Table 17.1. The six case study paintings and their historical lining recipes (SAAM 1–6).

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| Case study painting | 2019 recreated recipe | Collection survey |
| *Sun Setting, Denmark*  William H. Johnson, ca. 1930, oil on burlap  Lined to linen (1969)  Accession: 1967.59.720  s | SAAM 1 (Keck recipe):  6 parts unbleached beeswax  6 parts Multiwax W-445  2 parts dammar resin  2 parts colophony rosin  1 part gum elemi | SAAM 1 represents:  1/50 lining recipes  1/6 Johnson paintings  1/10 linings to linen |
| *Oak Trees*  Edward M. Bannister, 1876, oil on canvas  Lined to fiberglass (1983)  Accession: 1983.95.155 | SAAM 2:  3 parts unbleached beeswax  3 parts Multiwax W-445  2 parts Zonarez B-85 | SAAM 2 represents:  29/50 lining recipes  7/7 Bannister paintings  14/18 linings to fiberglass |
| *Cagnes-sur-Mer*  William H. Johnson, ca. 1928–29, oil on burlap  Lined to unidentified textile (1971)  Accession: 1967.59.702 | SAAM 3:  1 part unbleached beeswax  1 part Multiwax W-445  1 part Piccolyte S-85 | SAAM 3 represents:  5/50 lining recipes  5/6 Johnson paintings  5/19 unidentified textiles |
| *The Lesson*  Hugo Ballin, 1907, oil on canvas  Lined to unidentified textile (1979)  Accession: 1910.9.1 | SAAM 4:  3 parts Multiwax W-445  1 part Zonarez B-85 | SAAM 4 represents:  2/50 lining recipes  1/1 Ballin paintings  1/19 unidentified textiles |
| *Plenty*  Kenyon Cox,  1910, oil on canvas  Lined to fiberglass (1974)  Accession: 1910.9.6 | SAAM 5:  3 parts Multiwax W-445  1 part Piccolyte S-85 | SAAM 5 represents:  2/50 lining recipes  1/2 Cox paintings  1/18 linings to fiberglass |
| *The Windmill*  Jenne Magafan, ca. 1937, oil on canvas  Lined to unidentified textile (1979)  Accession: 1971.447.66 | SAAM 6:  Multiwax W-445 | SAAM 6 represents:  4/50 lining recipes  1/1 Magafan paintings  1/19 unidentified textiles |

*Note:* Each case study painting represents a different historical lining recipe (SAAM 1–6). The third column compares each case study to surveyed lining adhesives, prevalence of its use on other works by the same artist, and prevalence of its use with the same secondary support. The breakdown of secondary supports is as follows: linen (10/50 linings), fiberglass (18/50 linings), combination of linen and fiberglass (3/50 linings), and unidentified textiles (19/50 linings). Supports for *Cagnes-sur-Mer*, *The Lesson*, and *The Windmill* were unidentified in April 2019; visual examination later revealed that all three supports were linen.

Table 17.2. Wax and resin ingredients confirmed with GC/MSD to be present in the six case study paintings and recreated lining recipes.

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| Ingredient | Compounds in waxes/resins detected with GC/MSD | Retention time (minutes) | Ions (m/z) |
| Unbleached beeswax | Odd-numbered hydrocarbons (peak at C27H56)  Fatty acids (most peak at C24H48O2) | 24–25  (peak) | 71, 74 |
| Multiwax  W-445s | Odd- and even-numbered hydrocarbons (peak at C33H68 or C34H70) | 28–29 | 71 |
| Dammars | 5-dammarenolic acid methyl ester (C31H52O3) | 29–30 | 454 |
| Colophony | Dehydroabietic acid (C20H28O2)  7-oxo-dehydroabietic acid (C20H26O3) | 21–24 | 316, 328 |
| Gum elemi | α-amyrin / β-amyrin (C30H50O) | 29–30 | 426 |

*Note:* Each ingredient is identified by the presence of specific compounds at a particular molecular weight (m/z). GC/MSD seemed to have difficulty detecting microcrystalline wax (particularly when beeswax was present in the recipe) as well as the proprietary resins Zonarez B-85 and Piccolyte S-85 (not listed in table).

Table 17.3. Resin ingredients confirmed with Py-GC/MSD to be present in three of the case study paintings and three recreated lining recipes.

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| --- | --- | --- | --- |
| Ingredient | Compounds in resins detected with Py-GC/MSD | Retention time (min.) | Ions (m/z) |
| Zonarez  B-85S | Limonene monomer (C10H16), dimer (C20H32), and trimer (C30H48) | 3–10 | 136, 272, 408 |
| Piccolyte  S-85S | Limonene monomer (C10H16), dimer (C20H32), and trimer (C30H48) | 3–10 | 136, 272, 408 |

*Note:* Both Zonarez B-85 and Piccolyte S-85 were identified by the presence of the acid-catalyzed dimerization and trimerization of limonene.