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Report on the imaging of the Qur'anic portions of the Mingana-Lewis Palimpsest

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1. Introduction and overview

Cambridge University Library is very pleased to be working with Dr Alba Fedeli on this research project, which will enable a better understanding of this important manuscript.

This brief technical report outlines the approach we have taken to imaging the manuscript. Although this was undertaken in a different way to the original proposal and has taken longer to accomplish, we believe we have achieved good results which will serve the next stage of the project well.

In our initial discussions with Dr Fedeli, we considered allowing her colleague, Fabrizio Fenucci, to undertake the imaging within our studio. While Mr Fenucci has clear experience in imaging similar manuscripts, after further discussion within the Library and with colleagues at the British Library and the Hamilton Kerr Institute, we felt that we should undertake the imaging in-house, supported by appropriate experts. It would be an exception to allow an external photographer to capture the Library's material within our studio and we felt that given the importance of this manuscript we should assume the responsibility and risks ourselves. This was agreed with Dr Fedeli and TIMA.

Although the Library has undertaken film-based UV imaging in the past, it has not undertaken such imaging since moving to a completely digital workflow. So we consulted with an expert from the Hamilton Kerr Institute, the University museum's specialist investigation and restoration, undertaking some test photographs on a selection of the palimpsest leaves at the Institute on 26 June. These indicated that the manuscript would respond to ultraviolet and, to a lesser extent, infra-red imaging, but would benefit from capture at a higher resolution.

We set about assembling the necessary equipment and were ready to undertake further tests at the Library on 3 September and the full imaging of the Qur'anic parts of the manuscript from 6-8 September. Dr Fedeli has received sample images from the Hamilton Kerr Institute imaging in June and the full imaging in September and we are arranging transfer of the images.

2. Equipment and methodology

2.1. Preparation of the studio

A suitable enclosed studio space was allocated to the project. It was thoroughly cleaned and equipped with appropriate safety equipment and signage. The consultant from Hamilton Kerr measured the intensity of the UV lights, advised on safe procedures and prepared a full Health and Safety report for the project, which we include at the end of this report.

2.2. Equipment

A Phase One 645AF camera body with a Digital MF 120mm f/4 macro lens was fixed to a De Vere copy stand and different combinations of filters, lights and camera backs used to capture the images.

Two camera backs were used in the project, both P45s, capable of achieving 7246 x 5444 pixels which is roughly equivalent to 600 dpi for this material:

- Phase One Achromatic Plus – this has filters removed from the chip, enabling the full spectrum to be registered
- Standard Phase One back – for capturing the visible spectrum and UV fluorescence within the visible spectrum

The following lighting was used:

- Two Bowens Esprit 1500 Monolights – standard low heat emitting flashes for visible light capture
- Two Photon Beard 330 fluorescent lamps fitted with 6 x 15watt UVa “Black Lights” – low heat emitting lamps for UV capture
- Two 140 LED 940nm light sources – no heat emission, for IR capture

The following special filters were used:

- Schneider Optics B+W 420 UV blocking filter – used to capture UV fluorescence in the visible spectrum
- Schneider Optics B+W 092 IR filter – which blocks visible light up to 650nm and from 730-2000nm

2.3. Personnel

The project was overseen by Don Manning, Head of Imaging Services, and Grant Young, Digitisation and Digital Preservation Specialist. It was supported by Chris Titmus, Consultant Photographer from the Hamilton Kerr Institution.

Photography was undertaken by Les Goodey, Senior Photographer. Handling of the palimpsest was provided by the Library's conservators, working in pairs: Deborah Farndell, Jan Coleby and James Bloxam, and by the Head of the Library's Near and Middle Eastern Department, Yasmin Faghihi.

2.4. Procedure

All the relevant leaves from the manuscript were passed through each process in turn (normal light, UV and IR), so each leaf was handled by the conservators a total of five times. We did consider whether we could capture the full range of images while each leaf was in position, to reduce handling and achieve a better registration of the images (for post-processing). However we decided to reject this approach for the following reasons:

- Once exposed to air the manuscript continually moves, making registration impossible
- The swapping of filters and camera backs between leaves would also probably have altered the registration and would have significantly prolonged the photography
- Shooting all the UVa images in sequence minimised harmful exposure for the manuscript and staff
- Infrared capture requires a refocusing of the lens which alters the resolution, so this process could not be bracketed with the others

A ruler was included with all images to assist with the post-processing. A standard Gretag Macbeth colour target was also included with the first of the colour images we captured.

2.4. Images produced

The following images were produced for the Qur'anic portions of the Mingana-Lewis palimpsest. We will undertake UV capture for the remaining parts of the manuscript at a later date funded by the Library.

- 51 colour images using the standard P45 camera back without a filter and with flash lighting
- 50 greyscale images using the achromatic P45 camera back without a filter and with flash lighting
- 50 colour images using the standard P45 camera back with the B+W 420 filter and UV lighting
- 50 greyscale images using the achromatic P45 camera back with the B+W 420 filter and UV lighting
- 51 greyscale images using the achromatic P45 camera back with the B+W 092 filter and Infrared lighting

Images were produced in the Phase One RAW format and then processed as TIFF images. Both formats will be made available to Dr Fedeli and her colleagues. Automatically assigned sequential filenames were used and a reference file provided to Dr Fedeli to enable her to identify and match images.

The exposure times varied across the imaging, but were measured in seconds rather than minutes. This and other technical metadata is available for each image within the RAW and TIFF files.

After the imaging, each of the images was visually inspected and its filename checked by someone familiar with the manuscript.

3. Results and observations

We are confident that we achieved the best results we could with the equipment available, but recognise that other combinations of lights, lenses and filters may provide better results for some leaves. We hope, in time, to test some further equipment and combinations.

Each leaf of the manuscript has its own particular characteristics depending on its history and treatment, so the results vary considerably from image to image. On some leaves the UV capture brought out the underscript very clearly, while on others it seemed little different to the visible light image. We await the results of the post-processing stage of the project with great interest.

October 2010

Current number	Quire	Leaf	Underscript (according to Agnes Lewis)	Arabic later script (according to Agnes Lewis)	Qurans (Islamic Awareness)	Visual colour	Visual grey	UV colour	UV grey	IR
66	1	1	Transitus	Martyrium.s.Eleutherii						
68	1	2	Transitus	Martyrium.s.Eleutherii						
1	2	3	Transitus	Martyrium.s.Eleutherii						
2	2	4	Transitus	Martyrium.s.Eleutherii						
3	2	5	Transitus	Martyrium.s.Eleutherii						
4	2	6	Transitus	Martyrium.s.Eleutherii						
4	2	7	Transitus	Martyrium.s.Eleutherii						
3	2	8	Transitus	Mart.s.Eleuth, Athanasius historia						
2	2	9	Transitus	Athanasius						
5	2	10	Transitus	Athanasius						
6	2	11	Septuagint	Athanasius						
7	2	12	Paper, not palimpsest	Athanasius						
8	3	13	Quran 2	Theodosius	B-a-b	1472	1374	1520	1324	1622
8	3	13	Quran 2	Theodosius	B-a-b	1473	1375	1521	1325	1623
9	3	14	Quran 2	Theodosius	B-a-b	1471	1376	1522	1326	1624
10	3	15	Quran 2	Theodosius	B-a-b	1469	1378	1524	1328	1626
11	3	16	Quran 2	Theodosius	B-a-b	1466	1380	1526	1330	1628
11	3	17	Quran 2	Theodosius	B-a-b	1467	1381	1527	1331	1629
10	3	18	Quran 2	Theodosius	B-a-b	1468	1379	1525	1329	1627
9	3	19	Quran 2	Theodosius	B-a-b	1470	1377	1523	1327	1625
12	3	20	Quran 2	Theodosius	B-a-b	1464	1382	1528	1332	1630
12	3	20	Quran 2	Theodosius	B-a-b	1465	1383	1529	1333	1631
13	4	21	Transitus	Theodosius						
14	4	22	Transitus	Theodosius, Chrysostum ,not extant						
15	4	23	Transitus	Chrysostum						
16	4	24	Transitus	Chrysostum						
16	4	25	Transitus	Chrysostum						
15	4	26	Transitus	Chrysostum						
14	4	27	Transitus	Chrysostum						
13	4	28	Transitus	Chrysostum						
17	5	29	Protevangelium	Chrysostum						
18	5	30	Protevangelium	Chrysostum						
19	5	31	Transitus	Chrysostum						
20	5	32	Transitus	Chrysostum, Mar Ephraim						

20	5	33	Transitus	Mar Ephraim						
19	5	34	Transitus	Mar Ephraim						
18	5	35	Protevangeliium	Mar Ephraim						
21	5	36	Protevangeliium	Mar Ephraim						
22	6	37	Transitus	Mar Ephraim						
23	6	38	Transitus	Mar Ephraim						
24	6	39	Transitus	Mar Ephraim						
25	6	40	Transitus	Mar Ephraim						
25	6	41	Transitus	Mar Ephraim						
24	6	42	Transitus	Mar Ephraim						
23	6	43	Transitus	Mar Ephraim						
22	6	44	Transitus	Mar Ephraim, Mar Isaac						
26	7	45	Syriac Hymn	Mar Isaac						
27	7	46	Transitus	Mar Isaac						
28	7	47	Transitus	Mar Isaac						
29	7	48	Transitus	Mar Isaac						
30	7	49	Transitus	Mar Isaac, Chrysostum ,not extant						
29	7	50	Transitus	Chrysostum						
28	7	51	Transitus	Chrysostum						
31	7	52	Transitus	Chrysostum						
32	8	53	Quran 2	Chrysostum	C-a-b	1463	1384	1530	1334	1632
33	8	54	Quran 2	Chrysostum	C-b	1460	1386	1532	1336	1634
34	8	55	Quran 2	Chrysostum	B-a-b	1458	1388	1534	1338	1636
35	8	56	Quran 2	Chrysostum	B-a-b	1457	1390	1536	1341	1638
35	8	57	Quran 2	Chrysostum	B-a-b	1456	1391	1537	1340	1639
34	8	58	Quran 2	Chrysostum	B-a-b	1459	1389	1535	1339	1637
33	8	59	Quran 2	Chrysostum	C-a	1461	1387	1533	1337	1635
32	8	60	Quran 2	Chrysostum	C-a-b	1462	1385	1531	1335	1633
36	9	61	Transitus	Chrysostum						
37	9	62	Transitus	Chrysostum						
38	9	63	Transitus	Chrysostum, Theodorus						
39	9	64	Transitus	Theodorus						
39	9	65	Transitus	Theodorus						
38	9	66	Transitus	Theodorus						
37	9	67	Transitus	Theodorus						
36	9	68	Transitus	Theodorus						
40	10	69	Transitus	Theodorus						
43	10	70	Transitus	Theodorus						

42	10	71	Transitus	Chrysostum, Prodigal son						
41	10	72	Transitus	Chrysostum, Prodigal son						
41	10	73	Transitus	Chrysostum, Prodigal son						
42	10	74	Transitus	Chrysostum, Prodigal son						
43	10	75	Transitus	Chrysostum, Prodigal son						
44	10	76	Transitus	Chrysostum, Prodigal son						
			Peshitta							
45	11	77	Gospel(Mt.ix)1744/45	Chrysostum, Prodigal son						
46	11	78	Arabic Doc.	Chrysostum, Mar Jacob						
47	11	79	Peshitta gospel(Mt xvi)	Mar Jacob						
48	11	80	Dbl. palimpsest (Exod.)	Mar Jacob						
49	11	81	Peshitta gspl.(Mt x)	Mar Jacob						
49	11	82	Peshitta gspl.(Mt x)	Mar Jacob						
50	11	83	Arabic doc.	Mar Jacob						
			Peshitta gospel (Mt.xv.							
47	11	84	xvi)	Mar Jacob						
51	11	85	Arabic Doc.	Mar Jacob						
45	11	86	Peshitta Gospel (Mt.ix)	Mar Jacob						
52	12	87	Transitus	Mar Jacob						
53	12	88	Protevangeliium	Mar Jacob						
			Protevangeliium and							
54	12	89	transitus	Mar Jacob						
55	12	90	Protevangeliium	Mar Jacob						
55	12	91	Protevangeliium	Mar Jacob						
54	12	92	Protevangeliium	Mar Jacob						
			Protevangeliium and							
53	12	93	Transitus	Mar Jacob						
52	12	94	Transitus	Mar Jacob						
56	13	95	Quran 2	Mar Jacob		1454	1392	1538	1358	1640
57	13	96	Quran 2	Mar Jacob	B-a-b	1453	1394	1540	1361	1642
58	13	97	Quran 2	Mar Jacob	B-a-b	1450	1396	1542	1362	1644
58	13	97	Quran 2	Mar Jacob	B-a-b	1450	1396	1542	1362	1645
59	13	98	Quran 2	Mar Jacob	B-a-b	1449	1398	1544	1365	1647
59	13	99	Quran 2	Mar Jacob	B-a-b	1448	1399	1545	1364	1648
58	13	100	Quran 2	Mar Jacob	B-a-b	1451	1397	1543	1363	1646
57	13	101	Quran 2	Mar Jacob	B-a-b	1452	1395	1541	1360	1643
56	13	102	Quran 2	Mar Jacob	B-b	1455	1393	1539	1359	1641
60	13	103	Quran 2	Mar Jacob	C-a-b	1446	1400	1546	1366	1649
60	13	103	Quran 2	Mar Jacob	C-a-b	1447	1401	1547	1367	1650

61	14	104	Quran 2	Mar Jacob	C-a	1444	1403	1549	1368	1652
62	14	105	Quran 2	Mar Jacob	C-a-b	1443	1404	1550	1370	1653
63	14	106	Quran 2	Mar Jacob	B-a-b	1440	1406	1552	1372	1655
63	14	107	Quran 2	Mar Jacob	B-a-b	1441	1407	1553	1373	1656
62	14	108	Quran 2	Mar Jacob	C-a-b	1442	1405	1551	1371	1654
61	14	109	Quran 2	Mar Jacob	C-b	1445	1402	1548	1369	1651
64	15	110	Transitus	Mar Jacob						
65	15	111	Transitus	Mar Jacob						
65	15	112	Transitus	Mar Jacob						
64	15	113	Transitus	Mar Jacob						
69	15	114	Transitus	Mar Jacob						
67	15	115	Transitus	Mar Jacob						
70	16	116	Mar Jacob	Mar Jacob						
71	16	117	Mar Jacob	Mar Jacob						
72	16	118	Mar Jacob	Mar Jacob						
73	16	119	Mar Jacob	Mar Jacob						
73	16	120	Mar Jacob	Mar Jacob						
72	16	121	Mar Jacob	Mar Jacob						
71	16	122	Mar Jacob	Mar Jacob						
70	16	123	Mar Jacob	Mar Jacob						
74	17	124	Transitus	Chrysostum						
75	17	125	Transitus	Chrysostum						
76	17	126	Transitus	Chrysostum						
77	17	127	Transitus	Chrysostum						
77	17	128	Transitus	Chrysostum						
76	17	129	Transitus	Chrysostum						
75	17	130	Transitus	Chrysostum						
74	17	131	Transitus	Chrysostum						
78	18	132	Protevangeliium	Chrysostum						
79	18	133	Protevangeliium	Chrysostum						
80		134	Dbl. palimpsest	Chrysostum						
81		135	Peshitta gospels(John vi)	Chrysostum						
81		136	Peshitta gospels(John vi)	Chrysostum						
82		137	Dbl. palimpsest	Chrysostum						
79		138	Protevangeliium	Chrysostum						
78		139	Mar Jacob	Chrysostum						
83		140	Mar Jacob	Chrysostum						

84	141	Mar Jacob	Chrysostum						
85	142	Mar Jacob	Chrysostum						
85	143	Mar Jacob	Chrysostum, Mar Jacob						
84	144	Mar Jacob	Mar Jacob						
83	145	Mar Jacob	Mar Jacob						
86	146	Syriac Hymn	Mar Jacob						
87	147	Quran 1	Mar Jacob		1439	1408	1554	1342	1657
88	148	Quran 1	Mar Jacob		1436	1410	1556	1344	1659
89	149	Quran 1	Mar Jacob	A-a-b	1434	1413	1558	1346	1661
90	150	Quran 1	Mar Jacob	A-a-b	1433	1414	1560	1349	1663
90	150	Quran 1	Mar Jacob	A-a-b	1433	1414	1560	1349	1664
90	151	Quran 1	Mar Jacob	A-a-b	1432	1415	1561	1348	1665
89	152	Quran 1		A-a	1435	1412	1559	1347	1662
88	153	Quran 1			1437	1411	1557	1345	1660
87	154	Quran 1			1438	1409	1555	1343	1658
91	155	Small arabic			1430	1416	1562	1350	1666
92	156	Quran 1		A-a	1428	1418	1564	1352	1668
93	157	Quran 1		A-b	1427	1420	1566	1355	1670
94	158	Quran 1		A-b	1424	1422	1569	1357	1672
94	159	Quran 1		A-a	1425	1423	1568	1356	1673
93	160	Quran 1		A-a	1426	1421	1567	1354	1671
92	161	Quran 1		A-b	1429	1419	1565	1353	1669
91	162	Small arabic			1431	1417	1563	1351	1667