

Comparative Analysis: BN Energy's Block RS-12V vs. Arabian-Nubian Shield Mining Giants

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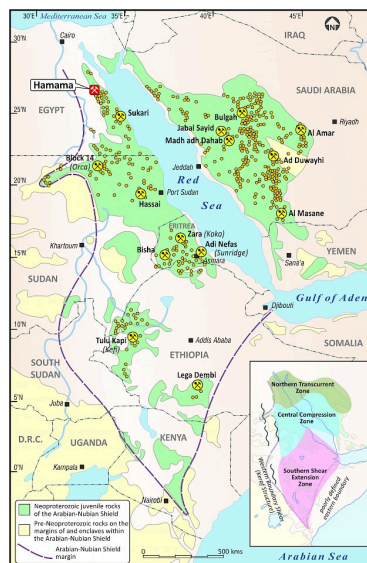
Executive Summary

The **Arabian-Nubian Shield (ANS)** represents one of the world's most significant exposures of Precambrian crystalline rocks, spanning approximately 3,500 km north-south and 1,500 km east-west across northeastern Africa and western Arabia . This geological province has garnered substantial attention for its mineral richness, particularly in gold and base metals. **BN Energy's Block RS-12V**, located in Sudan's Red Sea State, emerges as a potentially transformative asset within this region, demonstrating exceptional polymetallic potential that challenges existing geological models for the ANS. This analysis compares Block RS-12V's characteristics with established ANS mining operations, including the **Bisha Mine** (Eritrea), **Sukari Mine** (Egypt), and other significant deposits, highlighting its unique combination of high-grade copper-gold VMS mineralization, orogenic gold, and unprecedented nickel-cobalt sulfide mineralization—a previously unrecognized deposit type for the region.

1. Geological Setting and Regional Context

1.1 Arabian-Nubian Shield Fundamentals

The ANS formed through the collision of East and West Gondwana between 870–550 million years ago, creating ideal conditions for mineral enrichment through subduction-related magmatism, crustal metamorphism, and hydrothermal fluid activity . This shield is divided into crustal blocks or tectonostratigraphic terranes delineated by ophiolite shear zones or sutures, paired across the Red Sea . The region has a long history of mineral exploitation dating back to ancient Egyptian civilizations, with the earliest preserved geological map (Turin papyrus, 1150 BCE) created to show the location of gold deposits in Eastern Egypt .



A regional geological map of the Arabian-Nubian Shield, covering parts of Northeast Africa and the Arabian Peninsula

Block RS-12V is situated within the **Nakasib Suture Zone (NSZ)**, a particularly prospective mineral belt representing an ancient tectonic boundary where mineral-rich fluids have concentrated metallic elements. This zone is geologically analogous to the nearby **Hassai Gold Mine** in Sudan, which has produced over 5 million ounces of gold, providing validation of the region's mineral endowment.

1.2 Block RS-12V's Geological Composition

Preliminary data indicates Block RS-12V features diverse rock types including:

- **Ophiolitic sequences:** Ultramafic and mafic rocks that host nickel-cobalt mineralization
- **Metavolcanic-sedimentary packages:** Greenstone-type assemblages conducive to gold mineralization
- **Granitoid intrusions:** Tonalite and granite plutons that provide heat sources for hydrothermal systems
- **Structural features:** Shear zones and faults that serve as conduits for mineralizing fluids

This geological diversity creates multiple mineralization styles within a relatively compact area, enhancing the project's economic potential through natural resource diversification—a characteristic that distinguishes it from many established ANS operations.

2. Mineralization Styles and Metal Associations

2.1 Established ANS Deposit Types

The ANS is known for several characteristic deposit types :

- **Volcanogenic Massive Sulfide (VMS) deposits:** Cu–Zn–Au mineralization (e.g., Bisha in Eritrea, Jabal Sayid in Saudi Arabia)
- **Orogenic gold deposits:** Mesothermal gold mineralization in suture zones or competent rocks (e.g., Sukari in Egypt, Al Sukhaybarat in Saudi Arabia)
- **Porphyry copper-gold deposits:** Intrusion-related mineralization (e.g., Jebel Ohier in Sudan)

- **Epithermal deposits:** Often as overprints on VMS mineralization (e.g., Mahd Ad'Dhahab in Saudi Arabia)

These deposits typically contain **gold and base metals** such as copper and zinc, with gold often found in conjunction with copper (e.g., in VMS and porphyry systems) . Nickel and cobalt are **not traditionally associated with major ANS deposits**, as the shield’s known mineralization has historically focused on gold and base metals . Table 1 provides a high-level comparison of mineralization styles in Block RS-12V versus several major ANS deposits:

Table 1: Comparison of Mineralization Styles in Major ANS Deposits

Deposit Name	Country	Primary Metals	Deposit Style	Annual Production
Bisha Mine	Eritrea	Zn, Cu, Au, Ag	VMS	Significant producer
Sukari Mine	Egypt	Au	Orogenic gold	500,000+ oz gold
Hassai/Ariab	Sudan	Au, Cu	VMS & Orogenic	5M+ oz gold historical
Jabal Sayid	Saudi Arabia	Cu, Zn	VMS	Significant copper
Block RS-12V	Sudan	Cu, Au, Ni, Co	VMS + Magmatic Ni + Orogenic	Exploration stage

As shown above, Block RS-12V’s combination of **copper, gold, nickel, and cobalt** in a single project is unique in the ANS context. Established mines like Bisha and Sukari are highly successful but are largely single-commodity (base metal or gold) operations, whereas RS-12V’s polymetallic nature sets it apart.

2.2 Block RS-12V’s Unique Mineralization Signature

Block RS-12V contains three distinct, high-grade mineralization styles coexisting within the same concession :

1. **High-Grade Copper-Gold VMS Mineralization:** Surface samples exceeding **7% Cu** and **3 g/t Au** indicate rich, outcropping massive sulfide lenses . These grades far exceed typical

economic cut-off grades for copper mines (typically ~0.5–1.0% Cu) and are comparable to early surface sample grades from world-class VMS deposits like Neves-Corvo (Portugal) or Bisha itself. Such high-grade surface mineralization suggests the presence of significant primary sulfide bodies at depth.

2. **Orogenic Gold Mineralization:** Consistent gold values (2–3 g/t Au) across multiple samples associated with pathfinder elements (As) confirm a robust mesothermal gold system independent of the VMS mineralization . This provides a second, parallel exploration target and de-risks the project economically.
3. **Magmatic Nickel-Cobalt Sulfide Mineralization:** The reported **>1% Ni** (>10,000 ppm) values represent a geological revelation for the ANS, which has no known economic magmatic Ni–Cu–Co sulfide deposits . This suggests the presence of a fertile ultramafic intrusive complex at depth, a completely new exploration model for Sudan and the broader ANS region.

This **polymetallic signature (Au–Cu–Ni–Co)** positions Block RS-12V uniquely among ANS assets, with potential to host a multi-commodity mining camp rather than a single deposit type.



A close-up view of a rock face showcasing prominent gold mineralization with a geological hammer for scale

3. Grade and Tonnage Considerations

3.1 Comparative Grade Analysis

When evaluating early-stage exploration results, it's instructive to compare surface sample grades with those from established operations in similar geological settings. The chart below

illustrates the exceptional surface grades observed at Block RS-12V compared to other notable projects in the region.

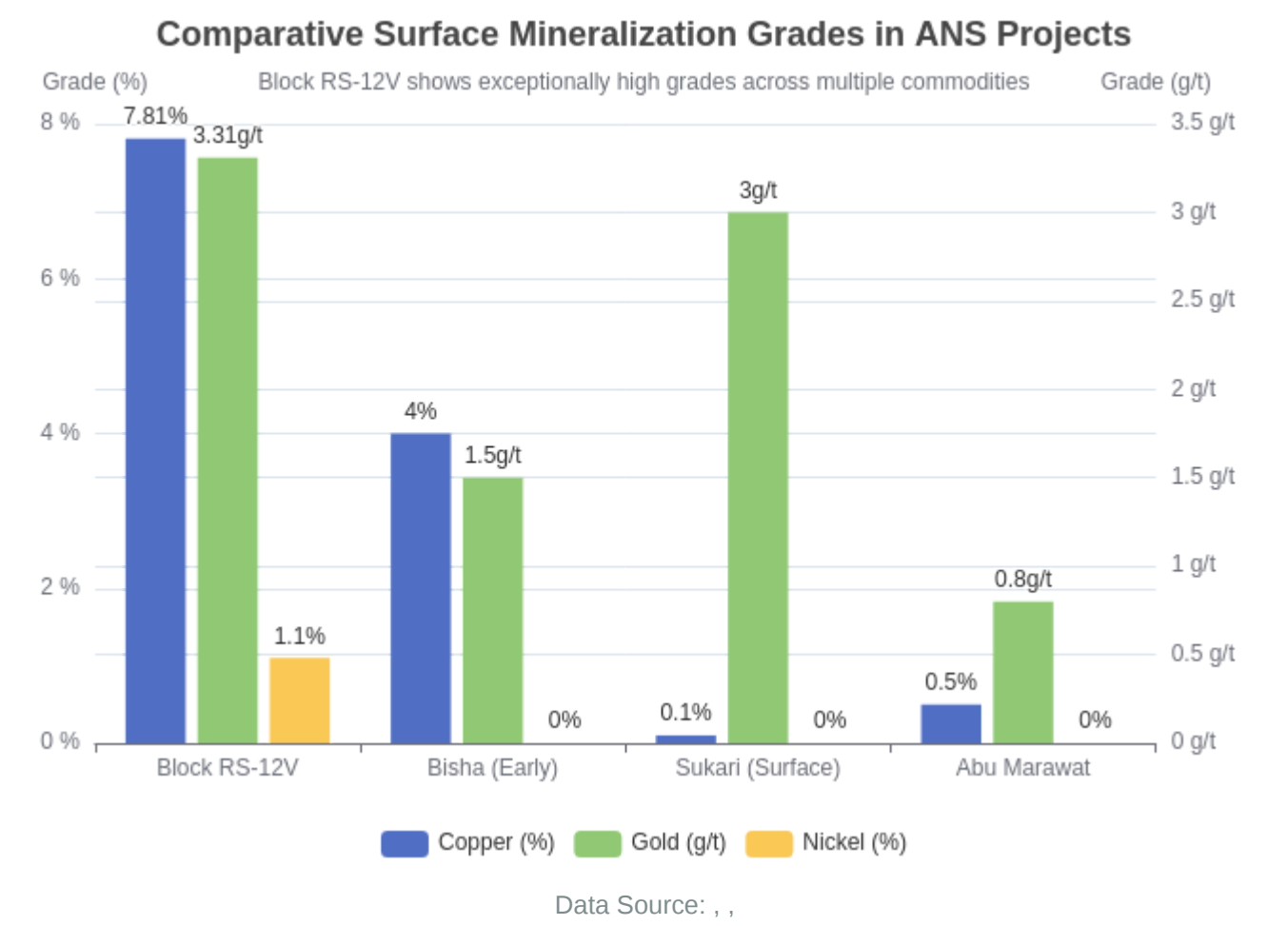


Table 2: Grade Comparison of Surface Mineralization

Deposit/Project	Copper Grade	Gold Grade	Nickel Grade	Other Metals
Bisha (Early Surface)	High (3–5% Cu)	Significant	None	Zn, Ag
Sukari (Surface)	Variable	High (1–5 g/t)	None	–
Abu Marawat (Surface)	Good (~0.5% Cu)	Good (0.8 g/t Au)	None	Zn, Ag
Block RS-12V (Surface)	Exceptional (7.81% Cu)	High (3.31 g/t Au)	Significant (>1% Ni)	Co, As

While these surface samples from Block RS-12V are notably high, it's important to recognize that surface grades may not be representative of bulk tonnage mineralization at depth. However, the consistency of high-grade samples across multiple mineralization styles is particularly encouraging.

3.2 Tonnage Potential and Depth Continuity

The critical question for Block RS-12V remains whether the high-grade surface mineralization continues at depth and possesses sufficient volume for economic exploitation. Established ANS operations demonstrate the potential for significant tonnage:

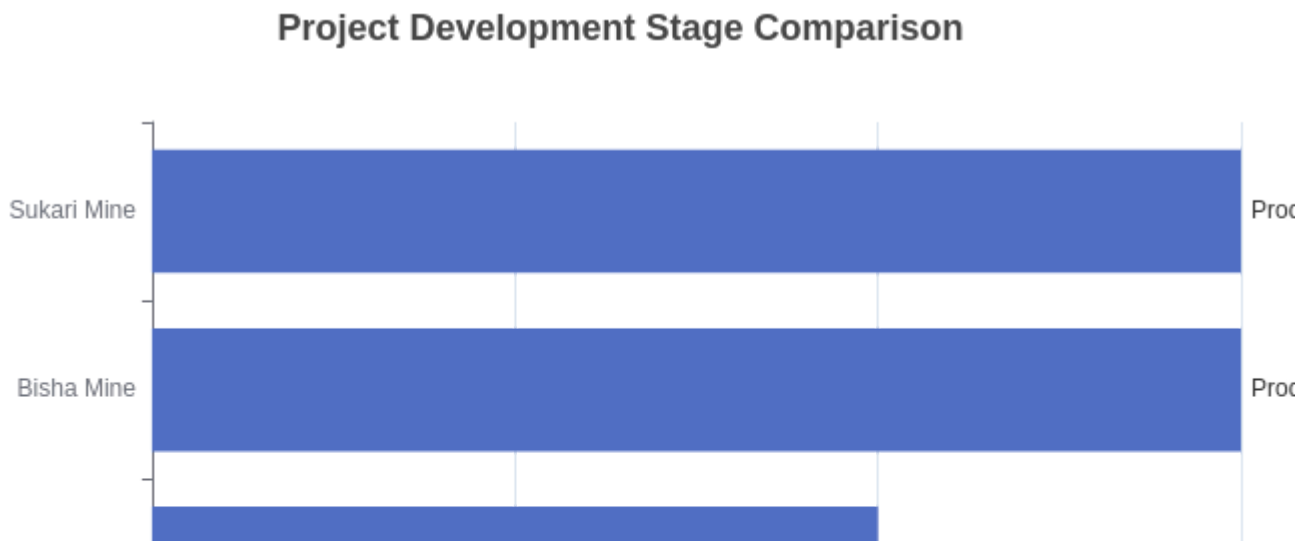
- **Bisha Mine:** Developed substantial open-pit resources with deep extension potential
- **Sukari Mine:** Combination of open-pit and underground mining with depth continuity
- **Hassai Mine:** Multiple deposits within a mining camp model

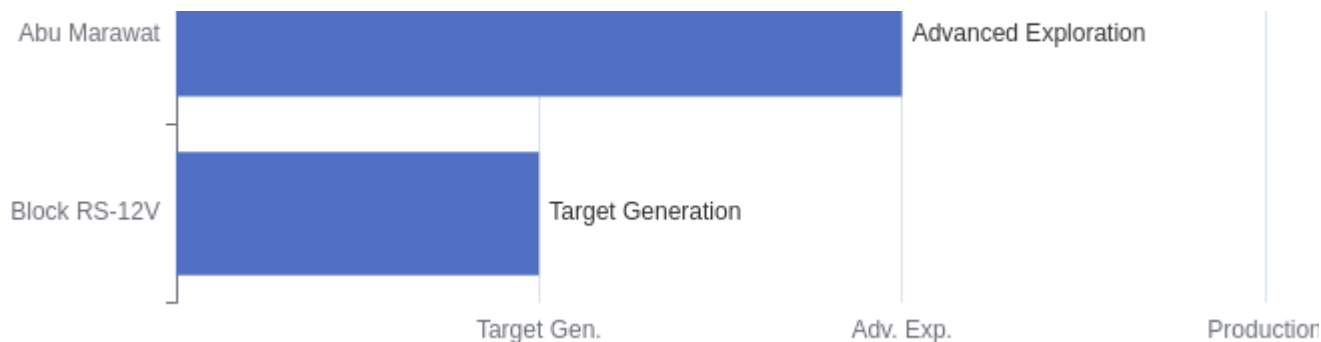
For Block RS-12V, the coexistence of multiple mineralization styles over a **5 km² battery metals zone** and **10.5 km² high-grade gold zone** suggests substantial tonnage potential . The immediate imperative involves conducting geophysical surveys (particularly EM) to define conductive massive sulfide bodies at depth and subsequent drilling to test continuity.

4. Development Stage and Infrastructure

4.1 Exploration Maturity Comparison

Block RS-12V is at an **early exploration stage**, in contrast to the advanced status of mines like Bisha and Sukari. The following chart and table summarize the relative development stages and key characteristics of these projects.





Data Source: , ,

Table 3: Development Stage Comparison

Parameter	Block RS-12V	Bisha Mine	Sukari Mine	Abu Marawat
Stage	Target Generation	Production	Production	Advanced Exploration
Drilling Completed	Limited	Extensive	Extensive	Significant
Resource Defined	No	Yes	Yes	Inferred Resource
Infrastructure	Proximity to Port Sudan (42 km)	Established mine infrastructure	Established mine infrastructure	Limited infrastructure

As shown, Block RS-12V is still in the **target generation phase**, with only limited drilling completed to date. In contrast, Bisha and Sukari are fully developed mines with years of production history and defined resources, and Abu Marawat is an advanced exploration project with an inferred resource.

4.2 Infrastructure Advantages

Block RS-12V benefits from **exceptional logistical advantages** that significantly enhance its economic viability compared to many ANS projects:

- **Proximity to Port Sudan:** Located just 42 km northwest of a major international port, dramatically reducing transport costs to approximately \$12/ton compared to the African average of \$30/ton

- **Existing road access:** Established transportation corridors reduce initial infrastructure requirements
- **Energy infrastructure:** Potential connection to regional power grids while maintaining opportunity for renewable energy integration
- **Solar energy potential:** The region receives high solar irradiation (2,200 kWh/m²/year), enabling development of solar-powered operations

These infrastructure advantages provide a significant NPV boost compared to more remote mining projects, particularly for bulk commodities where transport costs substantially impact economics.

5. Strategic Significance and Market Position

5.1 Commodity Portfolio Value

Block RS-12V’s unique combination of metals creates a natural hedging value against commodity price fluctuations. The current market prices for these key commodities highlight their strategic importance.



Data Source: , , ,

- **Copper:** Critical for electrical infrastructure and global energy transition (~\$9,000+/ton)
- **Gold:** Traditional safe-haven asset with stable demand (~\$1,800/oz)
- **Nickel:** Tier-1 critical mineral for EV batteries and stainless steel (~\$18,000/ton)
- **Cobalt:** Essential for battery stability despite efforts to reduce concentrations (~\$33,000/ton)

This diversified metal portfolio is particularly valuable given current market dynamics focused on energy transition materials and supply chain security.

5.2 Jurisdictional Considerations

The ANS spans multiple countries with varying jurisdictional risk profiles:

- **Egypt:** Established mining code with Sukari as flagship operation
- **Eritrea:** State participation requirements but functioning mining sector
- **Saudi Arabia:** Rapidly developing mining sector with government support
- **Sudan:** Significant mineral potential offset by political and investment risk

While Sudan presents inherent political risks, Block RS-12V's location in the Red Sea State offers relative proximity to international infrastructure and potential for isolation from areas of conflict. These risks must be managed through strong community engagement, government relations, and appropriate financial structuring, including potential political risk insurance.

6. Implications and Future Potential

6.1 Geological Implications

The potential discovery of a significant nickel-cobalt system within the ANS would represent a landmark geological event with far-reaching implications:

- **New Exploration Model:** Would require re-evaluation of ultramafic rocks throughout the ANS for similar mineralization
- **Tectonic Understanding:** Could provide insights into mantle processes during ANS formation
- **Regional Prospectivity:** Would open new exploration frontiers in under-explored parts of the shield

This potential geological significance extends beyond mere economic considerations to advancing scientific understanding of ANS formation and evolution.

6.2 Development Timeline and Next Steps

The development path for Block RS-12V requires systematic exploration:

1. Immediate (Next 3–6 months):

- Detailed geological mapping and geochemical sampling
- Ground electromagnetic surveys (critical for defining conductive massive sulfides)
- IP survey to characterize chargeability anomalies

2. Short-Term (Next 6–12 months):

- Mechanized trenching to expose continuous mineralization
- Diamond drill target definition
- Metallurgical scoping studies

3. Medium-Term (Next 12–18 months):

- Maiden diamond drill program (2,000–3,000 meters)
- Initial resource estimation upon success
- Further geological modeling

This accelerated exploration pathway could potentially lead to resource definition within 2–3 years, contingent on results and funding.

Conclusion

BN Energy's Block RS-12V represents a potentially transformative discovery within the Arabian-Nubian Shield, combining world-class geology with strategic positioning and unique mineralization characteristics. While still in early exploration stage, its exceptional surface grades and unique combination of three mineralization styles (VMS copper-gold, orogenic gold, and magmatic nickel-cobalt) position it as a potential tier-one polymetallic asset that could rival established ANS giants.

The project's key advantages include:

- **Unprecedented metal combination for the ANS (Cu–Au–Ni–Co)**
- **Exceptional surface grades comparable to world-class deposits**

- **Strategic infrastructure position near Port Sudan**
- **Solar energy potential for low-carbon operations**
- **Natural commodity hedging through diversified metal portfolio**

The forthcoming exploration program, particularly geophysical surveys and initial drilling, will be critical in determining whether the high-grade surface mineralization continues at depth with sufficient volume for economic development. If successful, Block RS-12V could not only become a significant mining operation but also redefine geological understanding of mineral potential in the Arabian-Nubian Shield.

Disclaimer: This assessment is based on preliminary exploration results and comparative geological analysis. Further exploration is required to determine the economic potential of Block RS-12V. All investment decisions should be based on comprehensive technical due diligence.

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