

PENENTUAN ZONASI BIJIH BERDASARKAN STUDI GEOKIMIA DAN
MINERAGRAFI PADA ENDAPAN EPITERMAL SULFIDASI TINGGI
DAERAH DISTRIK BAKAN, KABUPATEN BOLAANG MONGONDOW,
SULAWESI UTARA

SARI

Endapan epitermal sulfidasi tinggi merupakan salah satu tipe endapan hidrotermal penting yang berpotensi mengandung logam berharga seperti emas (Au), tembaga (Cu), timbal (Pb), dan seng (Zn). Studi geokimia dan mineragrafi diperlukan untuk memahami karakteristik mineralisasi serta menentukan zonasi logam sebagai dasar penentuan prospek eksplorasi. Penelitian ini dilakukan di Distrik Bakan, Kabupaten Bolaang Mongondow, Sulawesi Utara yang terdiri atas tiga prospek meliputi prospek X-Y-Z, dengan tujuan menentukan zonasi bijih berdasarkan analisis geokimia dan mineragrafi. Metode yang digunakan meliputi analisis petrografi untuk mengidentifikasi jenis batuan, Analisis geokimia dilakukan dengan metode AAS–Fire Assay terhadap unsur Au, Ag, Cu, Pb, dan Zn, sedangkan analisis *ore microscopy* digunakan untuk mengidentifikasi mineral bijih dan hubungan paragenetiknya dan analisis ASD (Analytical Spectral Devices) untuk menentukan jenis alterasi. Hasil penelitian menunjukkan terdapat tiga satuan litologi berupa breksi diatrem, tuff dan lava andesit, dimana telah mengalami ubahan yang membentuk zona alterasi meliputi Zona *Chlorite-Epidote* (Propilitik), Zona *Smectite-Illite* (Argilik), Zona *Alunite-Quartz±Dickite ±Kaolinite* (*Advance Argillic*), dan Zona Sillisifikasi (*Massive*). Pada daerah penelitian terjadi proses mineralisasi yang cukup tinggi, berdasarkan hasil observasi lapangan dan *ore microscopy* ditemukan beberapa mineral bijih yang berkembang pada area penelitian diantaranya Pirit (FeS₂), Kalkopirit (CuFeS₂), Kovelit (CuS), Kalkosit (Cu₂S), Bornit (Cu₅FeS₄), Galena (PbS), dan Spalerit (ZnS₂). Kemudian pada pengamatan lapangan juga ditemukan adanya mineral-mineral oksidasi-sulfat yang didominasi oleh Hematit, *Goethite* dan *Jarosite*. Berdasarkan hasil analisis AAS–Fire Assay tiap area prospek didapatkan unsur Au tertinggi pada prospek X dengan nilai kadar 1,4 ppm, prospek Y 1,37 ppm dan Z berada pada nilai 0,34 ppm. Unsur Cu pada prospek X mempunyai nilai tertinggi sebesar 434 ppm, prospek Y 93 ppm dan prospek Z 45 ppm. Sedangkan nilai kadar unsur Ag tertinggi berada pada prospek Y dengan nilai kadar 33 ppm. Serta unsur Pb-Zn dengan nilai kadar tertinggi pada prospek X dengan nilai kadar Pb 1120 ppm dan Zn 2650 ppm, dibandingkan prospek Y dan Z.

Kata kunci: zonasi bijih, geokimia, mineragrafi, epitermal sulfidasi tinggi, Distrik Bakan

ORE ZONATION DETERMINATION BASED ON GEOCHEMICAL AND
MINERAGRAPHIC STUDIES ON HIGH SULFIDATION EPITHERMAL
DEPOSITS IN BAKAN DISTRICT, BOLAANG MONGONDOW REGENCY,
NORTH SULAWESI

ABSTRACT

High-sulfidation epithermal deposits represent one of the important types of hydrothermal deposits with significant potential to host valuable metals such as gold (Au), copper (Cu), lead (Pb), and zinc (Zn). Geochemical and mineragraphic studies are essential to understand the characteristics of mineralization and to define metal zonation as a basis for determining exploration prospects. This study was conducted in the Bakan District, Bolaang Mongondow Regency, North Sulawesi, which comprises three prospects, namely Prospects X, Y, and Z, with the objective of determining ore zonation based on geochemical and mineragraphic analyses. The methods applied include petrographic analysis to identify rock types, geochemical analysis using the AAS–Fire Assay method for Au, Ag, Cu, Pb, and Zn, ore microscopy to identify ore minerals and their paragenetic relationships, and ASD (Analytical Spectral Devices) analysis to determine alteration types. The results indicate that the study area consists of three lithological units, namely diatreme breccia, tuff, and andesitic lava, which have undergone hydrothermal alteration forming several alteration zones, including the Chlorite–Epidote Zone (Propylitic), Smectite–Illite Zone (Argillic), Alunite–Quartz ± Dickite ± Kaolinite Zone (Advanced Argillic), and Silicification Zone (Massive). Intense mineralization occurs in the study area, as evidenced by field observations and ore microscopy analyses, which identified several ore minerals such as pyrite (FeS_2), chalcopyrite (CuFeS_2), covellite (CuS), chalcocite (Cu_2S), bornite (Cu_5FeS_4), galena (PbS), and sphalerite (ZnS). In addition, oxidation–sulfate minerals dominated by hematite, goethite, and jarosite were also observed in the field. Based on the AAS–Fire Assay results, the highest Au content was recorded in Prospect X at 1.4 ppm, followed by Prospect Y at 1.37 ppm, while Prospect Z shows a lower Au value of 0.34 ppm. Copper concentrations are highest in Prospect X at 434 ppm, followed by Prospect Y at 93 ppm and Prospect Z at 45 ppm. The highest Ag concentration occurs in Prospect Y with a value of 33 ppm. Furthermore, Pb and Zn show their highest concentrations in Prospect X, with Pb reaching 1,120 ppm and Zn 2,650 ppm, compared to Prospects Y and Z.

Keywords: ore zonation, geochemistry, mineragraphy, high-sulfidation epithermal, Bakan District