Biotopia Environmental Assessment Pty Ltd

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Biotopia Environmental Assessment

ENVIRONMENTAL ASSESSMENT REPORT

Report ID: 240830-1 [redacted]

Property: [redacted] VIC

Assessment date: 30 August 2024

Report for: [redacted]

Date of Report: 11 September 2024

Previous Report ID: N/A

EXECUTIVE SUMMARY

The subfloor is wet in the middle parts of the house especially under the communal central bathroom and adjacent bedroom #3, resulting in significant mould there, also mould visible on curtains likely due to continual condensation on windows due to the consequentially elevated humidity rising up through the flooring. Not wet elsewhere. Not especially mouldy elsewhere.

Some mould and other dusts found on A/c header unit, but this is fairly typical of them, not a significant health risk, and requires fairly easy routine cleaning as per manufacturer's instructions ideally by a professional and using non-ionic mild cleaning solutions to physically wash the delicate fins, etc.

Consistent with a significant pipe water escape from the hot water system or assoc. pipes outside the central bathroom, and fairly recently as only 'early coloniser' fungi such as Penicillium were seen to any great extent rather than other slow growing fungi including true wood rots. Not consistent with a shower base leak, although underneath is wet.

Remediation of the subfloor would likely require removal of flooring of bedroom and bathroom.

INSTRUCTIONS

Prior to assessment of this property, Biotopia was requested to investigate and provide a report on the following / interpreted thus:

1. Is there a significant mould or moisture ingress problem?
2. If there is a problem, what may be causing it?
3. Suggest a strategy for the remediation of the above issues.

BACKGROUND

From information given verbally by the owner/representative and from initial general visual impressions:

- The structure is a single-storey brick veneer free-standing house on a large property with a slight slope at and under the house, then sloping off at a greater gradient beyond the house; roof is metal with anticon-style blanket underneath (fibrous mineral top, foil bottom); suspended timber flooring with polished boards in many areas, tiles in bathrooms/WC, chipboard / carpet in bedrooms; wide slatted timber decking and veranda at one side (overlooking panoramic views down the slope); wide eaves and covered areas up the slope, with slab paving; asphalt sealed vehicle access and parking under covered carports.
- Occupants: at time of assessment, only one adult in the front section of the house and master bedroom; often occupied by multiple other people when operating as a 'bed & breakfast' however, with four bedrooms and separate bathroom, toilet, kitchenette at rear.
- The owner/occupant stated to me that:
    - A hot water system near the house at the bathroom mid-rear of the house on the uphill side had ruptured or otherwise involved in an event that caused flooding to the subfloor under this bathroom;
    - They were informed by a remediation company that there was mould throughout the entire house and that it was a health concern, and ought not be occupied nor run as a bed & breakfast until fully remediated by their company, and charged the owner around $6200 for the collection of samples taken from the site used to make this conclusion, and then estimated the cost of remediation to be around $140,000 or so;
    - They were greatly concerned by this as this was their primary income, and were also surprised by the far greater than expected costs.

- I declare that none of the relevant parties are known to me aside from this sole professional interaction, and that I have no conflicts of interest nor vested interests, and that I have an agreement for the payment of all my professional fees in advance regardless of the outcome of this report, and have been paid in full prior to report send-out nevertheless. I do not operate nor have financial interests in any remediation or similar cleaning or repair business. I am guided by the published best-practise standards and guidelines for physically testing mould/fungi and moisture. This is therefore a true and accurate report to the best of my knowledge.

OBSERVATIONS

1. MOULD: see Tables	Little evidence of significant mould in the habitable parts of the house; ample amounts in the subfloor; some in the roofspace; some on A/c louver/s; some visible Cladosporium on curtains in the small bedrooms. A small air purifier unit was in operation in bedroom #3. A/c units tend to collect dusts and grow mould under normal operation, especially if turned completely off from chilling function, hence leaving the wet fins to warm up and go mouldy; this is not a significant health hazard if cleaned out properly on a routine basis as per the manufacturer's instructions using mild, non-ionic cleaning agents perhaps annually, and turning the chilling function off some 5-15 minutes before turning the fans off to allow the fins, etc., to warm up and dry off. House would not currently pose a significant risk to health as is, but would benefit from a mould-specific 'deep clean' to mitigate the small mould and insect contamination at present, but will require far more invasive / destructive remediation works and subsequent repair/rebuild to access the dampness and large amounts of mould under the communal / central bathroom and nearby areas as this will cause greater loss/damage in the near future, including damage to the flooring, tiles, joists and bearers, and allow contamination of the habitable areas, etc.
2. TEMPERATURE & HUMIDITY	Outside: 19.2°C, 45.4%RH = 7.49 g/m^3; Dew point 7.1 °C Inside front kitchen: 19.8 °C, 50.2%RH = 8.58 g/m^3. DP 9.1 °C Hallway in rear area: 17.8 °C, 53.1%RH = 8.06 g/m^3. DP 8.1 °C Rearmost bedroom: 18.4 °C, 53.0%RH = 8.34 g/m^3. DP 8.6 °C Doors/windows were said to have been closed for at least 3 hours prior, but some were found slightly ajar in the three small bedrooms to rear.

	Hence, significantly more humid indoors Cf outdoors. Consistent with a significant source of humidity over a wide area such as a wet subfloor. At risk of condensation overnight.
3. MOISTURE by meter	Significant moisture in subfloor timbers, flooring near the communal bathroom mid-rear of the house, low in some external brick walls at the high-side periphery of the building, but not elsewhere nor higher up in the structure.
4. SIGNS OF MOISTURE	Visibly quite wet subfloor soil via hatch in BIR of bedroom #3.
5. CONTENTS	CONDITION 1 (normal) generally, but some Condition 3 (active growth) on curtains in the small bedrooms, albeit with Cladosporium mould ("mildew") that is relatively / mostly harmless: eminently remediable by washing.
6. VENTILATION	Bathrooms: reasonably well placed exhaust fans, serviceable but uncertain actual flow rate. Rangehood: OK Laundry: Undetermined. No signs of mould on bathroom / laundry / other ceilings, etc. It is unclear where the damp air is ported to exactly. There is a 'whirlybird' on the metal roof near the front kitchen, and the chimney / stovepipe at the front main living / dining / kitchen. It is hoped there are separate external vents or pipes through the metal roof for each exhaust fan, i.e., that they no not merely port into the roofspace and then indirectly out the whirlybird as this typically results in elevated humidity, condensation and mould growth.
7. REMEDIATION-RELATED AIR FLOW and activity	N/A
8. AIR FLOW TO SUBFLOOR adequate (≥6000 mm^2/m)	Not specifically measured, but unlikely due to the 'slits in bricks' type that are often half-covered, infrequent and narrow, with decking over the downhill side thus requiring double-sized vents (>12000 mm^2/m).
9. ODOUR	Musty, mouldy in several areas, primarily the small bedrooms low down near the floor, and greatly so in the subfloor.
10. THERMOGRAPHY:	No significant features seen

thermal features consistent with current moisture observed in locations suitable for this type of assessment such as plasterboard walls, ceilings.	
11. DAMAGE TO STRUCTURE, CONTENTS FROM MOULD, MOISTURE	Significant untreated damage / mould / moisture seen in subfloor around the central communal bathroom, but not elsewhere in the subfloor at front and rear where accessible by other hatches there. Some mould on windows, curtains in small bedrooms, but not greatly so.
12. CHEMICALS AND OTHER HAZARDS	Mouse droppings in the master / front bedroom WIR 'hatch'.

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CONCLUSIONS

1. Is there a significant problem?

1.1 Yes, there is a significant problem in the house, namely the dampness in the subfloor under / near the central communal bathroom and bedroom #3.

1.2 This has consequently resulted in condensation and mould on / near the windows in the small bedrooms.

1.3 Similarly the extreme mould found in the subfloor.

1.4 Mould found in the roofspace was a mix of old dust / spores blown in, and also some more recently grown fungi likely relating to the recent increase in humidity from the subfloor dampness.

1.5 Some mould on the A/c louver in the kitchen / front area (and by inference other A/c units), but not greatly so nor cause for concern, instead being typical of these units after a few years use. Can be associated with allergic rhinitis in sensitive individuals. Easily remediated by following the manufacturer's instructions to gently clean the fins, louvers, filters, coils, etc., on a perhaps annual basis, and avoid turning the fans off without having turned the chilling function off some 5-15 minutes before to allow everything to warm up and dry off, thus preventing the cold wet fins from becoming warm wet dusty surfaces prone to rapid mould growth. Do not ever use alkaline, oxidising or harsh cleaning agents on the delicate aluminium fins. Ideally get a professional A/c technician to perform this work, and watch that they actually do physically remove built-up grime, dusts, mould, etc., not just spray n' pray.

1.6 At present there is no evidence of significant mould growth in the habitable areas of the house, nor significant cross-contamination from the mouldy subfloor (and to an extent the roofspace), at least not so much as to be a significant cause for alarm.

Some deep-cleaning with a focus on mould removal (Cf just spraying or fogging with something) such as shampooing, washing, mopping, laundering, wet-wiping, microfibre cloth use, and drying promptly is suggested to mitigate the mild mould situation at present.

Also keeping the house well-ventilated and dry to prevent condensation and/or high enough humidity to allow mould growth.

However, this situation will change over time if the dampness in the subfloor is not dried out, and the mould that has already grown there is physically removed lest it be blown back into the habitable parts of the house. Encapsulation of the mould would be challenging to achieve given the very low

headheight that would greatly restrict the range of a spraying unit wand under the bathroom, and the encapsulant tending to trap moisture in the chipboard, timber and under tiles resulting in physical warping, foxing, delamination, waterproofing failure, tile cracking and lifting, floorboard cupping, and biological rotting by other organisms including insects, true wood-rots (Basidiomycetes), and consequent loss of physical structural integrity.

2. If there is a problem, what may be causing it?

2.1 Primarily, consistent with a pipe water escape or similar event at the uphill side of the house near the communal central bathroom, allowing a large amount of water to flow under it into the subfloor there, but not greatly so elsewhere far beyond.

This has then caused significant moisture in the subfloor timbers and flooring, with consequent mould growth there, and insect activity as typical.

Water vapour / humidity has then increased in the subfloor, affecting nearby floor sections, and risen up through the flooring especially in the three small bedrooms, as usually happens in these events.

This has then resulted in condensation on window panes overnight, and consequent mould growth on the panes, frames and curtains especially in the mornings when temperatures rise before curtains and windows are opened.

2.2 Not consistent with other possible events or ongoing maintenance issues other than that noted of the A/c header units.

That is:

- it is assumed the house had a valid certificate of occupancy indicating it was up to relevant in-date codes
- the house would benefit from greater subfloor airflow, but even if well above the minimum requirements, would not have prevented the noted dampness, mould in the subfloor as this is not the function of subfloor ventilation, instead being to keep a dry subfloor dry from groundwater / water table percolation, not to dry a wet subfloor.
- no evidence of significant water ingress elsewhere in the subfloor, being frontmost and rearmost areas, thus unlikely to be a significant flow of water down the gentle gradient at the uphill side of the house
- includes the asphalt sealed carport and roadway

- shower base in central bathroom doesn't appear to have been leaking in any significant manner such that if so it would usually show up as a particularly rotten, mouldy, damaged section underneath, typically along the corners where waterproofing often fails due to poor techniques, lack of 'bandage', fillets, 'noodle' / bond-breaker, etc. Instead, underneath seems OK even if damp. Of course this is near where the hot water system was for obvious reasons, and then flooded that area when it burst.

2.3 Consequent damage including excessive growth of fungi including moulds that have caused noxious odours and the release of hazardous, noxious dusts including great numbers of viable ("live") and non-viable ("dead") mould/fungal spores, and probably / typically also associated insects (dust mites, carpet beetles, springtails, etc.) in a manner likely to induce a significant immune reaction in susceptible people that increases over time with further exposure, especially if living/sleeping in that room and thus inhaling these particles or otherwise being present on/in them.

Some possible albeit small risk of infection and possibly mycotoxin intoxication, but far more likely allergy and triggering a cascade of cytokines that makes a person feel unwell, causes inflammation, etc., that can take a prolonged time (many months) to become less acute / less pronounced, and likely cause that person to be more or less permanently sensitive to those types of moulds, which may be present in other houses, apartments, hotels, foodstuffs and material items, etc.

3. Suggested brief strategy for remediation of above issues based on Results and IICRC / ANSI s500 and s520 Standards.

3.1. This suggested strategy is for the destructive strip-out and remediation of the central bathroom and nearby adjacent areas, not a temporary early mitigation deep-clean as described/suggested elsewhere.

3.2. Hence, areas / rooms to be contained / evacuated of contents items / sectioned off, etc.:

a. CENTRAL BATHROOM ITSELF

b. SMALL SIDE BEDROOMS #3, #2 AND POSSIBLY #1

c. HALLWAY / LAUNDRY AREA

d. OTHER ADJACENT AREAS FOUND TO BE WET, MOULDY, CONTAMINATED WHEN AFOREMENTIONED AREAS ARE OPENED UP ALLOWING DIRECT INSPECTION, MOISTURE METER READINGS, MOULD SAMPLING, ETC.

3.3. Inventory, remove, remediate-wash, wrap (or discard) all contents items including clothing, bedding, toiletries/cosmetics, cookware, food items, pictures/paintings, furniture, window coverings / blinds / curtains, rugs, etc., and store in a clean, safe, dry, temperature controlled location ideally verified mould-free. Run a dehum in it, ideally.

3.4. Identify and repair or temporarily mitigate the source/s of moisture ingress if not already so done. In this case, check that the plumbing at the high-side of the house is indeed repaired and unable to release water again.

3.5. Strict containment protocols as per standard, including: warning signs (ideally with date and contact name/mobile phone number); appropriate PPE with documentation of respirator filters being in-date; keeping health and site access / visitor logs; prohibition of any non-remediation personnel entering during remediation works; use of multiple containment cells via sealed plastic sheets, zip-doors, air pressurisation / flow balancing, HEPA filtration, etc.

Ideally the zip-doors will allow easy movement of personnel and large equipment through them, and are easy to zip shut, perhaps even self-seal as long as they can hold at least 20 Pa pressure differential and/or strong outdoor wind events.

Pressure test to ensure there is indeed a negative pressure / partial vacuum / low pressure ‘well’ established in the active work-zone / cell to prevent spill-out of dusts raised.

IT IS NOT ENOUGH TO HAVE A HEPA FILTER UNIT JUST RUNNING IN A ROOM.

Put a draft-tube on the HEPA unit's blowing end, ideally blowing FROM the active work-zone INTO the non-active cells or better yet outdoors. Ensure unfiltered air doesn't blow from the active-cell especially when personnel open the zip-door and enter/exit.

Replenishment HEPA filters through the barriers and zip-doors ought to be considered to prevent over-pressurisation without compromising filtration.

3.6. Remediate and seal up HVAC ductwork, vents, louvers, registers, electrical appliances (ovens, fans, etc.), fixtures/fittings (inc. lights, power-points, switches, ports, conduits), or remove them.

3.7. Ideally, complete remediation works in the cells furthest from the exit/s, then seal that cell with warnings on the zip-doors, working towards the exit/s thus limiting probability of back-contamination from personnel moving through cleaned areas.

3.8. Bag, wrap or otherwise seal all debris, materials to be discarded before they leave the containment cell, and ensure the skip bin is tarped down to better prevent dust escape and cross-contamination. Take the debris outdoors directly from the cell it came from rather than drag it through other areas: use windows if needed.

3.9. Remove skirting boards, tiles, shower bases, tubs, etc., and wall panels from floor to ceiling and remediate surfaces. Discard any fibrous insulation. Check any membranes on both sides for staining / damage / possible growth / signs of condensation, etc.

Note: humid air rises up within the wall cavities and thus mould often grows high within the cavity, but is usually not visible as normal for most moulds.

3.10. Replace rotten baseplates, bases of studs within cavities, cleaning/remediating underneath each. Seek advice from a suitable engineer/builder re. structural load-bearing elements.

3.11. Micro-detail clean, remediate, scrub, HEPA vacuum, wet-wash, mop, etc., all exposed surfaces including ceilings, walls, pelmets, windowsills, doors, floors AND all remediation equipment (dehums, air movers, HEPA units, etc.)

3.12. Continue to dry the subfloor soils/timbers, and wall frames completely

Note: watch for the two-phase drying profile and long 'tail-end' of drying typical of masonry, thick timbers. Air movement and many dehums helps 'wet' phase, but only heat helps 'damp' phase when fewer dehums / air-movers are required. Monitor the air temp and humidity. It is possible drying of the walls and floors will take many weeks-months. Careful attention ought to be paid to the likely adsorption of humidity by various hygroscopic building materials throughout the entire structure

including structural concrete walls / floors / underside of floor above that are hidden behind panels, the plasterboard panels themselves, timber frames (if any).

The ABCB Condensation in Buildings Handbook Section 4.8 suggests there would be perhaps 200-400 litres of hygric capacity above normal outdoor equilibrium that may need to be removed, having soaked into the materials while humidity was very high for an extended time. Not doing so tends to cause failure of new materials placed near them and a return of mould and insects.

3.13. After 48-72 hrs, repeat the micro-detail clean, then allow at least 24 hrs before clearance sampling by IEP

3.14. Have an independent IEP (IIEP) collect samples and perform a ***post-remediation verification*** (PRV) get a valid **PRV certificate** (as per IICRC s520 sections 12.2.1, 12.2.2, 15, 16; s500, 12.5.9, etc.)

NOTE: Do not attempt to collect samples or perform PRV yourself as this could be deemed a 'conflict of interest.' Similar comments regarding the remediator collecting samples for PRV.

NOTE: Ensure the IIEP is suitably qualified and experienced in mould sample collection including relevant ASTM standards, moisture 'mapping', and trained/qualified in remediation including the s500 and s520. These are not known to the majority of remediators, 'hygienists', builders, building consultants, engineers, etc., and this has a significant effect on the accuracy of the PRV and conclusions drawn.

3.15. Only after receipt of the valid PRV certificate should containment be taken down and site control formally passed to the Repair-Builder (R-B) for rebuilding works.

3.16. R-B ought not to have to remove any panels, architraves, floor coverings, skirtings, tiles, window frames, etc., as these should have already been removed by the remediator at the R-B's request, just in case pockets of mould/rot or mould-contaminated dusts are released without HEPAs in operation, personnel not wearing PPE, etc., and hence re-cleaning required.

3.17. Wiring, power points, junction boxes, electrical fittings, motors/fans, metal pipes, brackets, frames, ductwork, etc., ought to be tested by a suitably qualified professional, especially in formerly damp areas likely to have had corrosion.

OTHER NOTES

Methods used in the preparation of this report may have included but is not limited to, and in accordance with common practice in monitoring environmental surfaces in industry:

- Use of 'sterile technique', disinfection of hands, equipment before and after use, and due diligence to avoid cross-contamination. 400-hole plate was cleaned by warm ultrasonic bath in RO water with detergent every two weeks, and cleaned onsite with single-use alcohol-based lens cleaning wipes to avoid residue build-up.

- Viable-count surface samples (SV): Sterile cotton fibre tipped swabs, 10 cm^2 area, immediately inoculated onto agar media onsite. For transport or storage prior to inoculation, dry sterile cotton tipped swabs in their own sterile tubes were used dry and kept dry and cool (or no more than room temperature) and away from radiant heat / light.

- Total-count surface samples (ST): Where possible, as per ASTM D7658-17. Zefon 'Bio-Tape.' Total sample area 25.4 mm x 16 mm = 4.1 cm^2. Total counted area at 400x was **0.119 cm^2** (approx. 3% of total sample area), by 'no-overlap' method (63 discrete non-overlapping adjacent FoV, being 31.5 FoV/row x 2 rows; rows were typically separated by some distance and not adjacent) hence raw numbers of particles counted from inner red lines on Bio-Tape were converted to 'per cm^2' by **x8.42**

- Viable airborne fungal particles (AV): SKC 'QuickTake30' unit with an Andersen single-stage 400-hole impactor calibrated at approx. 30 L/min, 5 min hence ~150 L of air (~ 0.15 m^3). Calculation of raw-count viable airborne fungal numbers were (via pre-prepared lookup table), not factored for use of dried air and plastic Petri dishes (i.e., 1.0x) as per Andersen, J Bacteriol. 1958 November; 76(5): 471–484, then Andersen Table 1 was applied, then expressed as 'per m^3 ' as calibrated and rounding to nearest integer.

- Total airborne particle sample (AT) collection as per ASTM D7788-14: SKC 'QuickTake30' unit calibrated at approx. 30 L/min, 5 min hence ~150 L of air (~ 0.15 m^3), and a fresh Zefon 'Air-O-Cell' cassette unit that was then re-sealed. Analysis as per ASTM D7391-20: examined microscopically at 400x, counting 100% of the sample as per 12.3.8.1c, and thus converting from raw numbers per sample to 'per m^3 ' as calibrated.

- Agar media: "SabGC" agar media in plastic Petri dishes were used and cultured for 3 days at 27°C with periodic examination and photography if practicable. Raw counts were converted from 10 cm^2 sampled to 100 cm^2 by **x10**

- Microscopy: Radical RXLr-3 at 40x/100x/400x/1000x with Lactic Acid-Glycerol-Cotton-Blue and/or equivalent using a red dye for technical reasons, and/or epifluorescence, phase-contrast, bright-field, oil-immersion, Gram-stain techniques as required. Calibrated periodically (**490** μm diameter FoV at 10x40, resolution <0.7 μm). Images shown are not the complete FoV for technical limitation reasons, and are used for illustrative / confirmatory purposes rather than exhaustive.

- Thermography: Testo 875-2 thermographic camera with SuperResolution module active.

- Moisture, temperature, humidity: Testo 606-2 two-prong resistive moisture, and temperature humidity meter. Testo 616 pinless capacitive reactance moisture meter.

- When possible, occupants were asked to keep doors and windows closed for at least 3 hours before assessment, and to not run air-con, dehumidifiers, humidifiers / steam-generators, tumble dryers, oil burners and similar things that may alter the absolute humidity within the property to obtain the most representative figures of the humidity in the structure, and also airborne fungal counts given that both are significantly affected by ventilation.

- References include: CDC, USA guidelines (2003); US ACOEM 2002; Australian NHMRC EH32, others; Aust. EPA guidelines; WHO Guidelines for IAQ – Dampness and Mould, 2009, ISBN 978 92 890 4168 3; Australian Standards, Building code of Australia, ISO and other relevant recognised guidelines wherever possible including ASTM D7391-20, D7788-14, D7789-12, D7440-08, D7338-14, D7910-14, D7658-17, and peer-reviewed publications in scientific journals including WDBlack PLoS ONE 2020. See http://www.biotopia.com.au

N.B.: Mould will only grow in response to moisture on a suitable food source, producing a great number of live / viable spores. These spores can then spread like dust in small air currents and movement of people and contaminated items, being viable for a number of months but not growing unless a suitable damp food source is settled upon. People can inhale these spores and other mould-associated particles and become increasingly allergic over time, especially if the spores are viable and the person is susceptible to allergies. If a person is significantly immunocompromised or otherwise unwell, there is a risk of infection by some types of moulds that may or may not be present in any particular house. Other organisms such as house dust-mites, carpet-beetles, springtails, etc., may however also grow to significant numbers and elicit significant allergies under similar conditions. Note: high OA, DS, IS scores and/or lack of AE, especially with low viability suggests fungal counts are from mere accumulation of seasonal dusts over time rather than a true fungal growth event.

Dr Wesley D. Black

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Member of the Australian Society of Building Consultants (MASBC), Member of the Australian Society for Microbiology (MASM), Member of the Building Dispute Practitioners' Society (BDPS), Member of the Metrology Society of Australia (MSA), Member of the Australian Mycology Society (AMS), former Secretary of the Indoor Air Quality Association, Australia (IAQAA, 2019-2020), Member of the Australian Institute of Occupational Hygiene (MAIOH), Member of the Australian Virology Society (MAVS).

Dr Black is proficient in environmental assessments and is a qualified, recognised microbiologist with a PhD in that field. This report is intended to be used in conjunction with civil engineering consultant and other building professional reports as deemed suitable by the insurer and legal bodies.

Biotopia maintains the integrity of its reports but cannot be held responsible for inaccuracies or omissions due to inability to access all areas at the time of assessment, or subsequent actions by other parties that may have interfered with physical parameters, such as the opening up of formerly inaccessible enclosed areas that were damp, mouldy, rotten, or otherwise contaminated.

APPENDIX 1 – RESULTS TABLES

1) Airborne Viable (AV) fungal counts by culture

ID /	Location	Colony forming units (CFU)		AE SCORE	CLASS	Identified fungi (CFU)											
		/ sample	/ m^3			1. Alternaria	2. ascospores (undiff.)	3a. Aspergillus	3b. Penicillium	4. basidio: YEAST	6.Cladosporium	11. Ulocladium	12. Trichoderma	13. Chrysonilia	14. Phyllo/Phoma	15. Zygomycetes Rhizopus / Mucor.	Other comments
AV01	control, low	14	105		Normal	1	8	1	2		2						
AV02	control, high	22	161		Normal		14		5		3						
AV03	entry / kitch, dining	14	105		Normal	2	5		5		2						
AV04	front m'bed	14	105		Normal	3	8		2	1							
AV05	rear hallway	12	91		Low	2	3	1	3	1	1				1		
AV06	rearmost bedroom	5	35		Low		1		3	1							

AV QuickTake30: 'Betty' #867596; Calibration: 7 Mar 2024 @28.5 L/min.
NOTE: Not useful for detection of some fungi such as *Chaetomium* and *Stachybotrys*, and *Basidiomycetes* (mushrooms, toadstools, etc.) other than yeasts. Others tend to not sporulate within the standard 3 days incubation at 27 °C in incidental room light on SabCG medium, thus are counted as "2. ascospores (undifferentiated)".
Results read: 6 Sept. 2024, WDB.

2) Results: Surface Viable (SV) fungal counts by culture

ID /	Location	Colony forming units (CFU)		AE SCORE	CLASS	Identified fungi (CFU)											
		/ sample	/ 100 m^2			1. Alternaria	2. ascospores (undiff.)	3a. Aspergillus	3b. Penicillium	4. basidio: YEAST	6.Cladosporium	11. Ulocladium	12. Trichoderma	13. Chrysonilia	14. Phyllo/Phoma	15. Zygomycetes Rhizopus / Mucor.	Other comments
SV01	Pantry fridge top	72	720	3	Elevated		5	5	57				2		3	1	
SV02	front dining A/c	12	120		Normal		2	1	8		1						
SV03	master bed hatch over WIR	17	170		Normal		6		9	1	1						
SV04	rear bedroom1, shelf	48	480	4	Normal		4	23	16	1	3				1		
SV05	bed2, bedside table	25	250		Normal	4	4	4	5	3	3				2		
SV06	bed3, BIR shelf	9	90		Low		2	3	3		1					1	
SV07	rear kitchen, fridge top	51	510	3	Elevated	19	7	2	12		6		1		4		
SV09	roofspace	40	400		Normal	5	4		18		12		1			1	

NOTE: Not useful for detection of some fungi such as *Chaetomium* and *Stachybotrys*, and *Basidiomycetes* (mushrooms, toadstools, etc.) other than yeasts. Others tend to not sporulate within the standard 3 days incubation at 27 °C in incidental room light on SabCG medium, thus are counted as "2. ascospores (undifferentiated)".
Results read: 6 Sept. 2024, WDB.

3) Results: Airborne Total (AT) fungal count by direct microscopy

ID /	Location	Sum fungal structures		AE SCORE	CLASS	Identified particles (Units or coverage)																
		/ sample	/ m^3			1. Alternaria	2. ascospores (undiff.)	3. Pen. / Asp	4. basidiospores	5. Chaetomium	6.Cladosporium	7. Curvularia	8. Drechslera Bipolaris, Fusar.	9. smut Myxo Periconia	10. Stachybotrys	11. Ulocladium	Pollen	Mineral grit	Vegetable fibre, wood, textile	Hair, fur, dander	Insect parts, frass, eggs	Other comments
AT01	control, high	20	148		Normal		5	6	1		1		5			2	*					
AT02	control, low	10	74		Low		1		2	1	1		2			3	*		*			
AT03	entry, dining/kitch at front	39	289		Normal		9	14	3		1		7			5	*	*	*	*		
AT04	hallway 'laundry', rear	58	430	3	Normal		15	30	3		4		4			2	*	*	*	*		

AT05	rearmost bedroom	44	326	3	Normal		3	33	1		4		3				*			*	*	mite

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AT QuickTake30: 'Wilma' #A92719; Calibration: 7 Mar 2024 @27.0 L/min.
Air-O-Cell serial series #3704-xxxx; Use-by date: 2024-10
Results read: 10 Sept. 2024, WDB.

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4) Results: Surface Total (ST) fungal count by direct microscopy

ID /	Location	Sum fungal structures		AE SCORE	CLASS	Identified particles (Units or coverage)																
		/ sample	/ m^3			1. Alternaria	2. ascospores (undiff.)	3. Pen. / Asp	4. basidiospores	5. Chaetomium	6.Cladosporium	7. Curvularia	8. Drechslera Bipolaris, Fusar.	9. smut Myxo Periconia	10. Stachybotrys	11. Ulocladium	Pollen	Mineral grit	Vegetable fibre, wood, textile	Hair, fur, dander	Insect parts, frass, eggs	Other comments
ST01	dining room A/c louver	60	505	3	Elevated		21	17	3		16		3				*	**	*	**		OD4 + hyphae.
ST02	pantry fridge	51	429		Normal		26	12	1	1	4		5			2	*	*	*	*	*	
ST03	master bed / WIR hatch	6	51		Normal		3	3									*	*		*		
ST04	bed 2, bedside table	62	522		Elevated		8	48	2		1		1		2		*		*	*		

ST05	bed3, BIR shelf	7	59		Normal		5	1	1								*	*	*	*		
ST06	subfloor under shower	2056	17312		Extremely High	3	1000	1000			50					3			**		*** **	
ST07	roofspace at hatch	87	733	4	Elevated		25	35	5		22						**	**	*	*		

Bio-Tape serial series #B346-xxxx; Exp date: 08 / 2025
Results read: 10 Sept. 2024, WDB.

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KEY Table 1 – VIABLE AIRBORNE FUNGAL PARTICLE COUNT relative to Outdoor Air (OA) and (generally recognised historical mean numbers)

Rating	CFU/m³	Load category *1	Comments
Not Detected	0		May indicate lack of growth on media, lack of detection cf. actual absence
(Low)	<100	+	Only practically possible with HEPA filtration, >7 air-changes/hr and positive pressure
Normal	<OA (<500)	++	Slightly less than outdoor air, with range of organisms, no dominant species
Elevated	≤2OA (≤1000)	+++	Esp. if a species is dominant, or small numbers of species of similar xerophelicity. Check spore viability and materials moisture. Respirators recommended in addition to appropriate PPE if airborne over a substantial area. A preponderance of similar spores, thus of an aberrant ecology but normal or low number may be considered 'Elevated'
High	>2OA (>1000)	+++ +	As above. The source of mould and moisture should be identified and addressed. Containment and full PPE recommended if airborne over a substantial area. Clean tools, equipment, exposed items when leaving site. A preponderance of similar spores, thus of an aberrant ecology but 'Elevated' number may be considered 'High'
Extremely High	>2OA (>5000) (+AE)	+++ ++	As above. If airborne over a substantial area, remove occupants and workers without PPE, especially with predisposing respiratory and/or immunocompromisory conditions, chemotherapy, asthma, severe allergies, etc. Monitor for infection with known pathogenic species such as *Aspergillus fumigatus*. Log eye, nose, throat, lung, skin conditions and seek medical attention as appropriate. A preponderance of similar spores, thus of an aberrant ecology but 'High' number may be considered 'Very High'

AE = Aberrant Ecology score, from " " (0 AE, normal) to "*****" (5 AE, highly aberrant), being a preponderance of similar spores, likely to be clonal, and/or different types of organisms of similar high water-activity (a_w) requirements, and thus likely to be from the same active growth area *en masse.* A normal ecology has a range of various organisms in relatively balanced numbers, whereas an aberrant ecology may have a reduced range of organisms with one or more 'dominant' mould types, which may be 'moisture loving' (high a_w requirements) and/or prefers consuming other moulds (e.g., *Trichoderma*), and/or potentially infectious and/or mycotoxigenic. Aberrant ecology may bump the classification into the next higher rating class.

OA = Outdoor Air control/s and/or historical mean figures (Black, 2020).

Adapted from and/or as per Kemp & Neumeister-Kemp, "The Mould Worker's Handbook" (2010, 2nd ed.) and "The Australian Mould Guide" (2010, 2nd ed.)

*1: As adapted from ASTM D7658-17 and D7391-20 (total count) as a general representation of relative abundance / surface area coverage.

"s" : spot sample, primarily to ID an organism in a restricted area or visible patch, not indicative of the general area.

"g" : general sample, likely indicative of the general environment / broad area / room.

"sg": indicative of a restricted area, e.g., under carpet, in cupboard, wall cavity, subfloor.

KEY Table 2 – TOTAL AIRBORNE PARTICLE COUNT, relative to Outdoor Air (OA) and (generally recognised mean historical numbers)

Rating	TC /m³	Load category *1	Comments
Not Detected			May indicate lack of detection cf. actual absence
Low	<*OA/2* (<100)	+	Only practically possible with HEPA filtration, >7 air-changes/hr and positive pressure
Normal	<OA (<500)	++	Slightly less than outdoor air, with range of organisms, no dominant species / no aberrant ecology evident
Elevated	≤2OA (≤1000)	+++	Esp. if a species is dominant, or small numbers of species of similar xerophelicity. Check spore viability and materials moisture. Respirators recommended in addition to appropriate PPE if airborne over a substantial area.
High	>2OA (>1000)	+++ +	As above. The source of mould and moisture should be identified and addressed. Containment and full PPE recommended if airborne over a substantial area. Clean tools, equipment, exposed items when leaving site.
Extremely High	>2OA (>5000) (+High AE)	+++ ++	As above. If airborne over a substantial area, remove occupants and workers without PPE, especially with predisposing respiratory and/or immunocompromisory conditions, chemotherapy, asthma, severe allergies, etc. Monitor for infection with known pathogenic species such as *Aspergillus fumigatus*. Log eye, nose, throat, lung, skin conditions and seek medical attention as appropriate

TC = Total Count via microscopy; all identifiable fungal structures including spores, hyphae, conidiophores. Chains or clusters of small spores (*Penicillium, Aspergillus*, etc.), and/or aberrant numbers of large heavy spores (*Chaetomium, Stachybotrys*, etc.) shall be regarded as indication of nearby active growth

AE = Aberrant Ecology score, from " " (0 AE, normal) to "*****" (5 AE, highly aberrant), being a preponderance of similar spores, likely to be clonal, and/or different types of organisms of similar high water-activity (a_w) requirements, and thus likely to be from the same active growth area *en masse.* A normal ecology has a range of various organisms in relatively balanced numbers, whereas an aberrant ecology may have a reduced range of organisms with one or more 'dominant' mould types, which may be 'moisture loving' (high a_w requirements) and/or prefers consuming other moulds (e.g., *Trichoderma*), and/or potentially infectious and/or mycotoxigenic. Aberrant ecology may bump the classification into the next higher rating class.

OA = Outdoor Air control/s.

*1: ASTM D7658-17 12.2.10.1 Fungal Loading Categories and 12.2.10.2 Non-Fungal Particle Loading Categories. Category designations are subject to interpretation with reference to the control sample/s and other observations of aberrant ecology, mould types, surface area coverage. Adapted from and/or as per Kemp & Neumeister-Kemp, "The Mould Worker's Handbook" (2010, 2nd ed.) and "The Australian Mould Guide" (2010, 2nd ed.) and the manufacturer's instructions (Zefon, Air-O-Cell).

Designations are subject to interpretation with reference to the control sample/s and other observations of aberrant ecology, mould types, surface area coverage. Symbols rather than numbers are used in order to avoid confusion with numbers of particles.

KEY Table 3 – VIABLE SURFACE FUNGAL COUNTS; 10 cm² area via swab on 90 mm diameter Petri dish

Rating	CFU/100 cm² *2	Load category *1	Comments
(Not Detected)	0		May indicate lack of growth on media, lack of detection cf. actual absence
Low	<100	+	Surface may have recently been wiped or washed
Normal	<500	++	Typically with a range of common outdoor organisms, no dominant species / aberrant ecology
Elevated	<1000	+++	Respirators recommended in addition to appropriate PPE. Avoid stirring dusts up including use of HEPA air movers. Ideally use wet-washing techniques. A preponderance of similar spores, thus of an aberrant ecology but normal or low number may be considered 'Elevated'
High	<2500	+++ +	As above. Containment and full PPE recommended if over a substantial area. Clean all tools, equipment, exposed items, skin when leaving site. A preponderance of similar spores, thus of an aberrant ecology but 'Elevated' number may be considered 'High'
Extremely High	≥2500	+++ ++	As above. If airborne over a substantial area, remove occupants and workers without PPE, especially with predisposing respiratory and/or immunocompromisory conditions, chemotherapy, asthma, severe allergies, etc. Monitor for infection with known pathogenic species such as *Aspergillus fumigatus*. Log eye, nose, throat, lung, skin conditions and seek medical attention as appropriate. A preponderance of similar spores, thus of an aberrant ecology but 'High' number may be considered 'Very High'

CFU = Colony Forming Units via culture

AE = Aberrant Ecology score, from " " (0 AE, normal) to "*****" (5 AE, highly aberrant), being a preponderance of similar spores, likely to be clonal, and/or different types of organisms of similar high water-activity (a_w) requirements, and thus likely to be from the same active growth area *en masse.* A normal ecology has a range of various organisms in relatively balanced numbers, whereas an aberrant ecology may have a reduced range of organisms with one or more 'dominant' mould types, which may be 'moisture loving' (high a_w requirements) and/or prefers consuming other moulds (e.g., *Trichoderma*), and/or potentially infectious and/or mycotoxigenic. Aberrant ecology may bump the classification into the next higher rating class.

*1: As adapted from ASTM D7658-17 and D7391-20 as a general representation of relative abundance. Category designations are subject to interpretation with reference to the control sample/s and other observations of aberrant ecology, mould types, surface area coverage. ASTM does not appear to have a standard for analysis of viable airborne or surface fungi.

*2: Adapted from and/or as per Kemp & Neumeister-Kemp, "The Mould Worker's Handbook" (2010, 2nd ed.) and "The Australian Mould Guide" (2010, 2nd ed.) with acknowledgement of the lack of conclusively established and widely / formally recognised limits linked to health effects. Further adaptations from Black, 2020 and ATSM D7789-12.

KEY Table 4 – TOTAL SURFACE PARTICLE COUNT by lift-tape and direct microscopy

Rating	TC /cm²	Load category *1	Comments
Not Detected	0		May indicate lack of detection cf. actual absence
Low	<50	+	Surface may have recently been wiped or washed, especially if DS is low
Normal	<500 (≥3DS)	++	Typically with a range of common outdoor organisms; not aberrant ecology, especially if DS is high
Elevated	≤1000	+++	Esp. if . Check spore viability and materials moisture. Respirators recommended in addition to appropriate PPE if present over a substantial area.
High	>1000	++ ++	As above. The source of mould and moisture should be identified and addressed. Containment and full PPE recommended if present over a substantial area. Clean all tools, equipment, exposed items and skin when leaving site.
Extremely High	>5000 (especially >3AE <3DS)	+++ ++	As above. If airborne over a substantial area, remove occupants and workers without PPE, especially with predisposing respiratory and/or immunocompromisory conditions, chemotherapy, asthma, severe allergies, etc. Monitor for infection with known pathogenic species such as *Aspergillus fumigatus*. Log eye, nose, throat, lung, skin conditions and seek medical attention as appropriate

TC = Total Count via microscopy; all identifiable fungal structures including spores, hyphae, conidiophores. Chains or clusters of small spores (*Penicillium, Aspergillus*, etc.), and/or aberrant numbers of large heavy spores (*Chaetomium, Stachybotrys*, etc.) shall be regarded as indication of nearby active growth

AE = Aberrant Ecology score, from " " (0 AE, normal) to "*****" (5 AE, highly aberrant), being a preponderance of similar spores, likely to be clonal, and/or different types of organisms of similar high water-activity (a_w) requirements, and thus likely to be from the same active growth area *en masse.* A normal ecology has a range of various organisms in relatively balanced numbers, whereas an aberrant ecology may have a reduced range of organisms with one or more 'dominant' mould types, which may be 'moisture loving' (high a_w requirements) and/or prefers consuming other moulds (e.g., *Trichoderma*), and/or potentially infectious and/or mycotoxigenic. Aberrant ecology may bump the classification into the next higher rating class.

DS = Dust Score; particles including pollen, textile and mineral insulation fibres, dander, skin, grit (non-fungal, non-insect)

IS = Insect Score from 0IS – 5IS; particles including wings, wing-scales, body parts, hairs, carpet beetle larval hairs (non-fungal, non-dust)

Adapted from and/or as per Kemp & Neumeister-Kemp, "The Mould Worker's Handbook" (2010, 2nd ed.) and "The Australian Mould Guide" (2010, 2nd ed.) with acknowledgement of the lack of conclusively established and widely / formally recognised limits linked to health effects.

*1: ASTM D7658-17 12.2.10.1 Fungal Loading Categories and 12.2.10.2 Non-Fungal Particle Loading Categories

Category designations are subject to interpretation with reference to the control sample/s and other observations of aberrant ecology, mould types, surface area coverage

"s" : spot sample, primarily to ID an organism in a restricted area or visible patch, not indicative of the general area.

"g" : general sample, likely indicative of the general environment / broad area / room.

"sg": indicative of a restricted area, e.g., under carpet, in cupboard, wall cavity, subfloor.

APPENDIX 2 – IMAGES

1. The front of the property and house.


2. The externals, starting at the front carport, then around the high-side of the house, etc.







hot water system at central bathroom window

445



ground slopes away from house



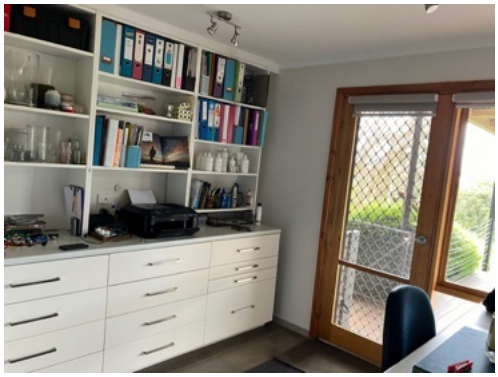





450

3. The front area open-plan kitchen, dining, living.

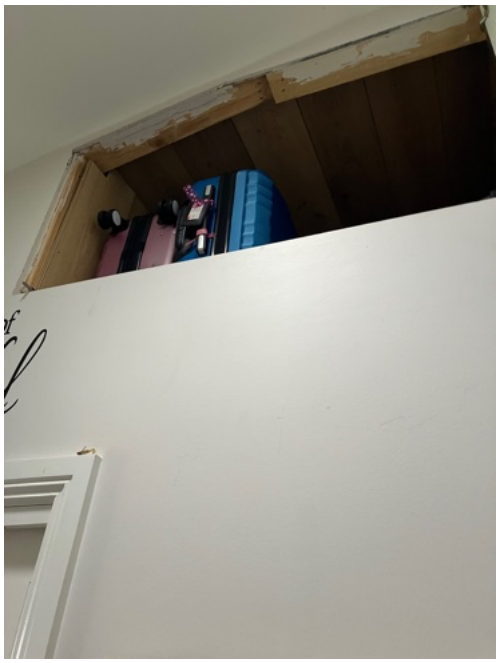
4. The pantry.

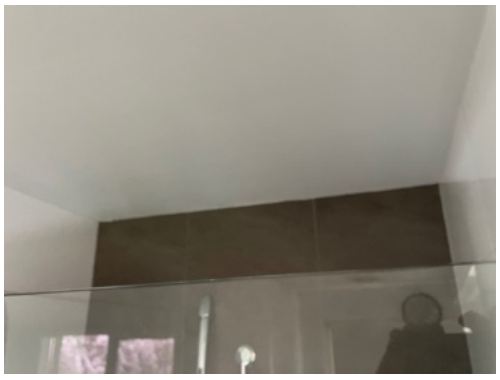


460

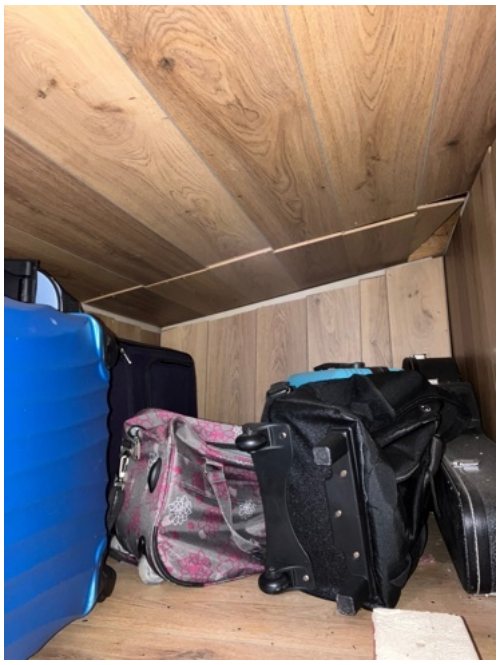
5. The rangehood flow seemed OK, and was plumbed out of the kitchen.

6. The master bedroom, its WIR, storage hatch, ES bathroom.

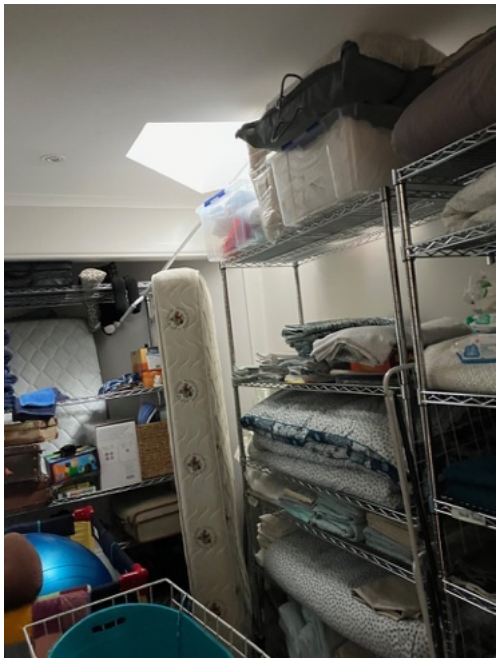





7. The storage hatch. Significant number of mouse droppings despite what seems to be a rodent bait unit.



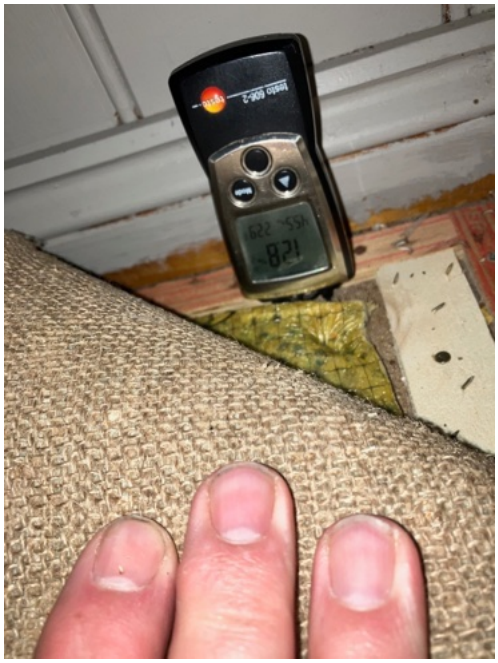
8. The storage areas to rear of front kitchen/dining.



9. The small side/rear bedrooms 1, 2 and 3, as digitally indicated.

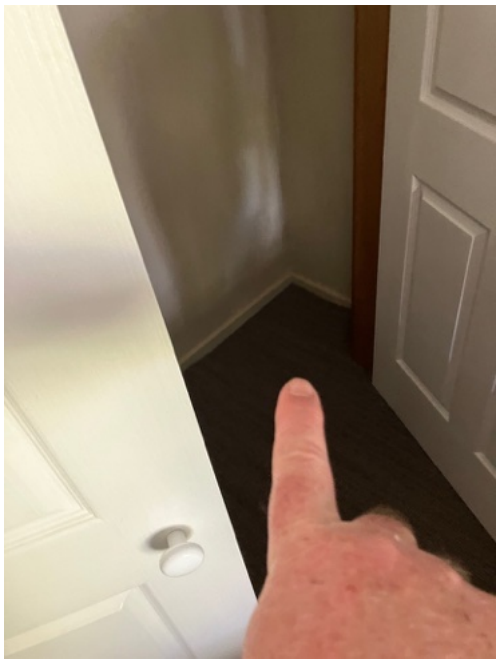
480

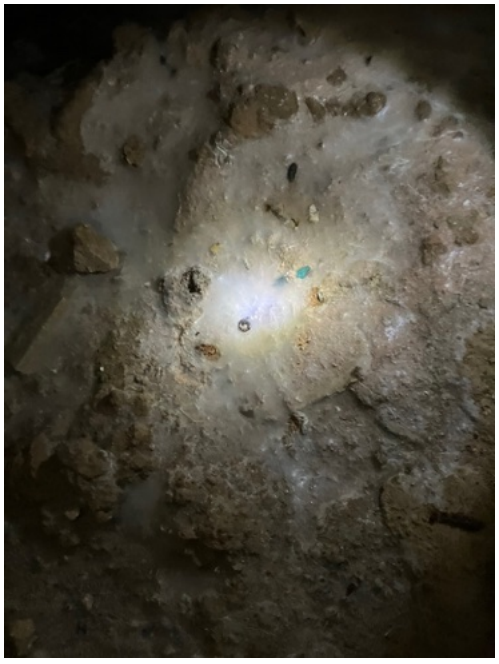
10. The bedroom 2: musty odour. Flooring not especially damp on its upper side under the carpet in various locations. Curtain not especially mouldy. Slight indication of occasional condensation on window panes.



490 **11.** The bedroom 3: flooring quite damp at far corner away from access hatch / bathroom. Rusted tacks on carpet gripper. Mouldy odour. Visible mould on curtains.

12. The bedroom 3 hatch into subfloor in the BIR adjacent to the bathroom shower. Hatch chipboard is wet as also other timbers. Strong mould and geosmin odours. The subfloor soil surface was wet and covered with a strange fibrous substance that may have been great amounts of fungal hyphae, but this is unclear. Definitely the underside of the chipboard flooring was visibly mouldy (pale dusts often in fingerprint sized colonies / patches, as typical of Penicillium and some Aspergillus species in these conditions). Soil is heaped up at this exact location, but slopes off to a possible height of about 300 mm at the high-side of the house to about 700 mm – 1 m at the low side. It is theoretically possible for a person to crawl under the house, but would be quite difficult to get under the bathroom and bedrooms in a manner to effect meaningful remediation.





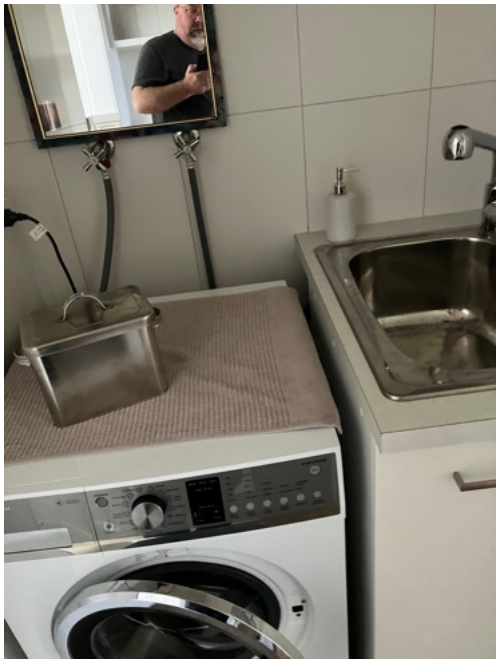
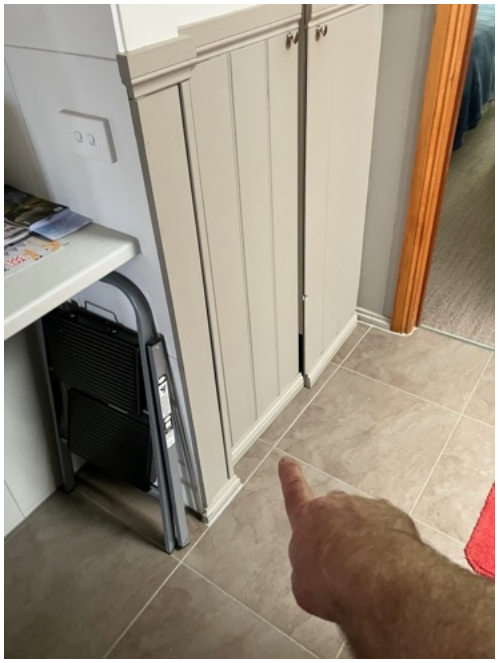


mould


wet

510

13. The hallway between front and rear sections of the house, with laundry, toilet, small cupboard to rear of the central bathroom shower. Tumble dryer is located outdoors under the front carport.

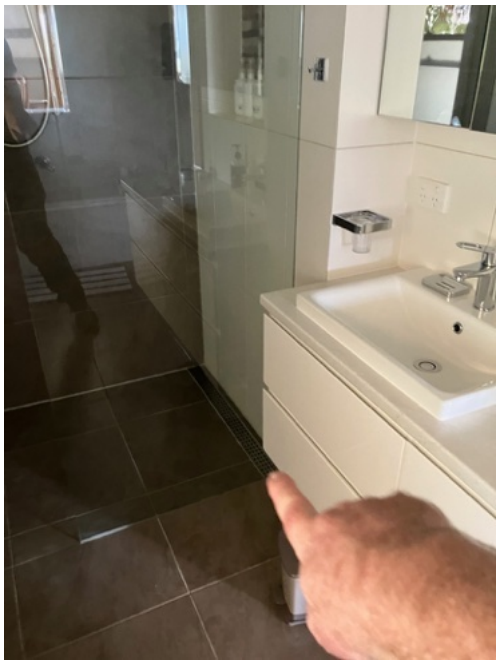
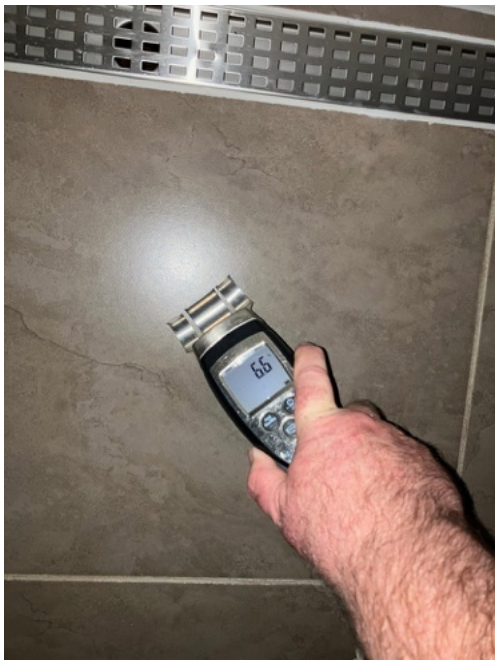



14. The bottom of the cupboard in the hallway behind the central bathroom: no evident damage, nor moisture by meter on upper surfaces of boards and backing of shower that is visible.

525

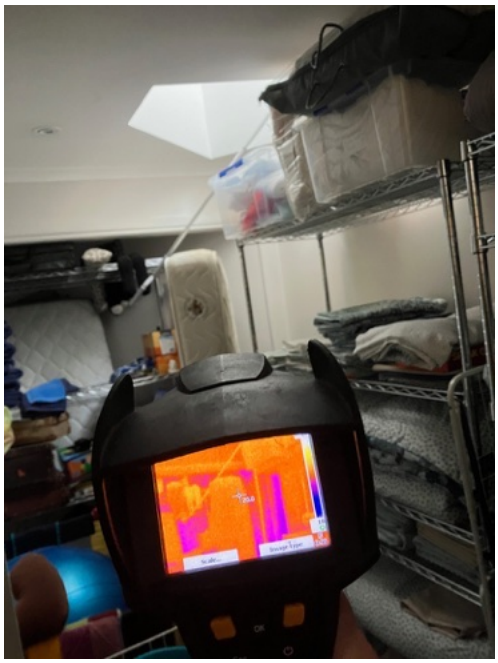
15. The central bathroom. Shower base is damp, walls dry, but not consistent with an actual leak from the shower, instead more consistent with significant dampness below the shower base and elsewhere under the tiles.



535

16. Thermography was unspectacular (subset only shown): not consistent with significant roof or skylight leak / ceiling dampness, nor tub leak, etc.

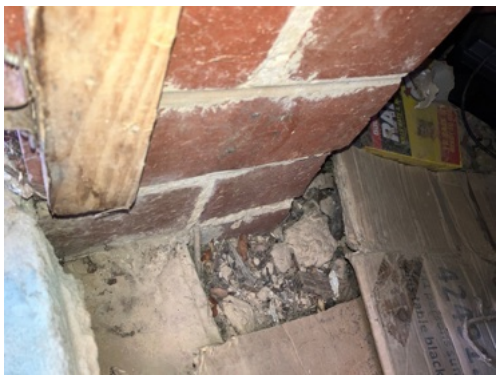


545 **17.** The rearmost kitchenette, bedroom.

18. The rearmost area flooring was borderline damp, more so on their undersides courtesy of how the two different meters work. No cupping visible, yet.

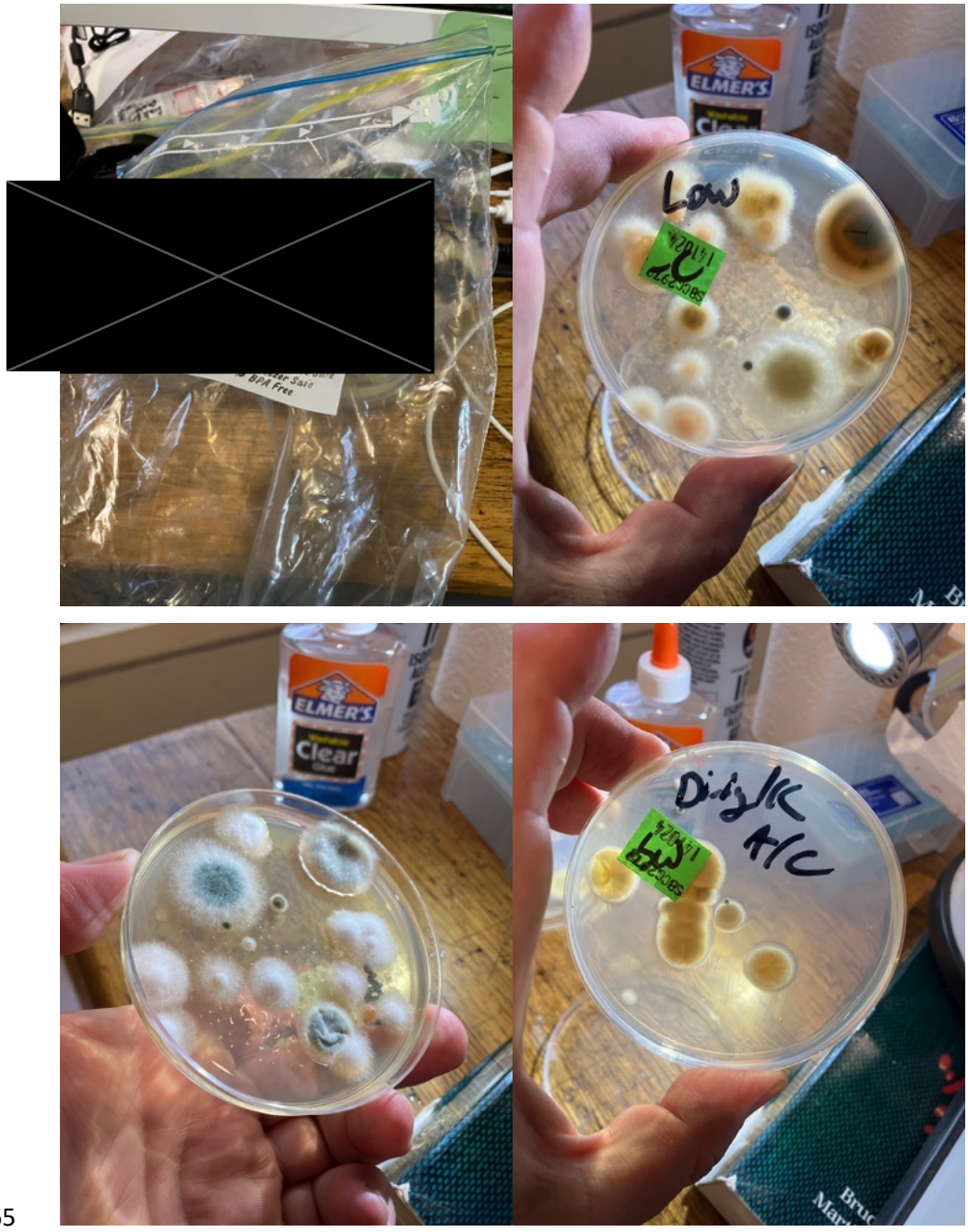
19. The subfloor hatch at the front of the house: dry and without evidence of generalised rising damp / moisture.



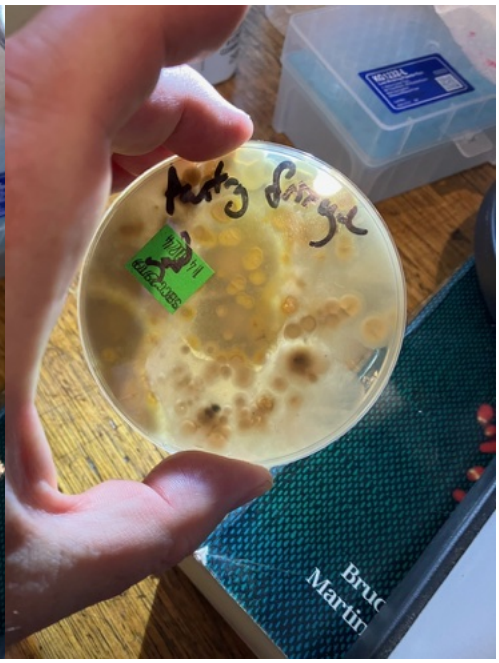



560

20. The viable surface and air samples after incubation.




ELMER'S

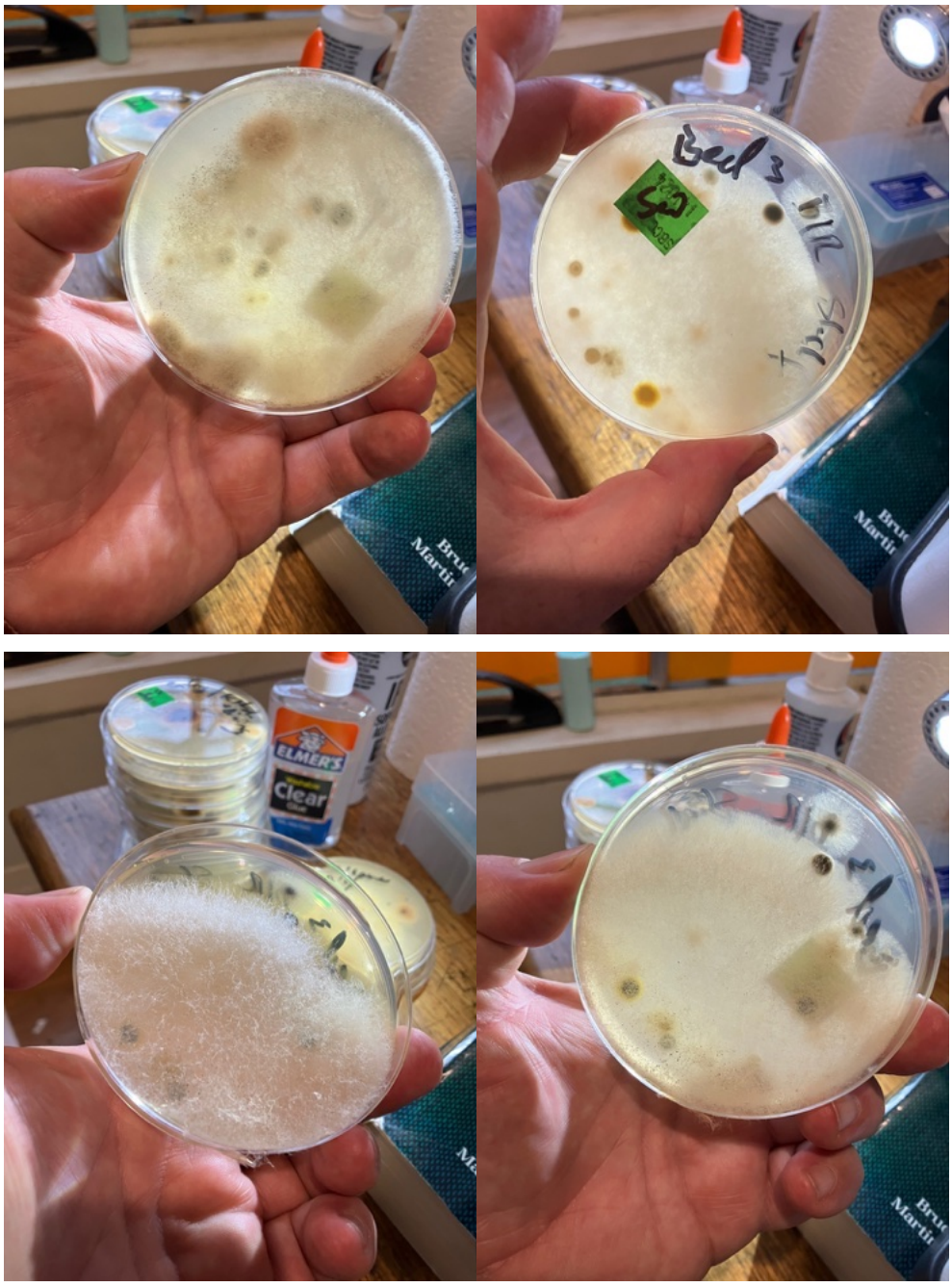



ELMER'S


ELMER'S
ELMER'S
Clear
Clear
Glue

570


ELMER'S
Clear
ELMER'S
Clear

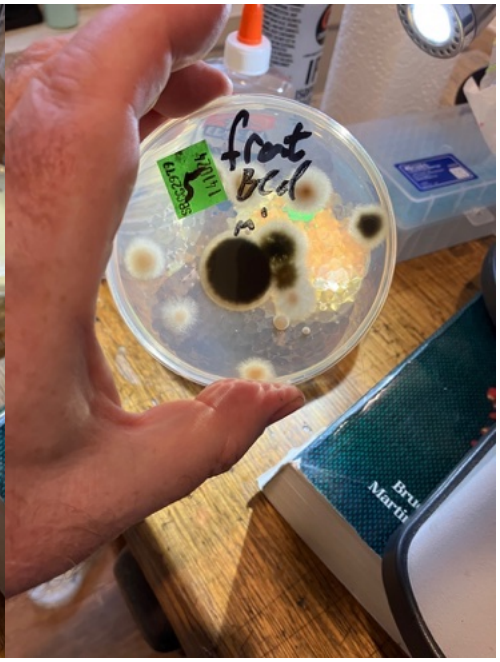


575

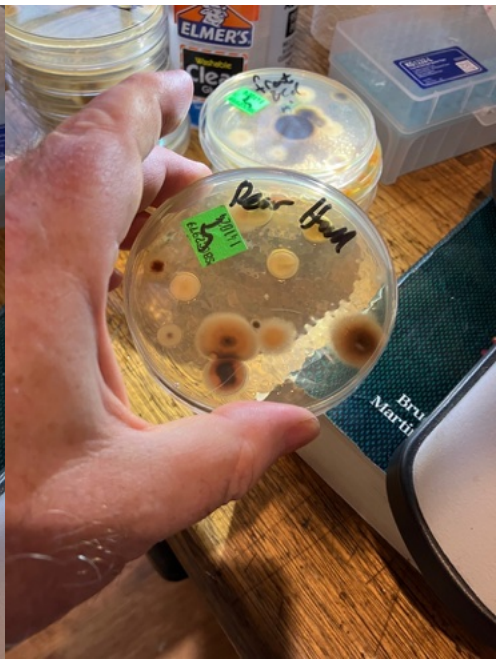

Clear
Glue


ELMER'S
Clear


ELMER'S
Clear


front
BCol


ELMER'S
Clear

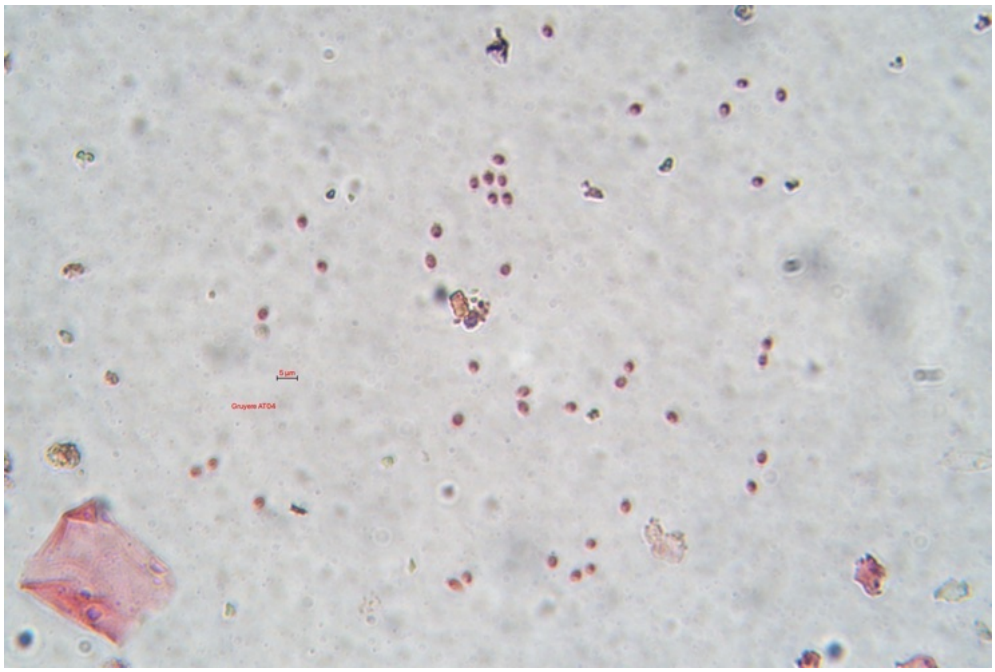

ELMER'S
Rear Hull

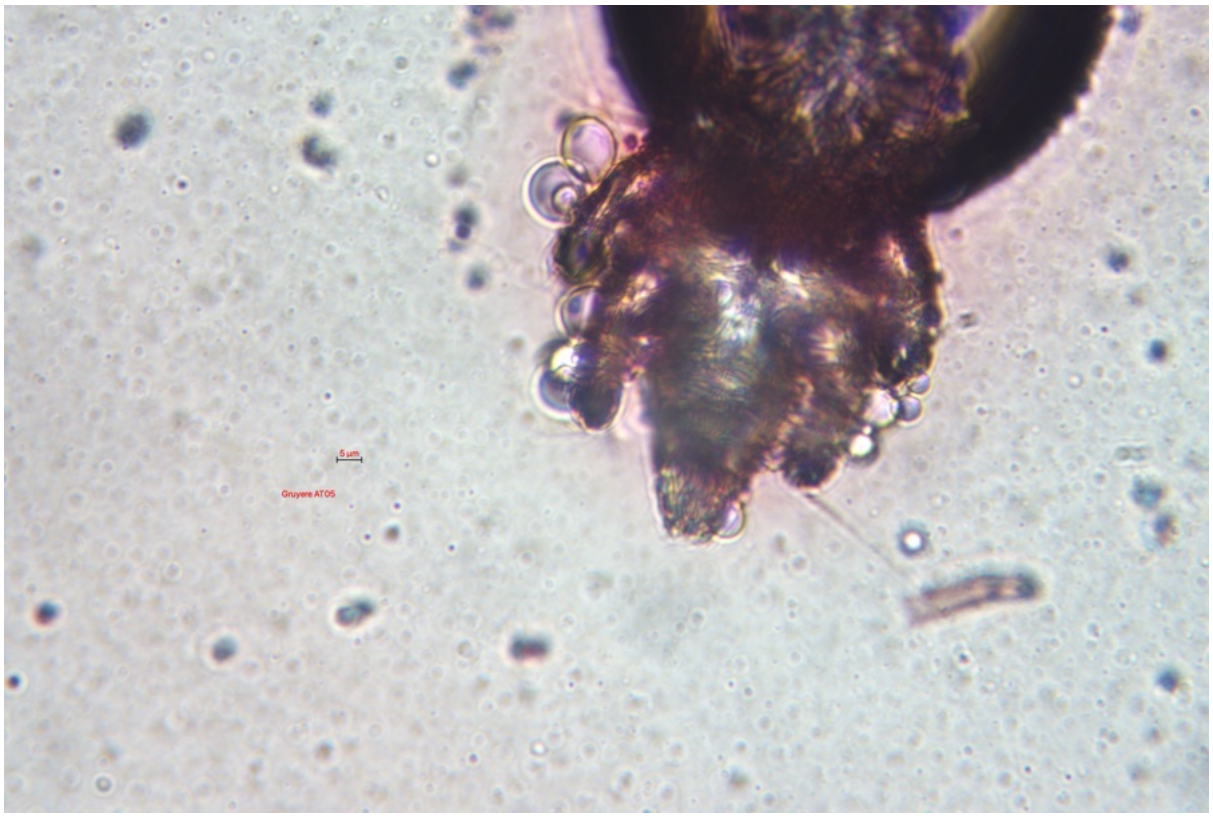

ELMER'S
Mid

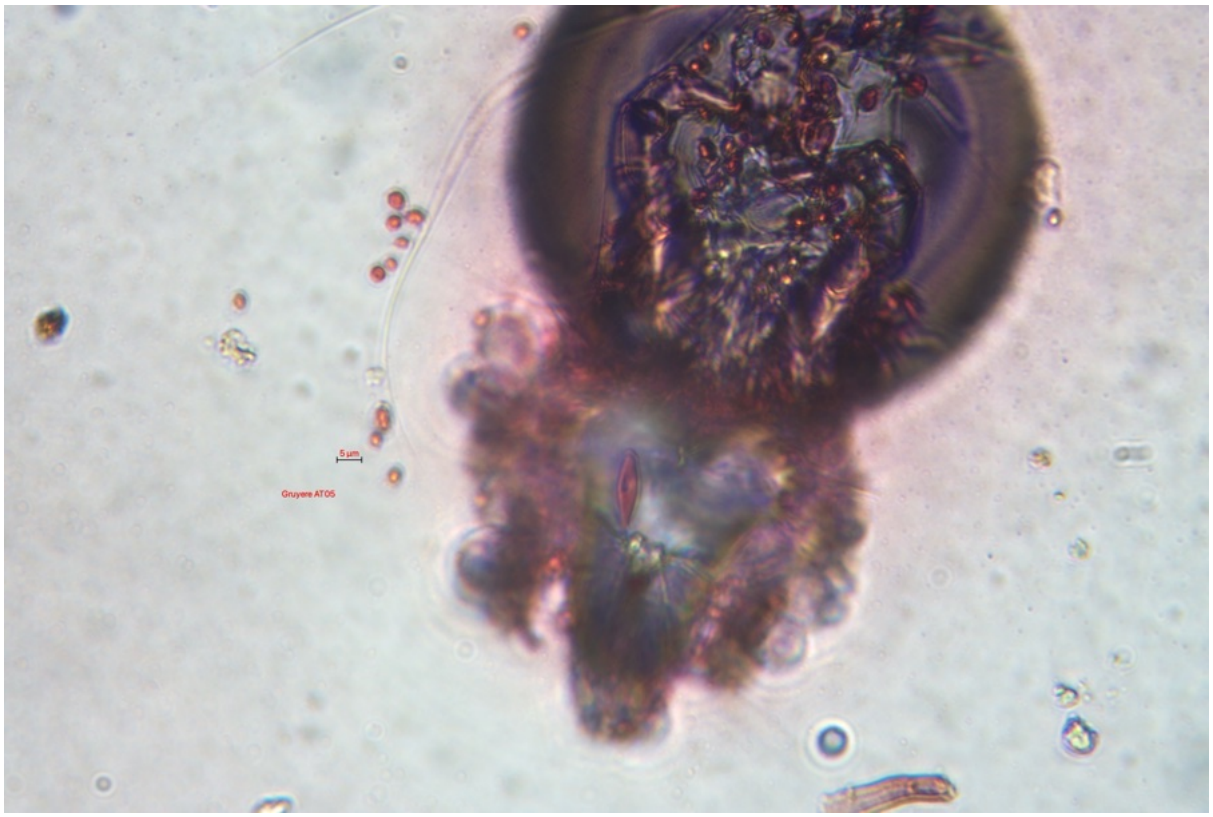

ELMER'S
Rear Hull

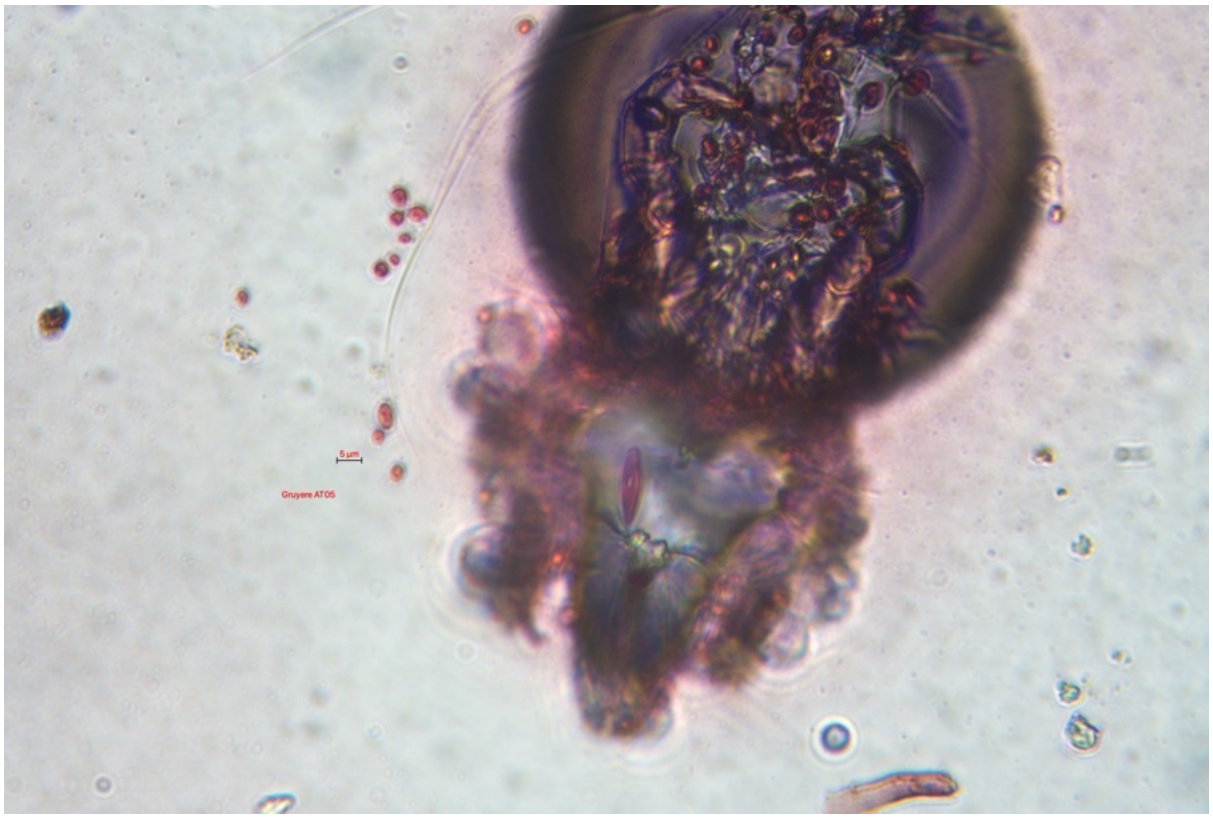
580

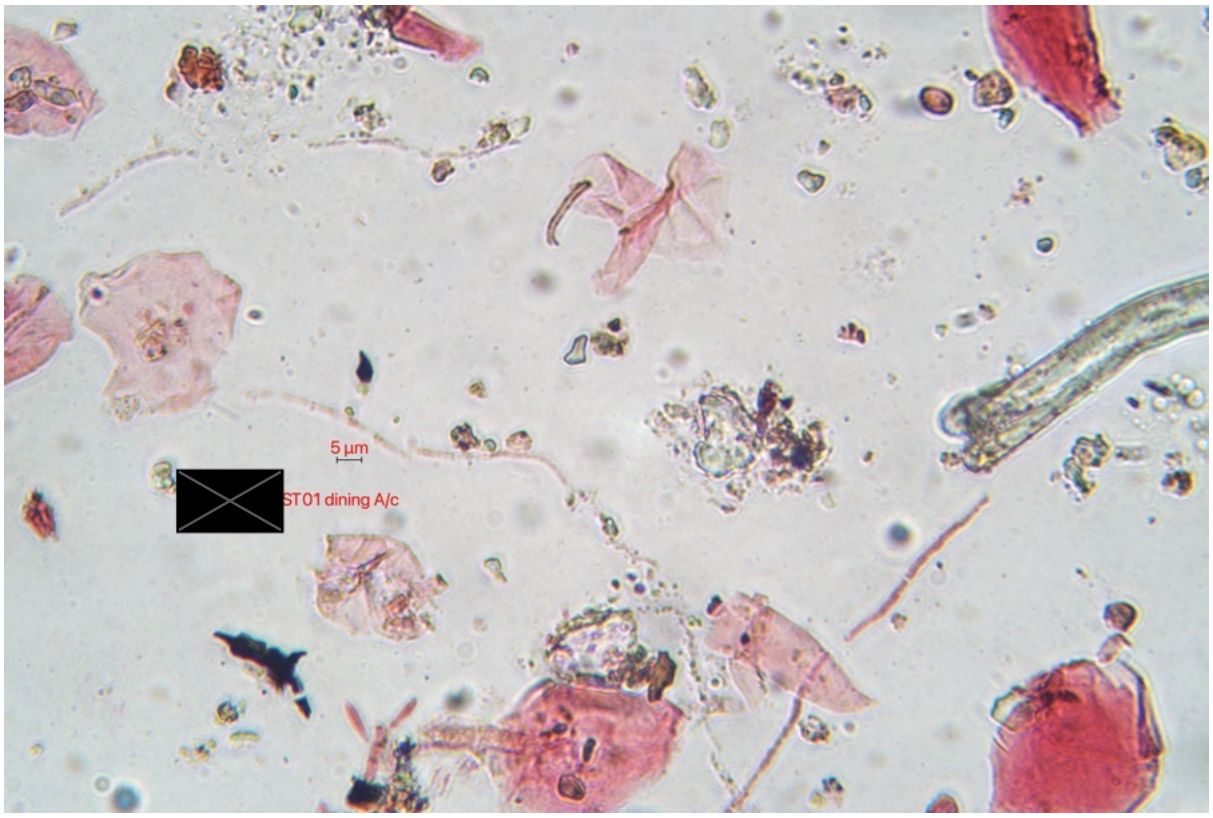
21. The total count air and surface samples: mould is stained red/magenta by this method, as also skin flakes, some textiles, some insect parts. A nearly whole dust mite (or similar) is visible with fungal spores evident around and inside it as they are known to consume such, and flourish under similar conditions of dampness. These images represent a very minor fraction of the entire sample examined by microscopy.

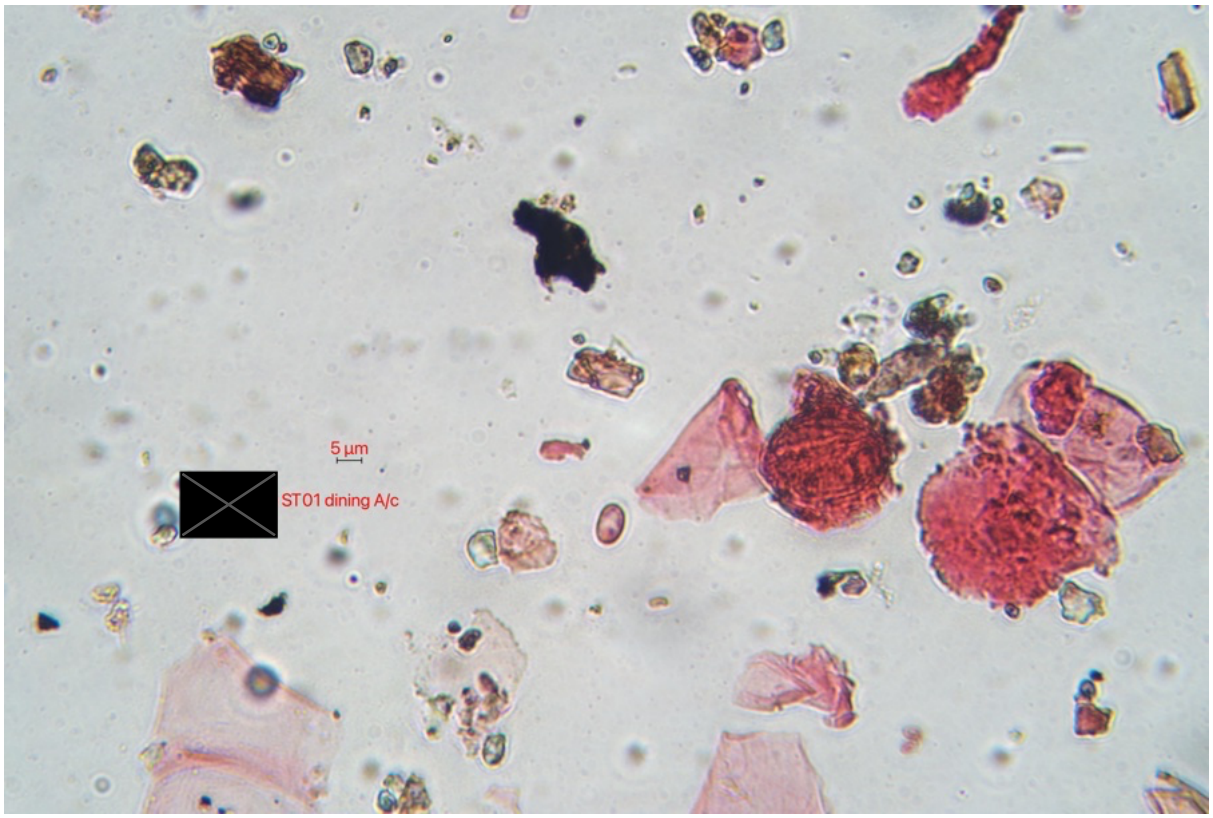


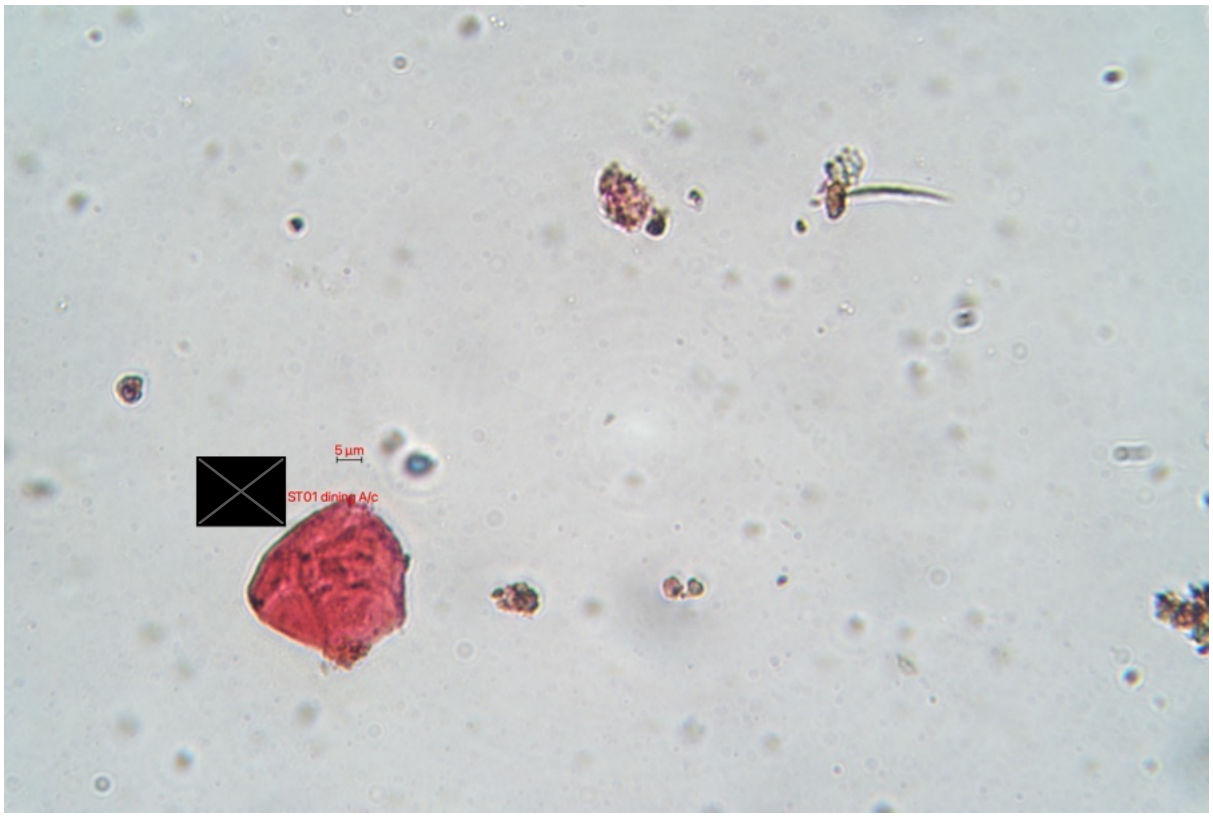



5 µm
Gruyere AT05

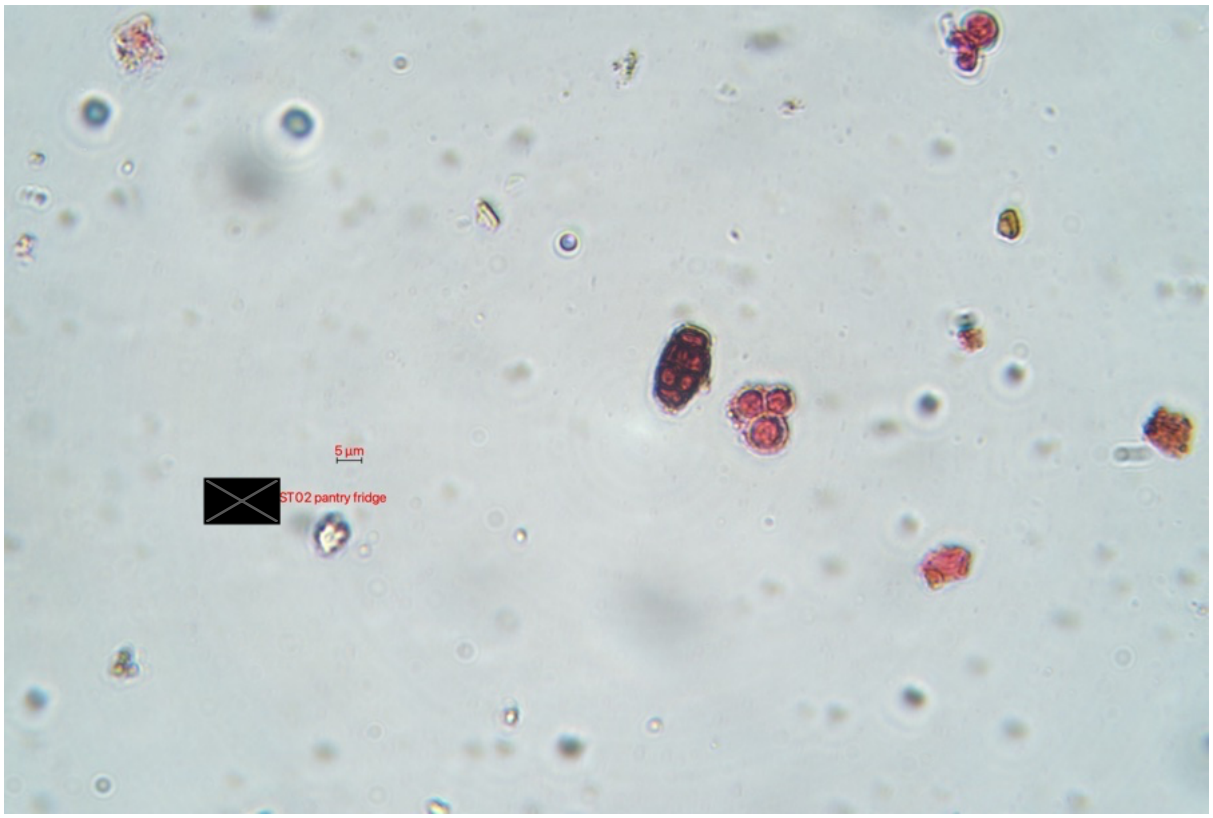

5 µm
Gruyere AT05


5 µm
[redacted]
ST01 dining A/c


5 µm
[redacted]
ST01 dining A/c



595



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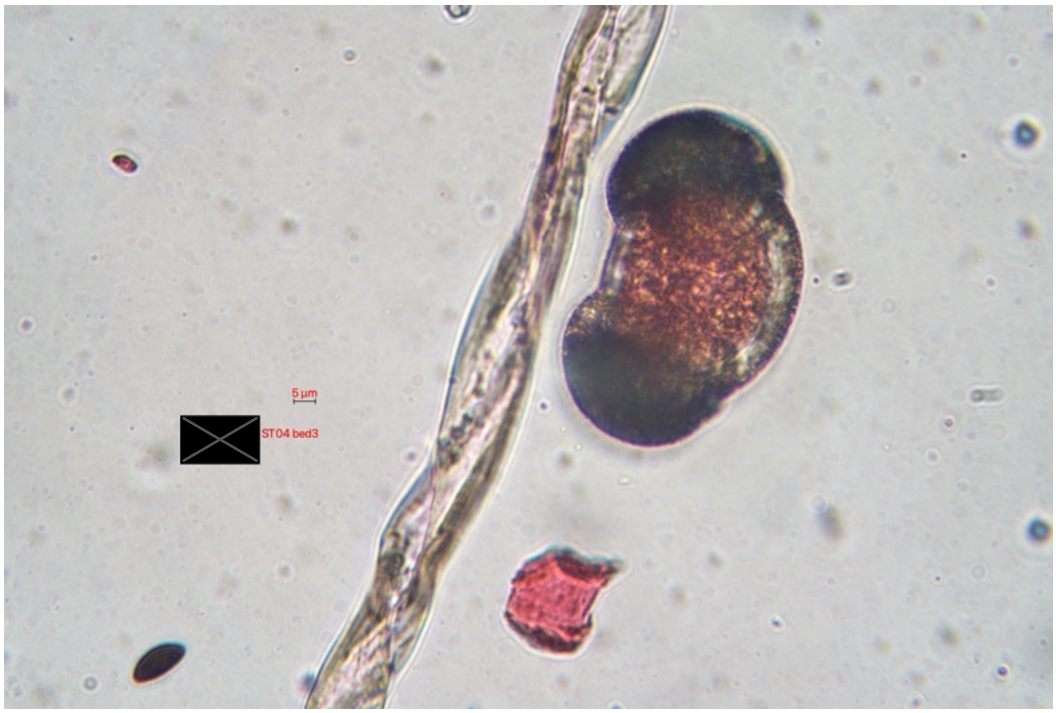
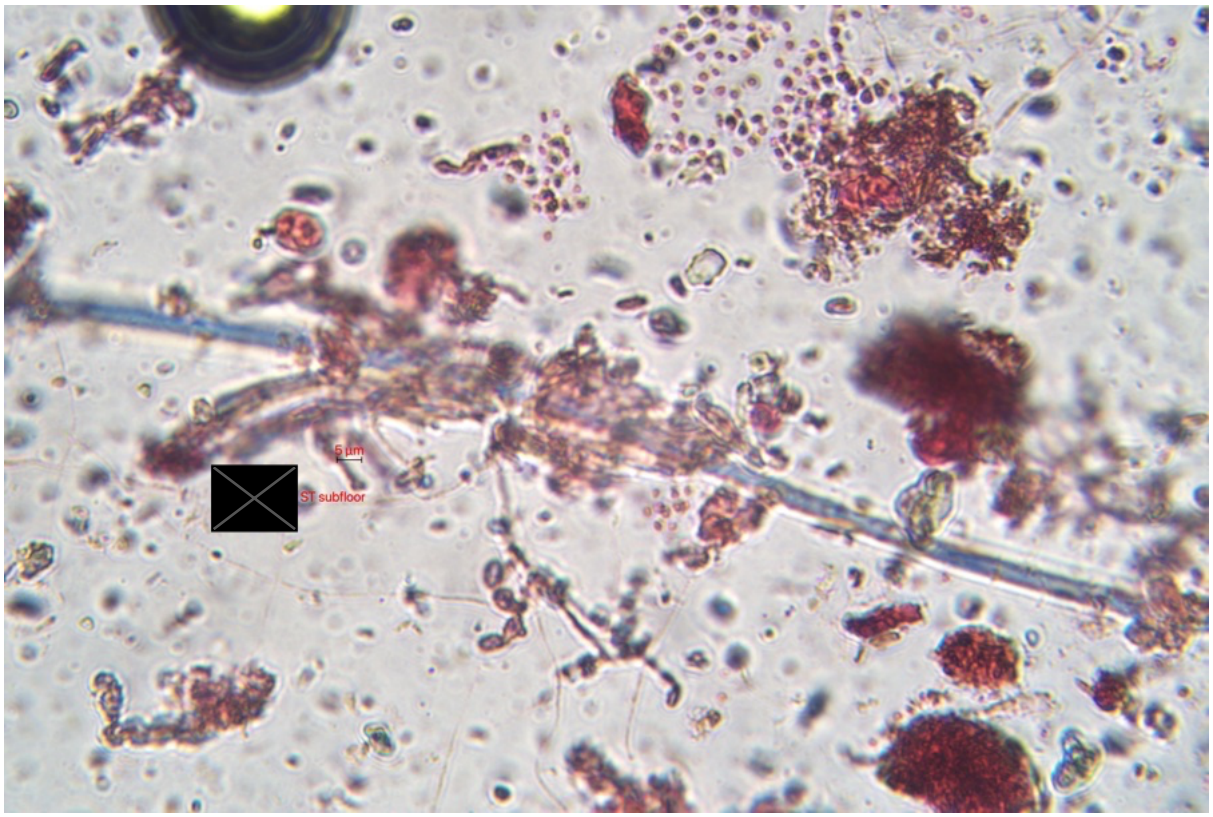


Above, pine pollen, cotton fibre, skin flake, and some spores.



600