A DATABASE FOR ANALOG SAMPLE MEASUREMENTS WITH Ma_MISS BREADBOARD. N. Costa[1], M. Ferrari[1], A. Frigeri[1], M.C. De Sanctis[1], S. De Angelis[1], M. Formisano[1]. F. Altieri[1], E. Ammannito[2], J. Brossier[1], L. Rossi[1], E. La Francesca[1].
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Introduction: ExoMars 2022 is a European Space Agency and Roscosmos mission, composed of Russian Kazakoch lander and European Rosalind Franklin rover. ExoMars 2022 will look for traces of past or present life potentially preserved into the rock layers within the subsurface of Mars. The rover payload includes a visible and near-infrared miniaturized spectrometer Ma_MISS (Mars Multispectral Imager for Subsurface Studies) installed into the drill's tip. It will acquire spectral images of the borehole to study the mineralogy of the subsurface in situ, up to 2 meters depth [1].

ExoMars 2022 designated landing site is Oxia Planum. Oxia is located at the western part of Arabia Terra, where geology shows evidence for a past where liquid water has long-lived [2]. Multiple channels of Coogoon Valles provide sedimentary material to the deltaic system that lies in the clay-bearing plain. Spectral analysis reveals the possible presence of Fe/Mg-rich phyllosilicate, such as vermiculite and saponite mixed with less or more olivine, and the presence of coating resistant unit that seems to have mafic features [3,4].

Many minerals are expected to be analyzed by the Ma_MISS instrument in the landing site. Therefore, it is important to have an ad-hoc spectral database to be used as a reference when Ma_MISS will be on Mars. For such purpose, we have acquired several different rocks samples and analyzed them with the Ma_MISS breadboard [5,6] to see how spectra change with compositional variations. We decided to structure the information related to the samples and the measurement into a database.

Methods: Many different samples have been measured with the Ma_MISS breadboard in the last years and often the information about the samples is dispersed and diverse. Sometimes the information about the samples is provided by the supplier and chemical analysis is taken by other laboratories. In other cases, the samples are collected during dedicated geological surveys or procured by other laboratories. In the end, the measured rocks are supplemented with a large number of data, often collected in a confused way and different places. Databases help in organizing the information related to our collection of samples and the measurements.

The auxiliary information related to our samples and measurements ranges from textual to imagery to raw data measurements.

Auxiliary data or metadata include:

- Information about the sample: providers, physical dimensions of the sample, alternative names used for identifying the sample;
- Geological information: geologic description, eventual components, geological age and formation, site of sampling;
- Information of geological survey: name, data, sampling method, geospatial reference ;
- Laboratory measurements: chemical analysis, spectral analysis, microscope pictures.
- Reference files: files in PDF format where are reported information about rocks and samples.

Data and discussion: We started including samples both from ALTEC or Leonardo company and from geological surveys of the Institute for Space Astrophysics and Planetology (IAPS). The first ones are accompanied by chemical analysis, but they lack geological information, such as geological unit and age. On the contrary, the second one's present data related to the geological survey, but not chemical analysis.

Even if we are not able to fill all the fields provided by our database schema, we are looking to maximize the information stored about a given sample and to try to have the same data for all rocks being analyzed in the laboratory.

Applications: We reported an example of how a sample is catalogued in the database. The examined sample is CAP-1, collected during the Capalbio 2021 geological survey of Institute for Space Astrophysics and Planetology (IAPS). In October 2021, it was gathered in an excavated trench in the area of Capalbio (Tuscany, Italy) (Figure 1). All this information about geological survey is written in the appropriate fields of the database.

Figure 1. Outcrop where CAP-1 is extracted.

As regards to geological information, we know that CAP-1 is Pleistocene metasedimentary rock subjected to hydrothermal alteration/weathering. This brownish siltstone/mudstone is quite compact rock in dry conditions and brittle in wet conditions. Inside it, there are a few discoidal, sub-angular grains with diameter higher than 2 mm and different colors (black, reddish and white) and low sphericity. Grains are not-oriented, except black Manganese aggregates, which form thin veins with a diameter of about 2-5 mm. Other grains are white rectangular precipitations of Al-bearing clay (kaolinite) and reddish irregular aggregates formed by iron oxide (hematite). The brownish fine-grained (granulometry in the order of silt-clay) matrix has medium porosity, without cement. It lacks stratification and it shows possible alteration due to iron oxidation. CAP-1 is well-sorted, texturally and compositionally mature (Figure 2).

Figure 2. Sample CAP-1.

Finally, we have collected a large number of measurements with different instruments such as Ma_MISS breadboard, XRPD and SEM/EDS. A few chemical analyses confirm the content of Si, Al, Fe, Mg e K as major elements in the sample. Moreover, we also have some the reference texts where there are detailed information about CAP-1 (Table 1).

Information	**Data**
Sample name	CAP-1
Supplier	IAPS
Geological description	Metasedimentary siltstone/ mudstone subjected to hydrothermal alteration
Chemical analysis	Major elements: Si, Al, Fe, Mg e K
Age (min, max)	Pleistocene
Origin	Capalbio, Tuscany, Italy
Date of geological survey	October, 2021
Name of geological survey	Capalbio 2021
Extraction method	Trench
Laboratory measurements	Ma_MISS breadboard and XRPD, SEM/EDS

Table 1. Summary of the information about CAP-1.

Conclusions: With our database, we are going to minimize the loss of details about samples and measurements using a database system, which also offer the opportunity to analyze and re-arrange the information no matter how big is our catalog in terms of number of samples and measurements. Ma_MISS science can thus count on a critical tool for the interpretation of data acquisition during the real mission on Mars.

Acknowledgments: This work is supported by the Italian Space Agency (ASI) grant ASI-INAF n. 2017-412-H.0. Ma_MISS is funded by ASI and INAF.

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