

BRAZIL

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The Moruru region, situated in the SW Amazon craton, Mato Grosso, Brazil) is composed of two domains: 1) undeformed bimodal volcanic rocks 2) deformed granitic-gneiss-migmatite rocks that also include a small occurrence of slightly deformed rhyolite. The undeformed domain is composed of felsic to mafic flows and volcanoclastic sediments; the felsic flows are essentially explosive deposits classified as ignimbrites, however coherent flows occurs interlayered. The composition of felsic flows are rhyodacite and dacite. Mafic flows are tholeiitic basalts and have within-plate petrologic and geochemistry characteristics. Felsic rocks are calc-alkaline in composition. Ages for granites and felsic flows range from 1.76 to 1.80 Ga and TDM model ages range from 2.02 to 2.16 Ga. During the study of 12 drill core in the area we identify two of them mineralized for gold. Gold occurs associated with Pyrite (90%) Chalcopyrite (9%) and Galena plus ilmenite (1%). The sulfide portion occurs disseminated in a coarse grained granite which shows completely replacement by hydrothermal alteration. The dominant process of hydrothermal alteration is the sericitization which occurs the pervasive form in the volcanic felsic rocks and granite body. The mineralized granite appears as a shallow intrusion coeval with the rhyodacite and dacite. Plagioclase change to carbonate due the alteration and albite neorformed converts to white mica with the progress of the alteration. Silicification occurs as second important type of alteration in the felsic rocks. This kind of alteration occurs as veins cutting the rocks or around sulfides. Carbonatation occurs as two ways: 1) as alteration of pyroxenes and plagioclase 2) filling veins and fractures in different directions. Basalts shows propylitization with epidote, chlorite, albite, carbonate and magnetite as important mineral association. These observations in the Moruru area take us to the conclusions that the gold can occur in two distinctive phases. 1- as sulfide dissemination (grading to massive sulfide) and 2- as remobilization of the first stages filling veins and fractures in later stage. A simple model for the evolution of the area and the mineralization was modified from Williams and Mc Birney, 1979 and includes a composite volcano which contains mafic intrusive sills and a sub-volcanic mineralized body in the central part of the volcano.

8-94 Poster Larizzatti, Joao Henrique

BEHAVIOR OF GOLD AND PATHFINDER ELEMENTS IN A BRAZILIAN LATERITIC PROFILE

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Keywords: Gold; Geochemistry; Laterite; Amazon; Exploration

Gold and indicator elements behaviour was studied in lateritic profiles located in equatorial environment at Garimpo Fazenda Pison (Amazonas State - Brazil). The objective was to interpret the evolution of the geochemical signature of the available sampling media in order to enhance geochemical exploration surveys in the West Amazonian environment. Two profile types were recognised (from bottom to top): (1) complete profile - fresh rock, saprolite, transition zone, iron duricrust, red latosol and yellow latosol; and (2) incomplete profile - fresh rock, saprolite, red latosol and yellow latosol. Above saprolite, a total obliteration of primary fabric takes place promoting gold dispersion. The in situ development of an haematitic duricrust took place during a seasonally contrasted tropical climate, which have been dismantled under the rainforest equatorial climate, giving rise to a goethitic latosol. The primary mineralisation is composed of a quartz-vein zone with a small stockwork zone cutting a granophyre emplaced in a sequence of acid volcanic rocks. Hydrothermal minerals, such as fluorite, sericite, epidote, chalcopyrite and pyrite were observed. Primary ore signature is Au-Ag-Bi-As-Sb-W-Cu-(Pb-Zn). Gold was observed filling spaces in quartz veins and wallrocks and as inclusion in pyrite. Primary ore is partly preserved in the saprolite where a leaching process can be observed (sulphide oxidation, kaolinisation of feldspars and mica). The leaching process progressively intensifies upward to duricrust and latosol, where most primary minerals are absent. The dissolution of primary ore minerals results from the interaction of these minerals with surface solutions and mobilisation of metals and change in geochemical signature takes place. Corrosion features in gold particles (pits and rounded edges) indicate gold remobilisation from saprolite upward. The weathering process controls the migration of gold and a dispersion halo is observed. Physical and chemical processes are responsible for the formation of the mushroom-type gold dispersion halo observed. Yellow latosol is the best sampling medium for soil geochemical surveys as it is the topsoil and presents the widest gold dispersion halo. Gold is the best indicator for gold deposits as it is the only element which keep its position in relation to mineralisation. Duricrust fragments can be an interesting sampling medium as they retain indicator elements related to mineralisation.

8-95 Poster Gu, Lianxing

MECHANISM OF EXTREME ENRICHMENT OF COPPER, GOLD AND SILVER IN DUCTILE SHEAR ZONES INSIDE THE MASSIVE SULPHIDE OREBODIES AT HONGTOUSHAN, NE CHINA

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Keywords: ductile shear zone; mylonite; massive sulphide; remobilization; copper and gold deposit

The Hongtoushan Cu-Zn massive sulphide deposit of Liaoning Province occurs in an Archaean greenstone belt of the Northern China craton. Ores have been strongly deformed and metamorphosed to upper amphibolite facies. Sulphides are dominated by pyrite, pyrrhotite, sphalerite and chalcopyrite. Average grades are 1.70-1.80 wt% Cu, 2.30-2.50 wt% Zn, 0.5 ppm Au and 36 ppm Ag. There are at least more than 30 oreshoots inside the major massive sulphide orebodies. These oreshoots range from 10 m to 30 m in length, 0.5 m to 1.5 m in width and 5 to 40 m in depth extension. They commonly show sharp boundaries with the felsic metamorphites but are gradational towards the nearby massive sulphide ores. Alterations are characterized by greenschist-facies minerals, such as epidote, chlorite, albite and carbonate. Six samples from the oreshoots average 11.7 wt% Cu, 3.5 wt% Zn, 4.0 ppm Au, 263 ppm Ag, showing extreme enrichment of Cu, Au and Ag relative to the massive sulphide ores. Textures of the oreshoots indicate that they are ductile shear zones formed on the background of massive sulphide ores. Quartz ribbons and flamebovants are commonly seen, and have been dynamically recrystallized or statically annealed. Pyrite is characterized by cataclastic deformation and porphyroclastic textures. Reduced grain size in the matrix is usually less than 0.1 mm, which is in sharp contrast to the grains larger than 1 mm in the massive sulphide ores. Pyrrhotite, chalcopyrite and sphalerite behave more plastically. Intense stretching of the grains has resulted in foliations of the ore mylonite. Post-shearing annealing is featured by foam textures of strain-free

fine grains of these minerals and straight polysynthetic twins of sphalerite. Annealed pyrrhotite is almost purely hexagonal in structure and is deficient in lamellar intergrowths with the monoclinic variety. Restricted distribution and minute grain size indicate that these ductile shear zones were formed during retrograde metamorphism. The dominance of pyrite, a brittle and competent mineral, over relatively plastic minerals suggests that solid-state remobilization is not an essential mechanism for the formation of the oreshoots. Abundant alteration minerals imply that hydrothermal overprinting during greenschist-facies retrograde metamorphism should be responsible for the extreme enrichment of Cu, Au and Ag in these shear zones.

8-96 Poster Sunder Raju, Perumala Venkata

SHEAR RELATED EPIGENETIC GOLD MINERALIZATION IN BIFs OF CHIKKASIDDAVANAHALLI, CHITRADURGA GREENSTONE BELT, DHARWAR CRATON, INDIA

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Keywords: epigenetic; shear; gold mineralization

Gold mineralization occurs at Chikkasiddavanahalli (C.S.Halli) in the Archaean volcano-sedimentary sequences of the Ingaldahl formation, Chitradurga greenstone belt in South India. The C.S.Halli hill range is ~1.2 km long and ~250m wide with N-S strike and vertical to steep easterly dips, consisting of mixed sulphide-oxide facies banded iron formations and ferruginous phyllites with massive metavolcanics. The banded iron formations (BIFs) ranging in width from 2-25m and 20-40km in strike length, occur as parallel to sub-parallel linear bands. These BIFs are highly deformed, sheared and metamorphosed to upper greenschist facies. The shears in BIFs occupied by syn-tectonic quartz-carbonate veins of various dimensions are favourable loci for gold-sulphide mineralization. Petrological studies show mineral assemblages of pyrite, arsenopyrite, subordinate grunerite, hornblende, chlorite, muscovite, ankerite, calcite, magnesian siderite and quartz. These BIFs show alteration zones such as pyritization, chloritization and sericitization. The gold mineralization occur mainly in sulphide lenses and as bands up to 1cm long with refractory and average grains gold (fineness) of 0.5 µm size in sulphides. These grains were analysed by EPMA which showed a concentration of 99.95% gold. SEM studies on the auriferous sulphidic BIFs from this area indicate the presence of gold inclusions in host sulfides. In the C.S.Halli area the BIFs and interbedded shales have yielded gold values ranging from 0.1 to >3.5 gpt. The average value of gold in the BIF with pyrite, adjacent to the quartz veins is <1.5gpt, while the quartz veins itself has 0.9-0.4gpt. On the basis of field, EPMA, geochemical and fluid inclusion studies in C.S.Halli area, it is suggested that gold associated with this greenstone belt has been brought up from the mantle along with silica and iron at Archaean Mid Oceanic Ridges (AMOR) by mantle derived silica rich hydrothermal solutions. This primary gold is deposited and enriched in fractures and transcraton shear zones of the crustal rocks during regional deformation and metamorphism. Active convergent margin settings related to accretionary processes and fluid activity are suggest to have led to epigenetic gold mineralization in BIFs at C.S.Halli area.

8-97 Poster Denduluri, Venkata Subba Rao

HYDROTHERMAL GOLD DEPOSITS FROM LATE-ARCHAean HUTTI-MUSKI SCHIST BELT, EASTERN DHARWAR CRATON, INDIA: IMPLICATIONS FOR GENETIC TYPES AND PRODUCTIVITY OF ORE-FORMING SYSTEMS

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Keywords: Archaean; Hydrothermal; Gold Deposits; Epigenetic; Hutti Schist Belt

The late-Archaean Hutti-Maski greenstone belt (HSB) in the eastern Dharwar craton hosts several hydrothermal gold prospects including the world class large scale (>100t) gold deposit at Hutti Gold Mines. The geological, ore petrological, and geochemical characteristics of the gold-sulphide bearing host rocks of the Hutti Mine (zone-I reef) and the satellite gold-sulphide deposits at Uti and Hirabuddini are investigated. Gold-quartz-sulphide lodes at Hutti are localized in a bimodal tholeiitic metabasalt-rhyodacite sequence, gold-sulphide ores at Uti are confined to amphibolites, and Hirabuddini Au ores are distributed in metabasalts-metarhyolites. These three economically significant types of epigenetic hydrothermal origin are localized along shear zones and are controlled by host rock chemistry as evidenced by intimate association of gold-quartz lodes mainly with sheared metabasalts. Ore minerals in these three types are represented by native gold, Py, Ar, Py, Pyrr, Cp, Scheelite, Mt and Il. These Au and Au-As(W) deposits are classified as volcanic-associated vein and shear zone deposits. REE patterns of the gold-sulphide bearing host rocks represent the REE patterns of the mineralizing hydrothermal fluids. REE patterns of the Hutti Zone I reef sulphide rich ores showing complementary patterns exhibit extremely low total REE (34ppm) as sulphides are not good hosts for REE. REE patterns of the Uti lodes show high total REE (~146ppm), LREE enrichment, negative Eu anomalies (Eu/Eu* = 0.73), flat HREE with low LREE/HREE ratios (2.2to3.3) and La/Yb ratios (2to2.8). Presence of negative Eu anomalies suggests interaction of secondary crustal hydrothermal solutions related to granitic diapirism within the host amphibolites. The Hirabuddini Au ores with similar REE patterns but with no Eu anomalies exhibit total REE lower than the Uti ores (67.2to78.6). LREE/HREE and La/Yb ratios in all three types of gold-sulphide ores suggest that the host rocks were affected by metamorphic, metasomatic and hydrothermal fluid activity. Data indicate that small scale gold deposits such as at Uti and Hirabuddini (>10t) and the large scale Hutti gold deposit in particular, have resulted from complex geodynamic interactions of mantle and crustal processes, which have elevated the productivity of primary ore forming systems.

8-98 Poster Vilor, Nicolay

THE ORE-GEOCHEMICAL ZONING OF THE EDGE SEAM OFF SIBERIAN PLATFORM

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Keywords: siberian; craton; geochemistry; ore; formation

The field where the Siberian craton southern end joins the Central Asia folding belt is a complex combination of non-homogeneous terrains contributing to the formation of continental crust and a powerful granite-metamorphic layer (GML). In the run of several phases, which have formed the current crust contour of the Siberian craton, granitoid magmatism, regional metamorphism, fluid and solution migration were most important. Ore-geochemical row consisting of Cu, Fe, Pb+Zn, Au(As,Sb,W), Sn+W is the feature of metallogeneous zoning. It came into being inside a passive transformed Rifean craton edge and its formation is connected with periods of rejuvenations, which occurred in the depth portions of GML inside the edge seam. P-T conditions of ore formation in ore deposits of the given row of elements corresponds to a generalized regressive