The Mineral Susceptibility Database: a new tool for mineral preservation

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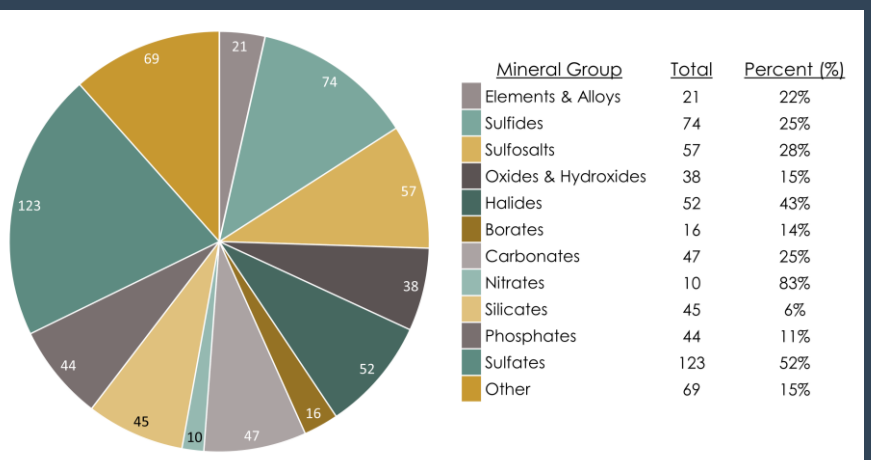
Abstract

Minerals are often overlooked in museum conservation due to their assumed stability. While many may be stable under ambient conditions, **at least 10% of known mineral species are susceptible within a museum context**. While there is a significant lack of quantitative information within museum literature regarding this topic, there is a wealth of relevant research within other sectors, such as materials science and geoscience. Yet findings from these fields rarely enter the heritage sector, as relevant research outputs are not easily accessible or transferable. As a response to this, a **new online resource, the Mineral Susceptibility Database** (MSD), has been created to provide scientific information relevant for the preservation of minerals under ambient conditions in a single, **openly accessible** location. The MSD collates and synthesizes data from various fields, and adapts key findings into an **easily digestible and usable format** tailored for non-scientific audiences. By being a repository of interdisciplinary research, the Database:

1. encourages informed decision making,
2. increases awareness of which disciplines & institutions are performing relevant research,
3. exposes additional research applications, and
4. advocates cross-disciplinary research and communication.

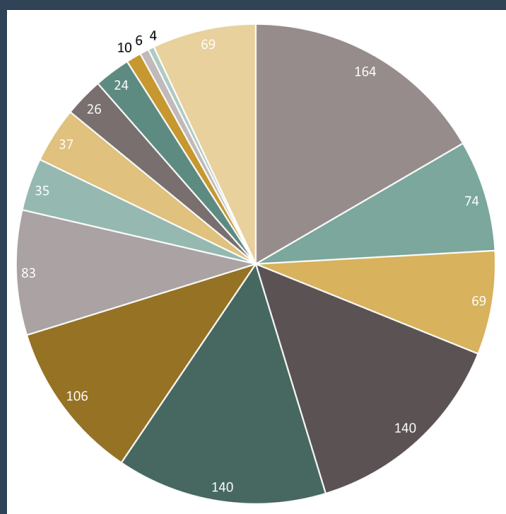
MSD Facts & Figures

- **596 minerals** listed = **10%** of total mineral species
- **987 entries** of mineral reactions that occur in a museum environment
  - Temperature: -20 – 50°C (-4 – 122°F)
  - Humidity: 1-99% RH
  - Light: visible, UV, & near-IR (~120-1100nm)
  - Indoor pollutants: particulates, aerosols
- cover 'extremes' that may occur in buildings without insulation or HVAC, or during:
  - equipment & infrastructure failure
  - unusual weather
  - flooding
  - localized heating by spotlights



Mineral Group	Total	Percent (%)
Elements & Alloys	21	22%
Sulfides	74	25%
Sulfosalts	57	28%
Oxides & Hydroxides	38	15%
Halides	52	43%
Borates	16	14%
Carbonates	47	25%
Nitrates	10	83%
Silicates	45	6%
Phosphates	44	11%
Sulfates	123	52%
Other	69	15%

Fig. 1: Distribution of susceptibility data entries within the MSD grouped by major mineral groups.



Response	Total	Percent (%)
Dehydration	164	17%
Hydration	74	8%
Photo-oxidation	69	7%
Oxidation	140	14%
Soluble - Water	139	14%
Soluble - Acid	105	11%
Deliquescence	83	8%
Hygroscopic	35	4%
Colour Change	36	4%
Porous	25	3%
Decomposition	24	2%
Efflorescence	10	1%
Structural Alteration	6	1%
Hydrolysis	4	0.4%
Other	69	7%

Fig. 2: Distribution of susceptibility data entries within the MSD grouped by response to an agent of change.

Top 3 Reaction Types

1. **Hydration = 25%**
   - Dehydration = 17%; Hydration = 8%
2. **Solubility = 25%**
   - by Water = 14%; by Acids = 11%
3. **Oxidation = 21%**
   - Oxidation = 14%; Photo-oxidation = 7%

- Combined = **70%** of entries
  - clearly common & important reactions
  - data = experimental, quantitative, robust
- Data for other reactions = far fewer & more qualitative
  - Is this a true reflection of reality?

Next Steps

There is still much work to be done on the MSD, such as:

- Inputting additional data
  - new entries
  - further references
  - other organizational systems
  - pictures exemplifying deterioration
- Moving to a more permanent location
- Enhancing usability & interactivity to aid searchability

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