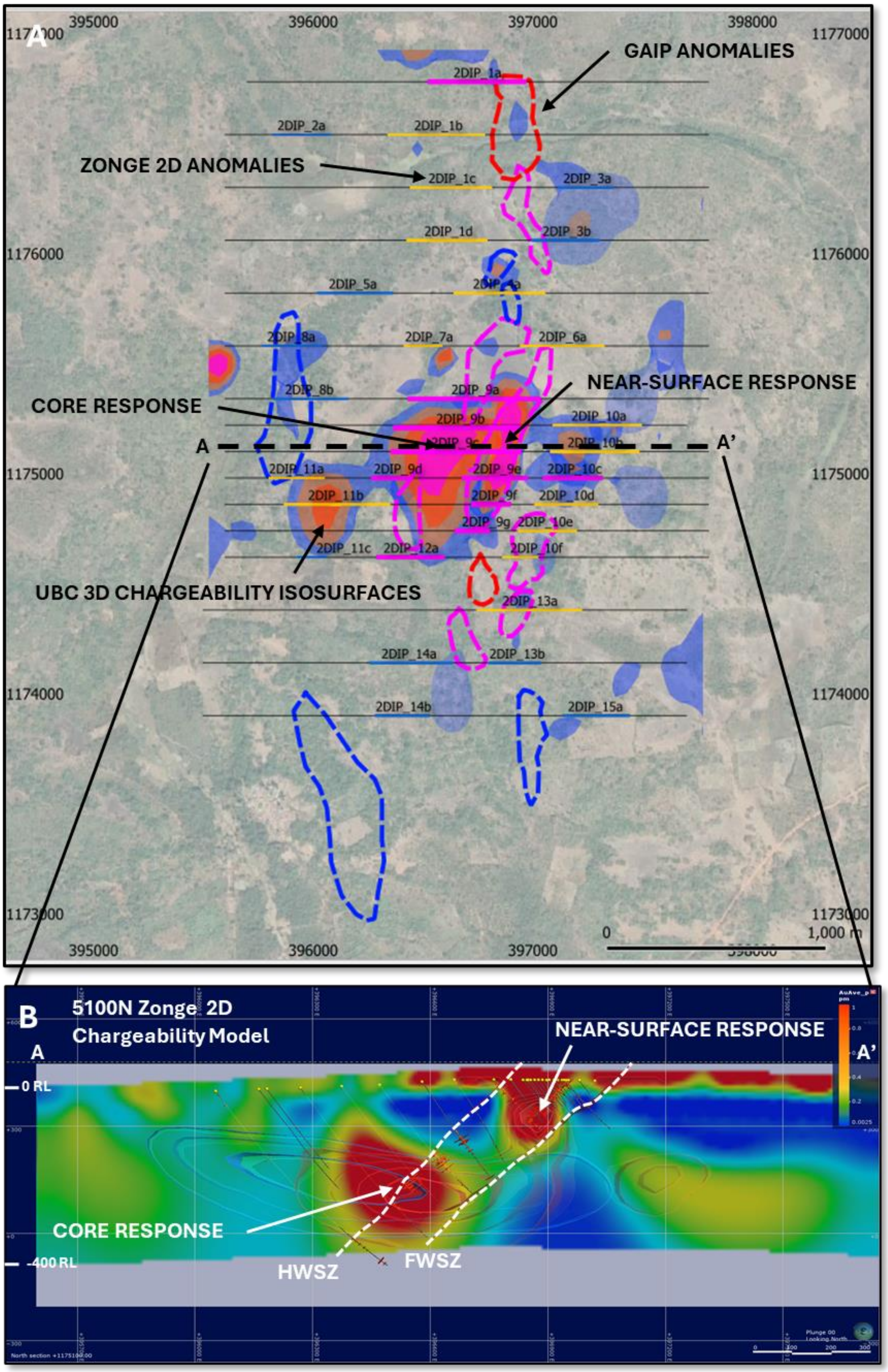

Figure 2. (A) IP results summary plan view map with GAIP, P-DP Zonge 2D and 3D UBC anomaly intrepetations (coloured by rank, warm = highest priority, cold = low priority) on aerial photography. (B) Line 5100N P-DP Zonge 2D chargeability model section view looking north and UBC 3D isosurfaces of chargeability (red) and resitivity (blue) models with drilling, gold assays and shear zone outlines (HWSZ, FWSZ).