# Distribution of tailing minerals deduced from remote sensing data in Bor mining area, east Serbia

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City of Bor is located in east part of Republic of Serbia. The exploitation of copper ore has been operated since 1903. Main types of the copper ore in Bor ore deposits are massive sulfide copper deposits, vein and stockwork-disseminated type of mineralization, porphyry mineralization, and reworked ore-clasts of copper sulfides. Underground mining and open pit mining carry out exploitations of ore. In the five-year-period, between 2010 and 2014, Mining and Smelting Combine Bor produced 155 thousand tons of copper, 24 tons of silver, and 4.5 tons of gold. Mining activities have produced large amount of waste materials. Until now, it has been disposed 450 million tons of overburden, 207 million tons of flotation tailings and 23 million tons of slag. Pyrite from the tailings is exposed to water and oxygen, which leads oxidation of this mineral and production of acid mine drainage. Releasing untreated acid mine drainage and wastewater from smelter into a river is a reason of serious environmental pollution. Fine-grained flotation tailings transported by winds and river water become air and soil pollutions and river sediment. In order to make comprehensive environmental evaluation and propose reclamation system, collaboration between Japan and Serbia has been started in 2015. This project is supported by SATREPS from JICA and JST. The project will be continued until 2020. This project has two main research groups; environmental evaluation group, and detoxification and resources recovery group.
Environmental evaluation group studied about distribution of tailings and wastewater deduced from satellite image data analyses. In 2015, the group members researched about tailing distribution by using satellite images. First, tailing positions were extracted from ASTER and LANDSAT images. Because spectrum of the tailing had decay slopes in Band 3 images in both of ASTER and LANDSAT, the tailing areas were identified from ratio between Band 2 and Band 3 of these images. ASTER and LANDSAT images were not able to distinguish between soil and tailing because of their wide Band ranges. Therefore, the members distinguished tailings from seasonal changes of spectrum in these areas. The seasonal change was caused by vegetation. Next, 22 samples of surface materials were took and observed. Almost surface materials matched satellite analysis results, but a few areas were different from the satellite analysis results. These 22 samples were analyzed spectrum by a spectrometer and determined mineral by XRD. These spectrum data were compared with satellite images. In addition, high-resolution images (World View 2) were purchased and analyzed with other images and data. Especially, Vrazogrnac plane where was confluence of Bor and Timok Rivers. Timok River connects to Danube River.
Environmental evaluation group would reveal from material content with depth in future drilling works. Spectrum data was correlated with XRD data. XRD result showed that tailing samples were including Jarosite, Kaorinite, Illite, and Gypsum. Vrazogrnac area was measured secular change and collected samples. There were also compared with spectrum data. High resolution images around there were also measured the areas in details.
These tailings would be transported to Danube River, the international river, then they could make around countries environmental influences. Our study would resolve the problems by continuing our observation about distribution of tailings. In order to research in details, we should prepare hyper spectrum images. Acquirement of images from Hyperspectral and/or LCTF-UAV would resolve these problems in the future.

 

Keywords: remote sensing, mining, tailings, pollution, Bor

 

# 宇宙食における衛生検査の重要性
# Importance of the examination of hygiene in space foods

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閉鎖空間における微生物管理は大変重要です。温度や湿度によって微生物が異常に繁殖することが考えられるからです。特に食中毒の防止は大変重要です。アメリカ火星協会がアリゾナに持つMDRS（閉鎖空間施設）において得られたデータから、注意すべき宇宙船内の微生物管理区域を考えました。食事に関する場合、調理操付近や調理済み食品の置かれている場所の衛生管理が必要です。食品の飛び散りも管理する必要があります。その際、アルコール消毒や次亜塩素酸ナトリウム消毒などでふき取りを行うことが有効です。トイレやシャワーでの衛生管理も重要です。乾燥していても、いったん湿気が戻ると微生物は繁殖します。水のふき取りは重要です。また寝具や服における衛生管理が必要です。怪我をしている人の指やし尿の始末における微生物管理の強化が必要です。

キーワード：宇宙食、微生物検査、衛生管理
Keywords: Space foods, Examination of microbe, Hygiene management

 

# 災害食の宇宙食としての利用－食形態の違いによる食味評価
# The use of the disaster food as space foods -Sensuality evaluation of the taste-

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災害食を宇宙食に利用することが今後行われていくと思います。宇宙食も災害食も長期間常温で保存可能であるためです。しかし市販されている災害食はいろいろな食形態をしています。主流はフリーズドライです。しかし、レトルトパウチ食品もあります。砂糖漬けや塩漬けもあります。おいしくなければ宇宙食も災害食も継続して食べ続けることはできません。おいしくて栄養バランスの良い食事が必要です。そこで本研究は市販されている災害食を組み合わせて献立をたてました。その献立に従って食事を試食しました。試食の結果、高い評価を受けた製品を用いて再度献立を作成しました。

キーワード：宇宙食、災害食、市販品、官能試験
Keywords: Space foods, Disaster food, Marketing product, Sensuality examination

 

# 災害食の宇宙食としての利用－食塩濃度調査

# The use of the disaster food as space foods -Salt density investigation-

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災害食を宇宙食に利用するためには、糖質と塩分量を調べる必要があります。食後の高血糖は糖尿病を引き起こします。宇宙では筋肉量が減少してしまうため基礎代謝が落ちます。そのため糖質摂取量には注意が必要です。同様に塩分量の摂取にも注意が必要です。浮腫を敷設必要があるからです。そこで本研究は市販されている災害食に含まれる塩分量を調べました。一日の塩分摂取量が10ｇ以下になるような組み合わせを考えました。糖質量もできるだけ少なくなるように組み合わせました。ビタミンやミネラルについても計算しました。やはり不十分な栄養素はサプリメントで取る必要があると考えました。

キーワード：宇宙食、災害食、市販品、食塩含有量
Keywords: Space foods, Disaster food, Marketing product, Salt content

 