Problems in the Care & Conservation of Geological Collections : MINERALS

PROBLEM	ASSOCIATED SPECIMENS	IDENTIFYING THE PROBLEM	CARE & CONSERVATION
Toxic Minerals **Some minerals are toxic either by ingestion, inhalation (of dust) or in some cases by repeated skin contact.** Acute poisoning is unlikely although arsenic (As), lead (Pb), Mercury (Hg) and thallium (Tl) minerals should be regarded as highly toxic. Arsenic and its compounds are considered carcinogenic. The lethal dose from arsenic can be as low as 20mg. Lethal dose for thallium as the oxide is 100-200mg for an adult. **NB: most minerals are, on the whole, safe. However you should be aware of the problems that do exist.**	See list of toxic minerals in appendix. This list is not exhaustive but others which occur are exceptionally rare. Look out for the following: **Antimony (Sb)** **Arsenic (As):** (especially claudetite, arsenolite and orpiment). **Barium (Ba):** (witherite, nitrobarite and frankdicksonite (rare), barite is much less toxic). **Bismuth (Bi)** **Boron (Bo):** All boron minerals. **Copper (Cu):** Some soluble minerals are toxic. **Fluorine (F):** Any soluble fluoride mineral. **Lead (Pb):** arsenates, carbonates, chlorides, oxides, phosphates and sulphates. **Mercury (Hg):** Native and in vapour form. **Selenium (Se)** **Thallium (Tl)** **Uranium (U):** In addition to radioactivity this element also causes kidney damage. **Zinc (Zn):** Especially dusts.	Read the label and locate on list of toxic minerals in appendix. Remember that the label may not be correct and identification should be undertaken by a competent mineralogist. Arsenic poisoning symptoms include burning of the mouth and nose, stomach disturbances and muscular spasms. Mercury vapour (from evaporation of mercury ores such as cinnabar) causes emotional problems and tremors. **Toxic effects are caused by a number of factors:** 1. The presence of a toxic element. 2. State: Fine powder or solubility. These can either be easily swallowed or easily absorbed by the stomach. 3. Physiological factors: Each person reacts differently according to weight, age, health and sensitivity. 4. Dose consumed: The only factor which is controllable. Try to reduce this as much as possible. If a mineral has a finely divided or powdery surface, or is sticky, use caution and wear gloves.	**There are no minerals which are so toxic that normal handling will produce dramatic poisoning,** however some are very toxic by ingestion or inhalation. Acid should never be added to arsenic minerals because of the risk of arsine liberation. **Arsenic or thallium** minerals should be handled with suitable gloves (latex or neoprene). It is sensible to wear gloves at all times when handling toxic minerals and to wash hands after handling. Do not eat, drink or smoke. Cupboards, drawers and/or specimens should be suitably labelled with a toxicity warning. Do not allow unsupervised handling, especially children. In general all minerals should be considered as unknown compounds when unidentified and **appropriate care when handling should be automatic.** **All mechanical processing** (cutting, polishing, cleaning, breaking, grinding, crushing) of the toxic minerals listed should be carried out in a fume cupboard. Do not leave specimens lying around where others can handle them. Do not lick minerals as an aid to identification (no matter how sure you are of the identification). Galena (the commonest ore of lead) is not normally considered toxic. **Store** in boxes and handle the boxes only when examining specimens.

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Radioactive Minerals Radioactivity occurs when uranium breaks down into daughter products emitting alpha and beta particles and gamma rays (which are the most penetrating). These emissions are classed as "ionising radiation" and levels of exposure have been specified by the National Radiological Protection Board. The upper limit is presently set at: 7.5 µSv per hour. This level is not likely to occur under normal conditions. **A collection of 6 or so specimens presents a negligible risk if handled very rarely (eg. 1 hour per year).**	See appendix: Tables 1-5. **Note: there are a large number of radioactive minerals but most of these are rare and unlikely to be encountered in most museum collections.** Some of the **commonest radioactive minerals** which can be found in museum collections are: uraninite, torbernite, metatorbernite and autunite. Uraninite is the most radioactive ore of uranium.	Read the label (if the specimen has one) and locate on lists provided. Use a beta radiation Geiger-counter/gamma-ray dose rate meter to detect radioactivity. Ask for help from local authority safety/radiation officer/ the National Radiological Protection Board or local university. **If in doubt, seek advice.** Get minerals identified by a competent mineralogist.	**Minimize handling time. Wear washable rubber or disposable plastic gloves**. **Always wash hands thoroughly after handling** (and before you touch anything else). Avoid breathing in over freshly opened drawers or where disturbance of specimens has produced airborne dust. **Wear a face mask** if dust is excessive. Do not eat or drink near the specimens or without washing hands after handling. No smoking. Do not handle specimens if hands are cut or the skin is broken. Some minerals (eg. Torbernite and Autunite) are not usually intensely radioactive. Treat as with toxic minerals. **Bag** specimens to reduce the build up of ordinary dust which can become contaminated with radioactive matter. Radiation warning labels should be attached to the cabinet and drawers where the specimens are located. Individual containers can also have a radiation warning. Radioactive specimens can be stored together in an area of a store which is not visited often, although this can increase the local levels of radiation. Is useful to reduce the density of storage to prevent this. Lead-lined boxes can reduce or eliminate the hazard although radon gas can build up. Move away from the box when first opened and do not breath in over it. This will allow the radon gas to disperse. **Remember:** the radiation hazard can be reduced if the specimen is at least stored within a closed cabinet. This will absorb some of the radioactivity. It can even help to put specimens at the back of drawers. For collections with significant numbers of radioactive specimens (exceeding half a dozen or so) consider segregating into a controlled radiation area. This should include extract-ventilation to remove the built up of highly toxic radon gas. Ventilation should be to an exterior wall. Be aware of the regulations for the storage of radioactive materials. Monitoring of radiation should be carried out. Contact your health and safety officer or nearest university physics or chemistry dept. for advice on Geiger counters. Expert advice should also be obtained from an appointed radiological protection adviser or safety officer with specialist training in radiological safety.

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Physical Hazards Some mineral specimens are hazardous because they have **sharp edges** or are fibrous. **Skin contact** with some minerals can cause irritation. **Dust** can also be a problem, especially when preparing specimens in a lab. Clay and quartz dust are industrial hazards.	**The obvious hazardous minerals are:** Fibrous zeolites, fibrous forms of amphiboles (tremolite or actinolite), pectolite, epidote, okenite and scholzite. Any mineral which has a **sharp surface** can be potentially hazardous. Specimens which can cause **skin irritation** include: petroleum oil, bitumen, and other hydrocarbons. **Mineral dusts** which can be hazardous are: quartz, olivine, magnetite and talc, or minerals which contain beryllium, cadmium, iron oxide, manganese, vanadium, chromium or nickel.	Look carefully at the specimens. If they are glassy they may have very sharp edges. They may have a sharp needle-like appearance and can puncture the skin if no hand protection is worn. Quartz dust can cause Silicosis.	**Wear gloves**, (preferably thick rubber) . It is always best to treat any fibrous minerals with care (and best not to handle at all as this may also damage the specimen). In general, use common sense and observe any potential physical hazards that may exist. **As a rule try to avoid inhaling any dust.** Wear masks when working in dusty conditions. Try to keep areas where dust is generated well ventilated (especially when cutting, grinding or polishing).
Asbestos Minerals Fibrous asbestos minerals are recognised human carcinogens and no safe level of exposure is acceptable.	**Asbestos minerals include:** Strictly the fibrous forms of amphiboles (usually actinolite) More generally: Chrysotile, Actinolite, Amesite, Crocidolite, Anthophyllite and Tremolite.	Always read the label. Treat any fibrous mineral with suspicion. In many collections these minerals are simply labelled as "asbestos". Asbestos fibres can cause irritation or inflammation of the lungs etc. At worst they can be carcinogenic or lead to pneumonoconiosis.	**Seal specimens in plastic bags** (two layers for safety). When handling wear a mask, gloves and lab coat. Label drawers with hazard warnings. **Remember:** asbestos minerals are very fibrous and fragments are easily broken off. Dust can acumulate quickly. Ideally all dust should be removed, However there are regulations covering the control of asbestos. Contact your health and safety officer who will be able to advise. Don't panic!! In most cases the rule is to eliminate direct contact and the build up of dust. The hazard is easily dealt with in this way.

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PYRITE DECAY Pyrite decay is more damaging to specimens than to people but there are some small potential hazards. Pyrite (Iron disulphide) breaks down in high humidity (>55%) to form various iron sulphate product and sulphuric acid. Specimens can become extremely friable and dusty.	Pyrite, Marcasite, Chalcopyrite. Is also occurs in rocks and particularly fossils which contain pyrite.	Specimens often smell of rotten eggs. A yellow/white powdery appearance is common. Often labels will turn brown or disintegrate. Boxes and drawers can also be damaged by the sulphuric acid. The main problem is inhalation of dust, especially iron sulphate.	Wear gloves and if the conditions are dusty, a mask. Do not get into the habit of sniffing specimens closely. If ingested in large quantities iron sulphate is an irritant and can cause stomach problems and liver damage. Often various chemicals are used to treat pyrite decay. Ammonia solution with PEG (Polyethylene Glycol) is sometimes used, as is dry ammonia gas. Ethanolamine Thiogylocollate is also used. Be careful with ammonia which is very toxic (and flammable). If ammonia vapour is in the air you will often feel stinging or your lips. It is also easy to smell. These problems will only occur if you are actually treating specimens.

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