

An Investigation of Material Changes Occurring within Mineral Collections

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According to the literature [1 and citations therein], **at least 10% of currently identified mineral species are susceptible to deterioration within the museum setting.** This primarily occurs through changes in hydration and oxidation state. There is a question, however, of whether such responses are overrepresented. Data for other reaction types are far fewer and generally more qualitative. Light-induced reactions are a poignant example: details such as illuminance, length of exposure, and distance from the illuminant are often missing, effectively making the reports little more than anecdotal. **Physical examinations of mineralogical collections were thus deemed necessary to determine:**

Abstract

1. **whether there is agreement between the material changes experimentally reported and what occurs within collections, and**
2. **whether there are any unreported species demonstrating deterioration within the museum context.**

The systematic mineral collection at Oxford University Museum of Natural History (OUMNH) was surveyed to investigate the above. 13,716 specimens belonging to 1,049 species from all mineral groups, including silicates, were examined. Results suggest that the aforementioned reaction types are indeed prevalent in museum collections and are likely not overrepresented in the literature. However, museum collections may also contain more species susceptible to other reaction types (e.g., photo-induced) than recorded. The nature of museum storage makes these species difficult to identify, especially without repeated surveying. **Yet of foremost importance is the susceptibility of minerals to physical forces.** About a quarter of OUMNH mineral specimens have been affected by physical forces to some degree. **All other potential reaction types occur in less than 10% of specimens.** These results act as a reminder that—whilst it is indeed important to identify a species' susceptibility to temperature, moisture, light, and pollutants—one cannot ignore physical forces altogether.

the OUMNH Collection

- **~ 40,000 specimens**
 - ~ 12,300 unique species
 - Age of specimens: c.1650 – present
- **Uncontrolled Environment**
 - T: 16–29°C, RH: 33–65

the State Survey

- **13,716 specimens**
 - 40% of collection
 - 1,049 species
 - ALL mineral groups
- **Time to complete:** 181 hours over 69 days
- **Method:** the Deterioration Phenomena State Survey Method [2]
 - Presence/Absence (1/0) of 15 criteria
 - Dimpled
 - Rounded
 - Corrosion
 - Tarnish
 - Efflorescence
 - Powder
 - Crumbling
 - Flaking
 - Breakages
 - Cracks
 - Dull
 - Dark
 - Pale
 - Opacity
 - Colour Change

Results

- **All Species:** 1,049 species
 - Over half show no signs of change – Great!
 - 26 show signs of physical forces, generally cracks
 - All other types of reactions seen in <20% of all surveyed specimens
- **25+ Specimens:** 155 more 'common' species
 - e.g., quartz, fluorite, calcite, pyrite
 - Enough specimens per species to inform how species change within museums
 - Allow for extrapolation to other collections
 - A matter of thirds:
 - 1/3 no change
 - 1/3 change due to physical forces
 - 1/3 change due to other reactions



Fig. 1: Example of surveying setup in the OUMNH mineral store.

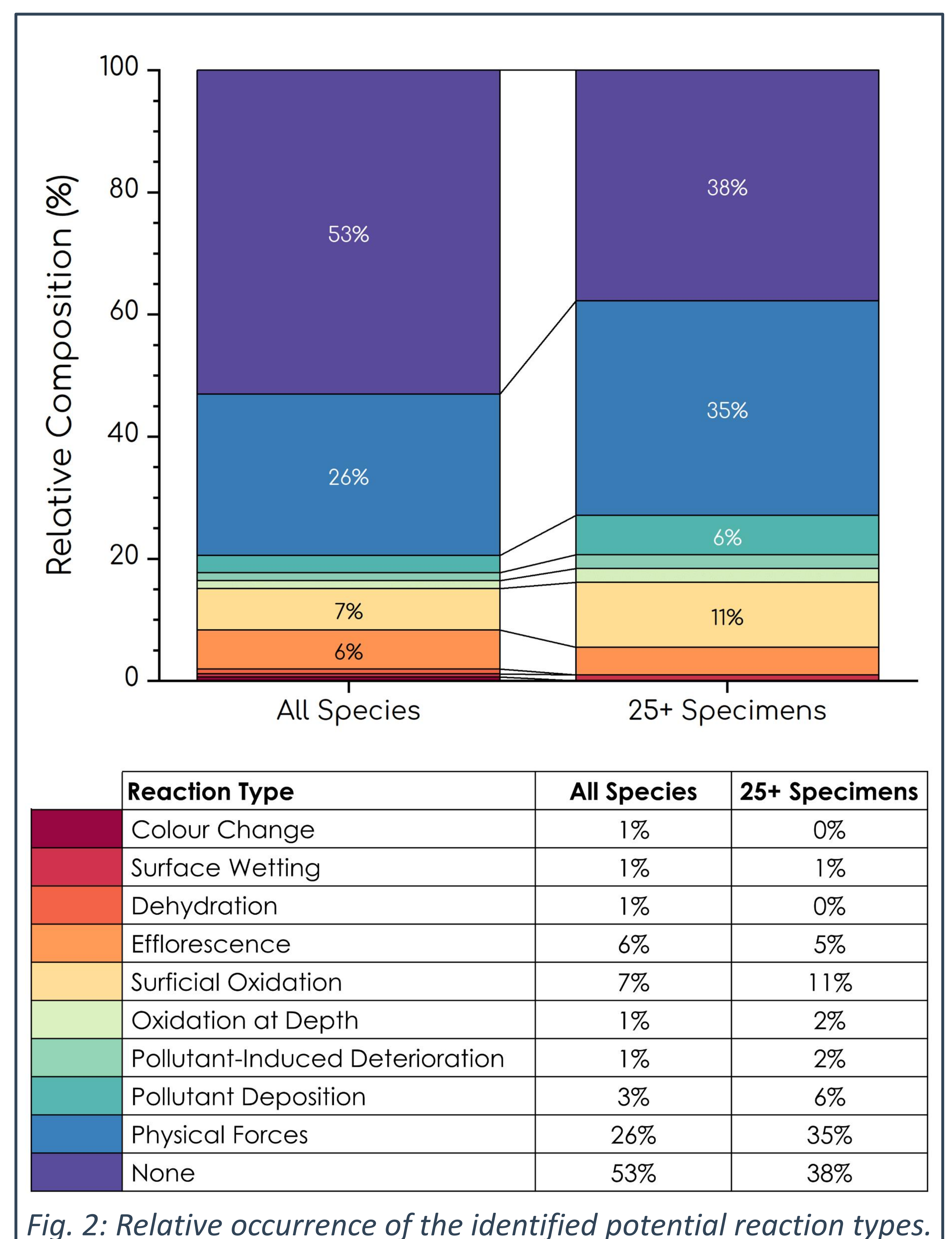


Fig. 2: Relative occurrence of the identified potential reaction types.

References:

1. Royce K (2023) *Assessing the Stability of Mineralogical Collections in Museums*. DOI: 10.5287/ora-d5dagxd4g
2. Royce K (2024) *Journal of Natural Science Collections*, 12, 85-105.