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Syriac Galen Palimpsest XRF Imaging

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Date: 3 August 2019

1 Syriac Galen Palimpsest XRF Imaging

This data set includes captured and processed data from the x-ray fluorescence (XRF) imaging of the Syriac Galen Palimpsest on Beamlines 6-2 and 10-2 at the Stanford Synchrotron Radiation Lightsource (SSRL) at the Department of Energy's SLAC National Accelerator Laboratory. Imaging took place on both beamlines initially from 9 to 17 March 2018, and in a follow-on session on Beamline 10-2 from 30 January to 3 February 2019, with a final session on Beamline 6-2 from 6-8 March 2019.

1.1 SLAC Imaging

X-ray absorption spectroscopy imaging of the Syriac Galen Palimpsest was conducted at SLAC, a multi-program national laboratory user facility by Stanford University supported by the U.S. Department of Energy (DOE), Office of Science, Office of Basic Energy Sciences under Contract No. DE-AC02-76SF00515. This imaging was conducted as part of fundamental research which is published or shared broadly with the scientific and scholarly community. This builds on XRF imaging of the Archimedes Palimpsest, and uses some of the same techniques and the metadata extensions developed during the Archimedes Palimpsest XRF imaging at SLAC.

The SSRL SPEAR3 3-GeV, high-brightness third-generation storage ring was upgraded in 2004. It operates at 500 mA in top-off mode, with high reliability and low emittance.

1.2 Illumination System

SSRL's extremely bright x-rays were used to image the Syriac Galen Palimpsest. Beam lines 6-2 and 10-2 are wiggler end-stations that are used for hard x-ray transmission x-ray imaging.

1.3 Detectors

The x-ray fluorescence from the SGP was detected with multiple Vortex detectors, each collecting multiple elements. More information on the detectors is contained in Edwards et al, J. Synchrotron Rad, 25, 1565-73 (2018), DOI: 10.1107/S1600577518010202

1.4 XRF Data Integration and Image Capture

The XRF image data are collected and saved at SSRL as HDF5 data files containing the raw data from a multichannel analyzer (MCA). Multiple channels of data are collected and stored, as cited in the metadata document. Data from scans in the original hdf5 and tar files are stored at SLAC and the University of Manchester for additional research. These are minimally processed data from the XRF detectors on each beam line and require special software (such as SMAK) for viewing.

1.5 XRF Imaging Processing

Sam's Microprobe Analysis Kit, or SMAK for short, is a data-processing toolkit for x-ray microprobes. This is used to view and analyze images both for textual analysis and for improvement in the imaging methods and techniques.

2 Rights

All images from Syriac Galen Palimpsest are in the public domain or released under Creative Commons licenses as Free Cultural Works. All significant results are to be publicly disseminated. Use of the SLAC SSRL facility must be acknowledged in all presentations and publications with the following "Use of the Stanford Synchrotron Radiation Lightsource, SLAC National Accelerator Laboratory, is supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences under Contract No. DE-AC02-76SF00515." SLAC SSRL should be informed of all publications, theses, awards, patents and other forms of recognition resulting from research conducted fully or partially with the results of this imaging.

3 Syriac Galen Palimpsest XRF Data Set Contents

The following bifolio of the Syriac Galen Palimpsest were imaged at two beamlines at SLAC SSRL in 2018, with some also imaged with an advanced 100 megapixel multispectral imaging system. These XRF data files from this session all have the prefix letters "SGP":

Beam Line 6-2

031r038v	031v038r	*Also 100 MP Multispectral Imaging*
033r036v	033v036r	*Also 100 MP Multispectral Imaging*
080r083v	080v083r	*Also 100 MP Multispectral Imaging*
103r-106v	103v-106r	
125r132v	125v132r	*Also 100 MP Multispectral Imaging*
143r146v	143v146r	*Also 100 MP Multispectral Imaging*
152r153v	152v153r	*Also 100 MP Multispectral Imaging*
167r-170v	167v-170r	
176r-177v		
191r194v	191v-194r	*Also 100 MP Multispectral Imaging*
216r-219v	216v-219r	

Beam Line 10-2

152r-153v	152v-153r	*Also 100 MP Multispectral Imaging*
080r-083v	080v-083r	*Also 100 MP Multispectral Imaging*
190v-195r	190r-195v	
094r-099v		
023r-030v	023v-030r	
199r-202v	199v-202r	
101r-108v		
125r-132v	125v-132r	*Also 100 MP Multispectral Imaging*

The following bifolio of the Syriac Galen Palimpsest were imaged on SSRL beamline 10-2 in January-February 2019. The data files from this imaging session have no prefix letters:

141v-148r
002r-003v
026r-027v
026r-027v
086r-092v
081v-082r
081v-082r
007v-014r
032v-037r
008r-013v
008v-013r
133r-140v
078r-085v

The following bifolio of the Syriac Galen Palimpsest were imaged on SSRL beamline 6-2 in March 2019. The data files from this imaging session have the prefix "G":

010v-011r
088r-0000
089r-090v
120v-121r
168r-169v
007r-014v
024v-029r
184r-185v
007r-014v
048r-053v
214r-221v

This data set comprises a core content set of digital images of the items imaged. The data set contains the following folders:

Data: Data captured from XRF imaging of the Syriac Galen Palimpsest that have been converted into TIFF images.

Processed: Digitally processed TIFF images from the captured XRF images of the Syriac Galen Palimpsest to reveal unseen features.

README.txt file: This description of the data set in txt form providing an orientation to the data and rights management.

The directory structure, starting from the root is as follows for the XRF data:

ResearchContrib

XRF Data

SGP_031_038
SGP_033_036
SGP_103_106
SGP_143r_146v
SGP_167_170
SGP_176r_177v
SGP_191_194
SGP_216_219
SGP_031_038
SGP_033_036
SGP_103_106
SGP_143r_146v
SGP_167_170
SGP_176r_177v
SGP_191_194
SGP_216_219
002r-003v
007v-014r
008r-013v
008v-013r
026r-027v
026r-027v
032v-037
078r-085v
081v-082r
081v-082r
086r-092v
133r-140v
141v-148r
G080r-083v
G010v-011r
G024v-029r
G073r-074v
G088r-090v
G089r-090v
G117r-124v
G120v-121r
G120v-121r
G168r-169v
G175r-178v
G184r-185v
G184r-185v
G214r-221v
G223v-226r

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3.1 Core Data

For each palimpsest bifolio side, the data set provides captured scans converted to TIFF images and JPEG thumbnail images with metadata. These images should be retained as archival images and will be easiest to read with most image viewers.

1. XRF images captured using SLAC SSRL operating systems and SMAK software were converted from .hdf5 format to 8-bit .TIF format.

The core data includes:

- Captured Image data consisting of captured XRF scans converted to TIFF. These are individual images from each of the scans created with specific elemental data.
- Computer Processed images. Images that have been digitally produced through the application of computer algorithms to combine and enhance visibility of text. All processed images are TIFF images and jpegs.
- Metadata is included in the overall metadata document.

4 General File Conventions

The remainder of the file name, including the extension, indicates the SSRL ID code and file type. The latter are usually:

1. TIFF still image files, ending in 'tif',
2. JPEG still image files ending in 'jpg'