Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SRD043-01 Room:201A Time:May 22 09:00-09:15

Geochemical and mineralogical characteristics of ion-adsorption type REE mineralization: A case of Phuket, Thailand

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Ion-adsorption type rare earths (REE) deposits are composed of weathered granite formed in warm and moist climate, providing both light REE (LREE) and heavy REE (HREE) resources. As REE are chemically adsorbed onto weathering products such as clays, they can be extracted by ion exchange reaction with electrolyte solutions. The REE deposits have been mined only in southern China and similar mineralization is locally identified outside China. In order to elucidate the genesis of ion-adsorption type deposits, particularly the transportation and adsorption of REE in the process of weathering, we studied geochemical behavior of REE and occurrences of REE-bearing minerals in weathered crust on the Kata Beach Granite in Phuket Island, Thailand.

The Kata Beach Granite is ilmenite-series biotite granite with transitional characteristics from I-type to S-type (ASI = 1.01), and is abundant in REE (595 ppm). REE are contained in fluorocarbonate and subordinate allanite and titanite with lesser amounts of apatite and zircon. Chondrite-normalized REE pattern of the parent granite indicates the enrichment of LREE relative to HREE and without Ce anomaly. The upper part of the weathering profile from the surface to 4.5 m deep are mostly characterized by positive Ce anomaly, showing lower REE contents ranging from 174 to 548 ppm and lower percentages of adsorbed REE (adsorbed REE / whole-rock REE x 100) from 34 to 68 %. In contrast, the lower part of the profile from 4.5 to 12 m deep are characterized by negative Ce anomaly, showing higher REE contents ranging from 578 to 1084 ppm and higher percentages from 53 to 85 %. These REE contents, percentages of adsorbed REE and thickness of weathered crust are comparable to those of ion-adsorption type REE deposits in China. The upper part of the weathering profile is a leached zone in which Ce^{4+} is immobilized as CeO_2 in an oxidizing condition and REE with the depletion of Ce are dissolved in acidic soil water. The lower part of the profile is an accumulation zone in which REE with the depletion of Ce transported from the upper part of the profile are adsorbed onto weathering products or are distributed into the structure of secondary minerals such as rhabdophane. The immobilization of REE results from the increase of pH due to the contact with higher-pH groundwater. In ion-adsorption type ores (weathered granite with $>$50 % adsorbed REE) the majority of REE is present in the ion-adsorption phase with negative Ce anomaly, not in mineral structures, leading to the negative Ce anomaly of whole-rock geochemical data. Thus, the percentages of adsorbed REE are positively correlated with whole-rock negative Ce anomaly. Fractionation between LREE and HREE is not simply explained because it is controlled by occurrences of REE-bearing minerals and adsorption affinity. However, La/Yb ratios indicate that LREE tend to be more adsorbed onto weathering products than HREE.

The result of this study suggests that the occurrence of easily-soluble REE fluorocarbonate is important for formation of ion-adsorption type REE deposits. Whole-rock negative Ce anomaly of weathered granite suggests the ion-adsorption type mineralization and is a useful geochemical indicator for exploration of the deposits. As LREE tend to be more adsorbed than HREE in the process of weathering, identification of HREE-rich parent rocks is required to explore HREE-rich ion-adsorption type deposits.

Keywords: REE, granite, weathering, adsorption, mineralization, Phuket

SRD043-02 Room:201A Time:May 22 09:15-09:30

Origin of lithium in Uyuni salt flat, Bolivia: constraints from Li isotope ratio

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Lithium (Li) is one of important natural resources. The South American salt lakes contain abundant Li. The Li enrichments of the South American salt lakes are attributed to the effective drying of the influent Li-enriched river water (Rettig et al., 1980; Aloso and Risacher, 1996). The Li contents in the Grande river that flows into the Uyuni salt flat range from 3.1 to 26ppmLi (Rettig et al., 1980). Because the average Li content in river water is 1.5 ppb (Huh et al., 1998), the high Li content in the Grande river cannot be explained as the simple rock-fluid interaction at low temperature. Accordingly, the high Li content in the Grande river should due to the Li-enriched volcanic fluid and/or Arima-type deep fluid. To constraint on the origin of Li in the Uyuni salt flat, the author analyzed Li isotopic compositions of salt and brine from the Uyuni salt flat. The author will discuss the origin of Li in the Uyuni salt flat based on the Li isotopic data on Uyuni salt flat, volcanic fluid, non-volcanic Arima-type deep fluid, mud volcano fluid.

Reference:
Rettig et al., 1980, Chem. Geol. 30, 57-79.
Alonso and Risacher, 1996, Revista Geol. Chile 23, 113-122.
Huh et al., 1998, GCA 62, 2039-2051.

Keywords: lithium isotope, geofluid, Uyuni salt flat, volcanic fluid, Arima-type deep fluid, mud volcano

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SRD043-03 Room:201A Time:May 22 09:30-09:45

Relationship between granitic magmatism and formation of hydrothermal ore deposits: An example from Naegi granitic body

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Late Cretaceous to Paleogene granitoids located in the Inner zone of Southwest Japan are classified into three belts: the Sanin-Shirakawa belt, the Sanyo-Naegi belt and the Ryoke belt (Ishihara, 1971). W-Sn-Cu mineralizations are characteristically associated with the granitoids of the Sanyo-Naegi belt. Although numerous geochemical studies have been made for the hydrothermal ore deposits accompanied with these granitoids, the entire process from the granitic magma crystallization to the formation of hydrothermal ore deposits is still in debates.

The Naegi granitic body in the eastern part of the Sanyo-Naegi belt and related ore mineralizations have been investigated in this study to clarify detailed chemical characteristics of ore forming fluids for a future discussion of the process.

The Naegi granite intrudes into the felsic ignimbrites called the Nohi rhyorite. A high Rb/Sr ratio and an REE pattern with a distinct negative Eu anomaly were reported from the granite (Ishihara et al., 2001), implying its origin as a highly fractionated magma. The granitic body is associated with numerous hydrothermal ore deposits, from center of the body to the surroundings: (1) U-Th-REE-bearing pegmatites, (2) W-Sn-Bi-Be deposits, (3) W-As-Bi deposits, and (4) Cu-Pb-Zn-As deposits. Compositions and the physicochemical conditions of ore fluids have been estimated from detailed petrographic studies, EPMA analyses of minerals and LA-ICP-MS microanalyses of fluid inclusions for 14 elements (Na, K, Mn, Fe, Cu, Zn, Rb, Mo, Sn, Sb, Cs, W, Pb and Bi). Temporal relations of fluid inclusions trapped in quartz and topaz crystals were investigated by microscopic observations. Characteristics of the deposits are as follows:

(1) U-Th-REE-bearing granitic pegmatites are consisted of quartz, feldspar, biotite, muscovite and trace amounts of REE minerals. Fluid inclusions show homogenization temperatures of 200-470C with salinities ranging 1-7wt%. Base metal (Cu, Pb, Zn) concentrations in fluid inclusions are 2-3 times higher than those of W, Sn and Bi concentration, while Sb concentrations are relatively stable.

(2) W-Sn-Bi-Be deposits are of wolframite-cassiterite-native bismuth-topaz-beryl-quartz veins in the granite and the ignimbrites. Fluid inclusions show homogenization temperatures of 250-430C with salinities ranging 1-33wt%. Base metal concentrations are higher than those of W, Sn and Bi.

(3)W-As-Bi deposits are of wolframite-loellingite-arsenopyrite-native bismuth-quartz veins in the ignimbrites with silicification. Fluid inclusions show homogenization temperatures of 185-360C with salinities ranging 1-7wt%. Base metal concentrations are higher than those of W, Sn and Bi.

(4)Cu-Pb-Zn-As deposits are of sulfide (Cu-Fe-As-Zn-S) -chlorite-quartz veins in the ignimbrites. Fluid inclusions show homogenization temperatures of 150-360C with salinities ranging 1-6wt%. Almost all the metal concentrations, especially Cu, Pb, Zn, Fe, W and Mo, of fluid inclusions in (4) are 2-3 times higher than those of the other deposits.

Although the above physicochemical characteristics of the ore forming fluids have been clarified in the present study, much detailed examinations are required to investigate the entire process of ore formations and geneses and evolutions of the fluids.

Keywords: LA-ICP-MS, fluid inclusion, Naegi Granite, rare metal, base metal, hydrothermal ore deposit

Japan Geoscience Union Meeting 2011
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SRD043-04 Room:201A Time:May 22 09:45-10:00

Precipitation condition of antimony-rich and gold bearing hydrothermal minerals associated with shallow-water hydrotherm

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The eastern part of the innermost part of Kagoshima Bay contains a small, crater-like depression called Wakamiko Crater, where maximum water depth is approximately 202 m. Active fumaroles have been reported in this area (Kagoshima Prefectural Government, 1978; Oki and Hayasaka, 1978), resulting in its designation as an active volcano named Wakamiko. In addition, occurrences of hydrothermal petroleum and mineralization related to hydrothermal fluid-sediment interaction have also been reported within the crater (Yamanaka et al., 1999, 2000; Ishibashi et al., 2008; Nakaseama et al., 2008), strongly suggesting occurrence of hydrothermal activity at the crater floor. In 2007 during the dive study of ROV/HyperDolphin belonging to Japan Agency for Marine-Earth Science and Technology (JAMSTEC) we found vigorous hydrothermal venting at the northwest area in the crater at depth 200 m, measured temperature of the venting fluid was reached up to 192?C. We found three vents, and the venting fluid were emitting from the top and foot of the chimney like cone-shaped mineral precipitations (about 2 m in height and 3˜4 m in diameter at the foot), respectively. The chimneys are composed mainly talc and carbonate with minor amount of anhydrite and stibnite. It is very rare that shallow water hydrothermal venting involve forming chimney like mineral precipitation. On the other hand, those talc-rich chimneys were formed on the mounds, which deposit of blackish boulder size (up to 50 cm in diameter) lump of sulfide minerals. The lump was aggregate of almost stibnite with minor amount of talc and pyrite. The stibnite aggregate was composed ˜1 mm length needle-sharp stibnite. Although any characteristic inner structure was not observed to the aggregate, pumice-like vague vestiges replaced by talc was rarely found in the aggregate. From the bulk analysis Au was detected in the those precipitations, bulk concentration of Au in the stibnite aggregate was reached 19 ppm. Therefore, we considered the precipitation condition of the stibnite aggregate using REE pattern.

Significant contents of REEs were detected in barite minerals occurred in the stibnite aggregate. The condrite-normalized REE patterns of the aggregate shows a pronounced positive Eu anomaly that is probably inherited from the hydrothermal fluid, suggesting insignificant contribution of seawater during precipitation. Total REE contents of the aggregate were higher than those of the chimney precipitations, it may reflect low growth rate of precipitation minerals in the aggregate.

Au and Ag were concentrated significantly on stibnite relative to talc and barite, and their contents in the aggregate and chimney precipitation formed inner part of the chimneys were one order of magnitude higher than those of the chimney precipitations formed outer part of the chimney. The precipitation temperature of the chimneys between the inner and outer parts were expected different based on the oxygen isotope geothermometer using talc, the estimated precipitation temperatures were 195 deg-C for the inner part and 174 deg-C for outer part. Although the oxygen isotope data of the aggregate was not measured, the high Au and Ag concentrations in the aggregate suggests that the precipitation temperature of the aggregate is close to the inner part of the chimney precipitations.

From those results the stibnite aggregate is expected to form beneath seafloor and erupted on the seafloor. It suggests that such antimony-rich precipitation is expected to distribute extensively beneath the seafloor, and the estimated amount of the precipitins is not negligible compared to the case of aggregate depositing as hydrothermal mineral mound as a result of collapse of chimney precipitations.

Keywords: shallow-water hydrothermal activity, hydrothermal precipitation, Antimony, gold, REE

SRD043-05 Room:201A Time:May 22 10:00-10:15

Bazman epithermal gold-silver mineralization, Sistan and Baluchestan province, Iran

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The study area is located 160 km northwest of Iranshar in Sistan and Baluchestan province, southeast of Iran. The area is geologically located in the SE-trending part of the Central Iran magmatic arc zone known as Sahand-Bazman magmatic zone. This zone extends to Turkey to the northwest and to Pakistan to the southeast. The Arabian Plate was subducted and collided beneath Eurasian plate to form a few arc-trench systems in Turkey, Iran and west of Pakistan from Cretaceous to recent days. Among them is the active Makran subduction zone formed by the convergence of the Arabian plate and Lut block in Iran and Helmand block in Afghanistan. The Neogene volcanoes of Bazman, Taftan in Iran and Sultan in Pakistan have spatial link with this subduction zone. Epithermal mineralization occurs in Sahand?Bazman magmatic zone of Iran as a result of the Neogene volcanism and related processes. The study area is located in the northeastern slopes of Quaternary Mount Bazman. Geology of the mineralized area consists of andesite, andesitic basalt, basalt, olivine basalt, and pyroclastic rocks that had all been erupted from the Mount Bazman. Preliminary studies revealed considerable potential of gold and silver mineralization in the area. Mineralization occurs in a vast area and ore grade is high (up to 16 ppm Au and 120 ppm Ag). The mineralization mainly occurs in and around a few veins. The mineralized veins strike N 25 to 35 E and vary from 50 cm to 2 m in width and from 500 m to over 1000 m in strike length. The veins are generally crustiform banded to brecciated with colloform to cockade banding. Pure white and milky quartz and chalcedony occur in central part of the veins (along axial line of the veins). The volcanic rocks close to the milky pure quartz and chalcedony veins (seems as halo) are brecciated and strongly silicified and contains abundant pyrite. Phyllic, argillic and propylitic alteration occur peripheral to the veins. Mineralization is associated with the pyrite-rich brecciated parts around the axial line of the veins. Other sulfides are chalcopyrite, covellite, silver-rich covellite, galena, sphalerite, tetrahedrite and an unknown Ag-rich phase. Quartz is main gangue mineral and occurs as large euhedral to microcrystalline grains. Chalcedony occurs with quartz periodically in crustiform banded veins. Other gangue minerals are adularia, calcite and phyllosilicates. The brecciation is first stage followed by silica precipitates as cockade structure. Finally crustiform quartz and chalcedony were formed along central part of the veins. Pyrite is the most common sulfide. It occurs in every rock samples. Chalcopyrite and Ag-minerals occur as late veinlets. Gold (less than 1 micron up to 2-3 microns) occurs in the hydrothermal breccias of final phase. This paper will discuss many data that obtained by polarization microscope, XRD, XRF and EPMA.

Keywords: Bazman deposit, epithermal gold-silver mineralization, Neogene volcanism, hydrothermal breccias, XRD, XRF and EPMA

SRD043-06 Room:201A Time:May 22 10:15-10:30

Hydrothermal alteration and minerlization in Abdar Caldera, Kerman province, Iran

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The Abdar Caldera is located in 35 km northeast of Shaher-e-Babak, southeast of Iran. This area is geologically a part of northwest of the Dehaj-Sardueih Belt (a part of Uromieh-Dokhtar magmatic arc) that consists of a thick sequence of Eocene volcanic, pyroclastic and volcanoclastic rocks and Oligo-Miocene intrusions. Post-collisional processes also produced adakitic and alkaline rocks in this zone during the Plio-Pleistocene and Plio-Quaternary. Local geology consists of Eocene fine-grained tuffs, andesitic tuff, andesite, andesitic basalt, trachyandesite and basalt, and Oligo-Miocene, diorite and granodiorite. The above rocks are mainly porphyry in texture and contain plagioclase, K-feldspar, quartz, biotite and hornblende and minor titanite, magnetite, apatite and zircon. The volcanic and pyroclastic rocks were cut by numerous quartz veins in the area. Every vein surrounded by an intense alteration halo. The quartz veins show banding and comb structures in their central part where contains large (up to 3 cm) pyramidal quartz. The quartz crystals decrease in size outward. Phyllic and propylitic alterations occur at the periphery of the veins. Although hydrothermal alterations occur around the veins in a vast area but the veins are weakly mineralized. Most of the assemblages and fluid inclusions can be assigned to epithermal alteration and mineralization. Mineralization occurs as sulfides and oxides. The sulfides are pyrite, galena, sphalerite, chalcopyrite, stibnite, tetrahedrite, tennantite, arsenopyrite and covellite.The oxides are hematite, magnetite, pyrolusite and iron hydroxides. The gangue minerals are mainly quartz, barite, calcite and phyllosillicates. In this paper we document and interpret petrography and geochemistry of volcanic rocks using microscopic and XRF data. Alteration mineralogy checked by XRD. Sulfide and oxide minerals were analyzed by EPMA and the mineral chemistry will be discussed in this paper.

Keywords: Abdar Caldera, Oligo-Miocene intrusions, porphyry copper, hydrothermal alteration, Iran

SRD043-P01 Room:Convention Hall Time:May 22 10:30-13:00

Major and trace elements geochemistry of Co-rich ferromanganese crust from the #5 Takuyo Seamount, northwestern Pacific

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Large amount of hydrogenetic cobalt-rich ferromanganese (Fe-Mn) crusts are known to occur on the surface of seamounts or ocean plateaus in the Pacific Ocean. The Fe-Mn crust is one of the most promising seafloor mineral resources enriched in not only Cu, Co, and Ni but also REE and PGE. Here we report the geochemical features of the Fe-Mn crusts collected from the #5 Takuyo Seamount, which is located 120 km west from the Minami-torishima Island, northwestern Pacific.

The amounts of trace elements in the crusts are controlled by the MnO_2(or Fe_2O_3) content: Those of Ni, and Cu are roughly proportional to the MnO_2 contents, while REE, especially HREE, show strong positive correlation with the Fe_2O_3 content. The Mn/Fe ratios decrease toward the surface of the crusts in all samples taken at various water depths between 965m and 2987m. The Fe/Mn ratios of crust samples from the surface part within 3 mm tend to be higher along with the increase of water depths, which is similar to the vertical profile of dissolved oxygen amount in the Pacific Ocean. The crusts are characterized by high total REE contents (La-Lu) varying from 1267 to 2168 ppm (average 1660 ppm). PAAS-normalized REE patterns show flat patters with conspicuous positive Ce anomalies. We believe that the Fe-Mn crusts are promising alternative as the source of HREE because of the high REE contents and the large ore reserve.

Keywords: ferromanganese crust, minor elements, #5 Takuyo Seamount, REE, resource evaluation

SRD043-P02 Room:Convention Hall Time:May 22 10:30-13:00

Mineralization of Miyazaki Ore Deposits, Miyagi Prefecture, Japan -Especially about Bonten Gypsum Deposit-

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Several gypsum, manganese, zinc-lead deposits are distributed in the Miyazaki mining area, northwest of Miyagi Prefecture. The Bonten gypsum deposit is a sedimentary type and is embedded in the rhyolitic tuff of early Miocene age. The rhyolitic tuff in the vicinity of the deposit dips 7-10 degrees south and is covered with tuffs containing rounded andesitic pebbles (Anzai, 1955). The center of the deposit is affected by remarkable clay alteration and contains satin spar gypsum up to 15cm. The Bonten gypsum deposit, Bonten manganese deposit of early Miocene and Yunokura Pb-Zn deposit are focused in this study.

In this study we collected ore and rock samples from each deposits and outcrops and analyzed by XRD, microthermometry of fluid inclusions, and EPMA to elucidate the mineralization of this area.

The clay ore of the Bonten gypsum deposit contains quartz, pyrite, sphalerite, and sericite, halloysite. Although pyrite, analcime, mordenite, smectite is detected in tuffaceous host rocks around the deposit, they are not detected in rocks far from the ore deposits. Fluid inclusions of gypsum indicate 50-60 degrees homogeneous temperature and 4.9-3.2 wt.% NaCl equivalent. Judging from the surrounding geological setting, pressure revision to the temperature is very low, and it is thought that this area has affected by the thermal spring activity of about 70 degrees or less. This fact is in accordance with that no anhydrite is detected in this area (Kinoshita, 1924). Calcium may be originated from rocks in the vicinity during the process of smectite alteration. On the other hand, about the origin of S, we have two ideas; 1, if this deposit has occurred during shallow marine sedimentation, S originates in seawater, 2, if this deposit occurred at secondary alteration after sedimentation, it is suggested that S originates in thermal spring water. (leaching of pyrite in the lower formation)

The Yutorinuma Formation which overlies the Bonten gypsum deposit contains the Bonten manganese deposit. Pyrolusite and hematite which are known to be indicators of oxic environment are detected from this ore deposit. The Yunokura sulfide deposit embedded in the Nagashida Formation which overlies the manganese deposit. This deposit produces sphalerite, galena, chalcopyrite, pyrite, and barite. The T_H of fluid inclusion from these samples is 120-200 degrees. Hydrothermal alteration zones are sporadically occurred in this area. These facts suggest that the Miyazaki mining area have widely received multiple and different thermal (spring) activities.

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SRD043-P03 Room:Convention Hall Time:May 22 10:30-13:00

Oxygen isotopic variation of vein quartz at the Toyoha deposit: a reconnaissance study

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The Toyoha deposit, an epithermal polymetallic vein-type deposit, was formed by two-stages mineralization. The veins in the northwestern part of the deposit were formed early mineralization (early-stage veins), while southeastern veins were formed by late mineralization (late-stage veins).

The oxygen isotope ratios of vein quartz were obtained for major veins. Delta ^{18}O values of quartz from early-stage veins (Rebun, Rishiri, 3rd Chikugo, Bizen and Tajima veins) are +2.8 to +5.5 per mil, and those of late-stage veins (Izumo, Sorachi, Iwami, Shinano veins) are +3.3 to +8.8 per mil. The delta values of late-stage veins are higher than those of early-stage veins. Calculated delta ^{18}O values of ore-forming fluid responsible for the veins are -9.3 to -4.2 per mil for early-stage veins, and -7.2 to +1.6 per mil for late-stage veins. These values are between local meteoric water (-11 per mil) and primary magmatic fluid (+5.5 to +9.5 per mil). The variation of delta values of ore-forming fluid can be explained by the difference of mixing ratio of meteoric water and magmatic fluid.

Previous mineralogical and geochemical studies have revealed that ore-forming conditions for early-stage and late-stage veins were distinctive. Early-stage veins were formed under relatively high oxygen fugacity, and ore-forming fluid was supplied by magnetite-series magma. Late-stage veins were formed under reduced condition, and have polymetallic nature. Difference of ore-forming conditions was explained by the model, where magnetite-series magma responsible for early-stage veins assimilated sedimentary rock then changed to reduced nature and supplied ore-forming fluid of late-stage veins (Ohta, 1995). If assimilation of sedimentary rock occurred, delta ^{18}O values of bulk rock would shift to heavier. Then oxygen isotopic data of this study supports the model proposed by Ohta (1995).

Keywords: oxygen isotope, Toyoha deposit, ore-forming fluid, quartz

SRD043-P04 Room:Convention Hall Time:May 22 10:30-13:00

PGE-rich clays in a mantle peridotite xenolith from Avacha volcano, the southern Kamchatka arc

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Platinum-group elements (PGE) have strongly refractory features within the mantle peridotite/melt system, and favor sulfides or metals (such as the earth′s core). In addition, these PGE are not mobile during weathering and/or low temperature alteration processes. We found unusually high-Ni, Fe clays in a highly metasomatized mantle peridotite xenolith (sample #159) from Avacha volcano, the southern Kamchatka arc. The sample #159 contains Ni-rich spots, composed of mantle minerals with high-Ni contents: NiO contents of olivine, orthopyroxene, and chromian spinel is up to 5.3 wt%, 1.1 wt% and 1.1 wt%, respectively, there. The high-Ni, Fe clays are located at the center of the Ni-rich spot, and the Ni content of minerals decreases from the center outward. The high-Ni, Fe clays are brownish-yellowish in color under the microscope. Some of the clays are also quite rich in S (? 66,000 ppm). The Ni/(Fe+Ni) atomic ratio of the clay is highly changeable (0-0.7), and does not show any correlation with the S content. However some incompatible trace elements (Nb, Sr, Zr and Ti) are strongly depleted in the high-Fe, Ni clays, their rare earth element features are similar to those of Avacha silicic glasses and/or the host andesite. In addition, some clays show extremely PGE enriched features, and the concentrations of Os, Ir and Ru in the clays are 106 times higher than the chondrite values. Geochemical features of minerals around the high-Ni, Fe clay clearly indicate that the clays are an alteration product from the metasomatic agent that drastically enhanced the Ni content of surrounding minerals. Possible candidate of the metasomatic agent is sulfide, but we can deny the possibility because there is no Ni enrichment halo around intact sulfides in sample #159. We propose that the high-Ni, Fe clays were peculiar silicate melt or silicate-bearing aqueous fluid with high concentrations of Ni, Fe, S and PGE, and it possibly plays an important role in mobilization of transition elements and PGE within the mantle wedge.

Keywords: platinum-group elements, transition elements, peridotite xenolith, mantle wedge

Japan Geoscience Union Meeting 2011
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SRD043-P05 Room:Convention Hall Time:May 22 10:30-13:00

Geochemical, Petrological and Environmental Tectonomagmatic dykes in north of Rabor (Southeast of Iran)

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The study area is inclusive some dykes located in the Kerman province, 10 km north of Rabor. Geologically the area is in the Central Iranian, located volcano-plotonic zone of Urumieh- Dokhtar and southeastern Dehaj- sarduiyeh belt. These dykes have partly ordered array with process dominant north- south and are thickness intermediate 4 meters. These rocks are andesite and dacite in composition with porphiric texture at age Miocene- Pliocene that intruded in the Eocene pyroclastic rocks and Miocene sedimentary units. phenocryst minerals and basic constitutive this rocks are composed of plagioclase, amphibole, biotite and somewhat pyroxene. These minerals somewhen attendants with vitrophyr are in background these rocks. Phenocryst this rocks special plagioclase minerals show disequilibrium textures such as oscillatory zoning, soluble and sieve texture. Peer this disequilibrium structures more due pressure decrease and changing pressure water vapor is in the season those form. In microscopic section dominant texture porphyric this rocks, but in those may observe microlitic porphyric, hyalloporphyritic and microgranolar textures. Based on geochemical studies, denote that inverse increase content silica oxide, alkali element oxides, contents Rb, Ba, Sr, Pb, elements increased and other oxides and V, Y, Co, Ni, elements decreased. Changing positive Ba, Rb, U, Th, Pb, Ce, Cs, La and Sr elements, negation V, Cr, Ni, Yb elements this rocks than chondritic normalization and primitive mantle normalization may due work fluid subduction zone and or differentiation minerals such as pyroxene and hornblende. Beside negation anomaly Nb and Ta elements this rocks probably product those contamination with crustal material. Changing increasing ratios Th/Zr, Ce/Y with stable ratio Zr/Nb in the rocks, probably due efficacy dehydration slab subduction is in the mantle wedge metasomatism. Geochemical instance various such as high LREE contents this rocks rather than HREE contents and high LILE/HFSE ratios show those probably formed in the seat continental margin correlate subduction and melting mantle wedge due dehydration slab subduction. Field survey, geochemical and structural this dykes show that probably fractions result activity Sarduiyeh and Dehshir- Baft fault adequate in those forming.

Keywords: Iran, Kerman, Rabor, Petrology, Geochemistry, Andesitic dykes

Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SRD043-P06 Room:Convention Hall Time:May 22 10:30-13:00

Geology, mineralization and alteration in Nehbandan Mahor Mine, West Lut Block of Iran

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The study area is situated within the Lut Block 130 Km east of Nehbandan. The oldest exposed rocks are cretaceous limestone and conglomerate. Dacite-rhyodacite lava and pyroclastic rocks erupted over oldest rocks. Volcanic activates in Tertiary time consist of andesite, trachyandesite, basalt-andesite, dacitic tuff and rhyolite in composition. Plutonic rocks mainly consist of granite, diorite, granodiorite and monzonite. Volcanic rocks are K-rich calc-alkaline. The pattern of spider diagram in comparison with mantle, they are enriched in Cs, Ba, Rb, and Zr and depleted in Nb, K and Ti. In this area alteration zones are silicified, propylitic, sericitic and argillic. Mineralization associated with volcanic rocks show signs of Ag, Au, Zn, Pb and Cu geochemical exploration anomalies.

Keywords: Nehbandan, Geochemical exploration, Alteration, Mineralization, Mahor, Iran