

Hyperspectral Scanner for Artwork

미술품, 벽화, 실내공간 등의 촬영에 적합



Art Scanner



Rotary Scanner

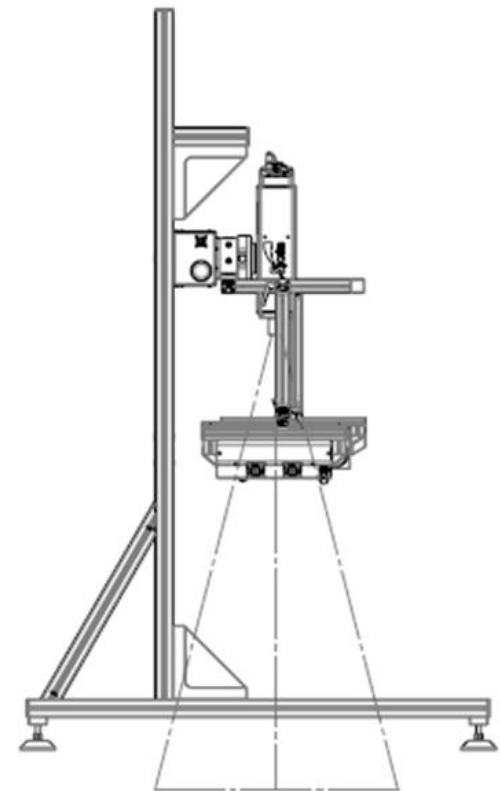
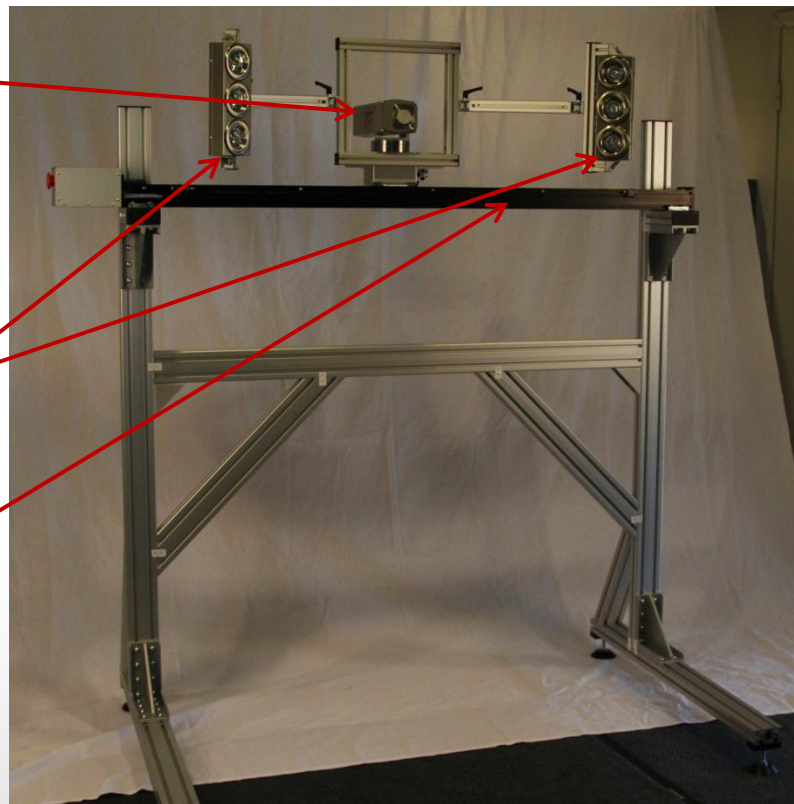
Hyperspectral Scanner for Artwork

스캐닝 시스템 구성

Push-broom hyperspectral camera
with exchangeable
front lens

Light source,
moves with camera

Motor driven linear stage

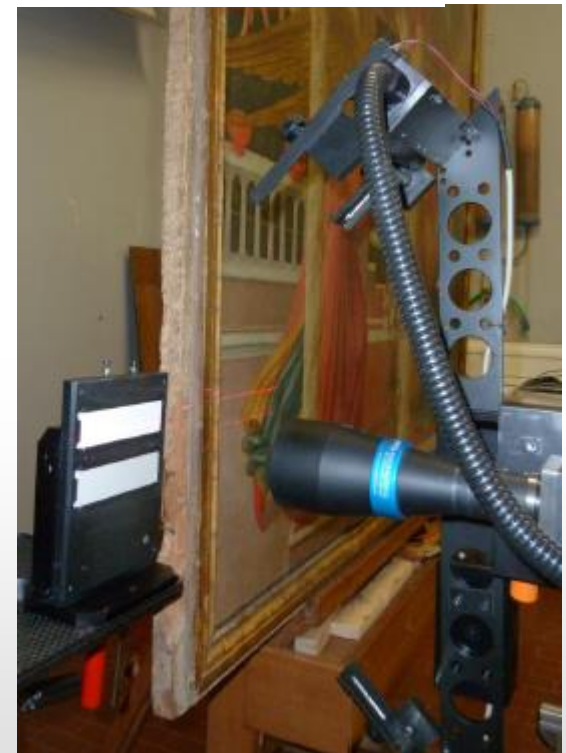




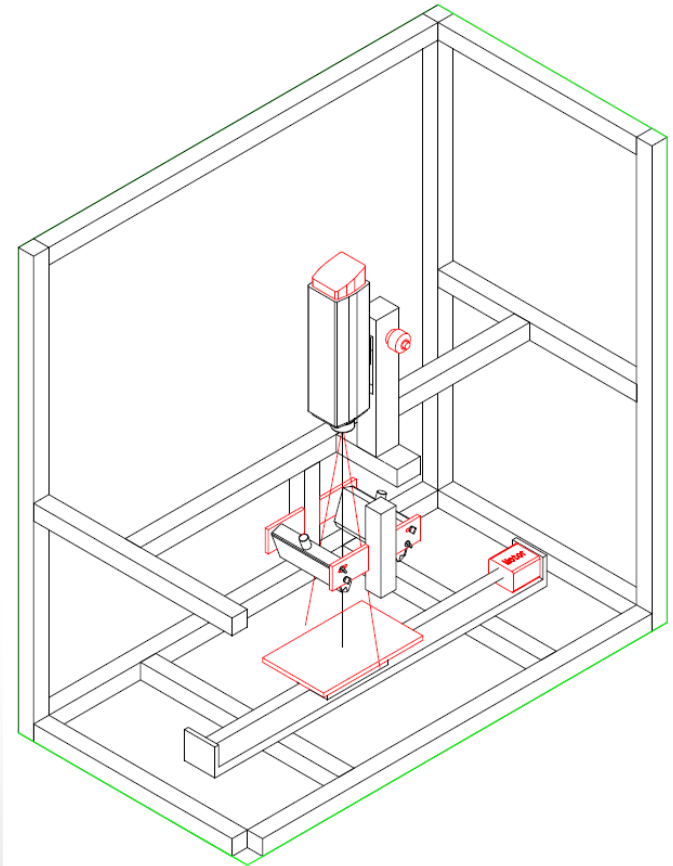
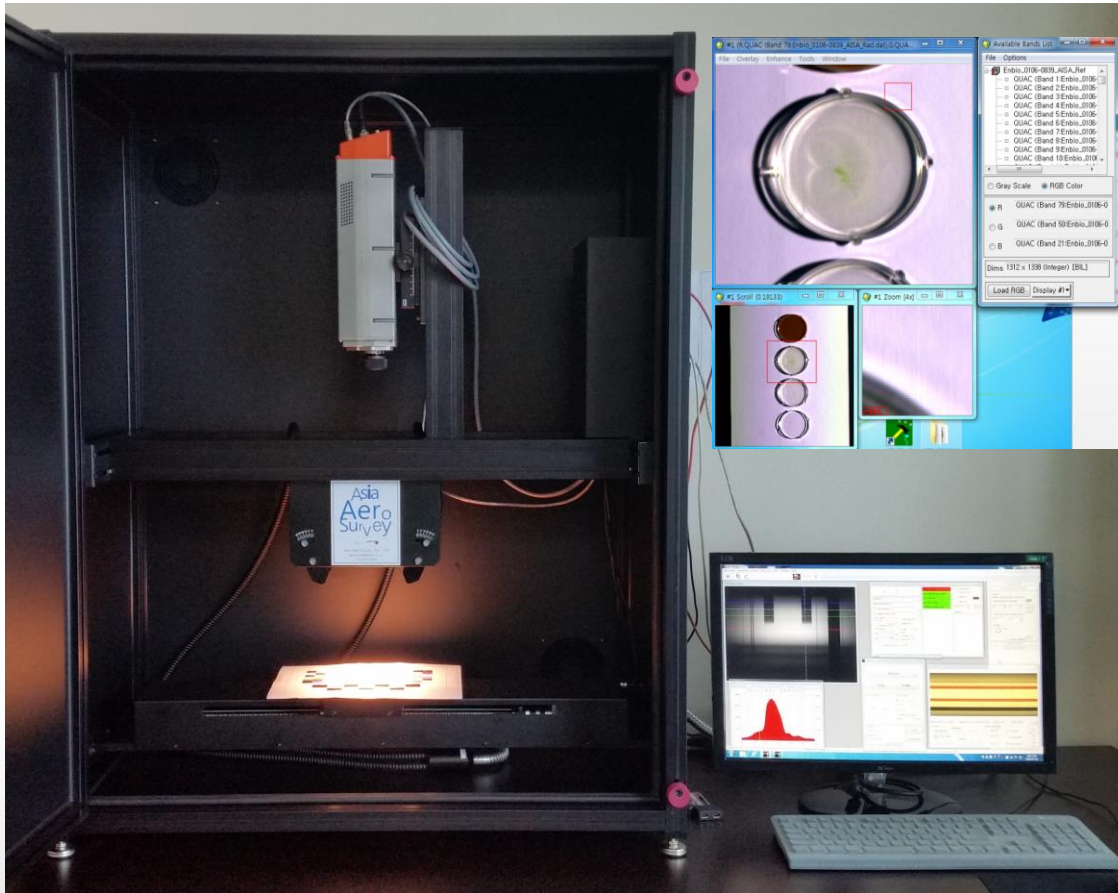
X/Y Scanning



Istituto di Fisica Applicata "N. Carrara" (IFAC-CNR)
Consiglio Nazionale delle Ricerche - Italy



초분광 암실 스캐너 (Hyperspectral Dark Chamber Scanner)



초분광 암실 스캐너 : 암석시료, 유물, 서적 등의 측정 및 분광 Library 구축용

파장별 활용분야

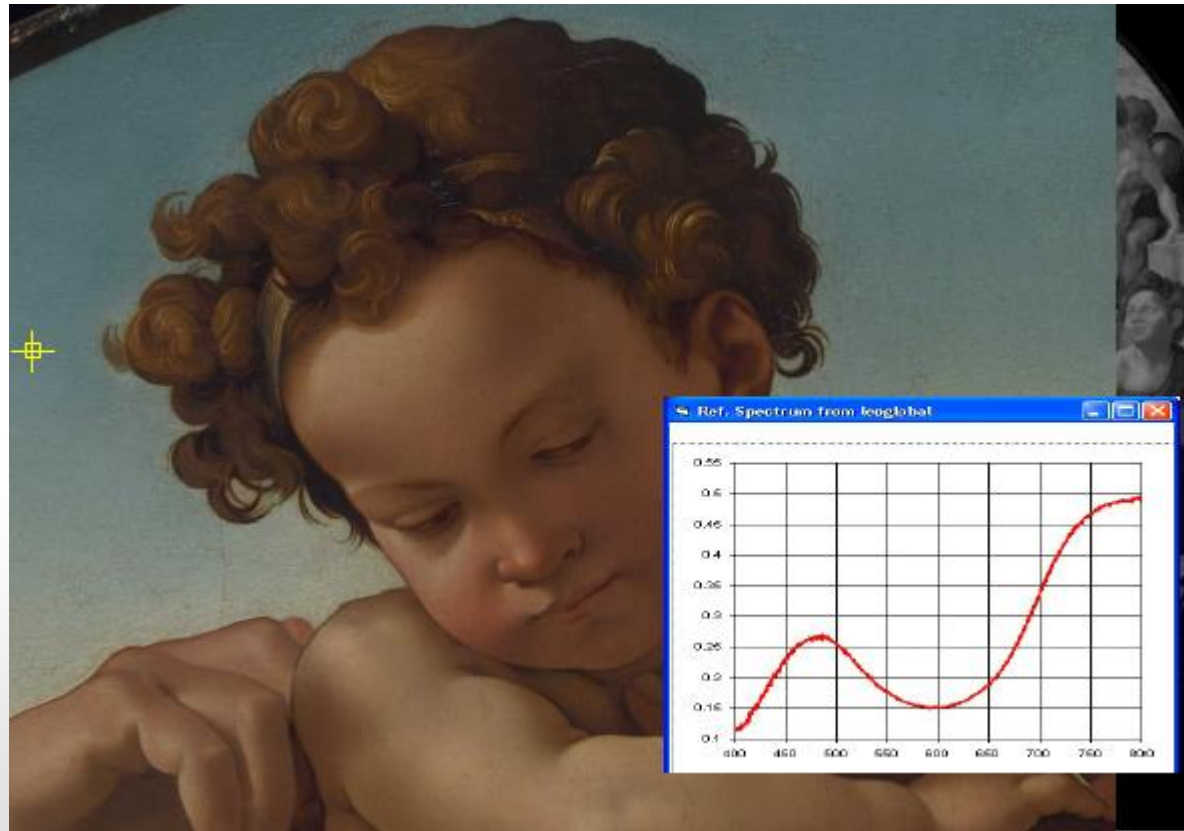
More Information with Broader Spectral Coverage

VNIR 400-1000 nm

Documentation of valuable artwork.

Pigment identification.

Color reproduction.



파장별 활용분야

More Information with Broader Spectral Coverage

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NIR/SWIR 900-1700 nm/1000-2500 nm

Inspection of inner layers (under-drawings and retouches).
Improved chemical material identification/
discrimination.



Color – SWIR – X ray



RGB



SWIR at 1600 nm



X-ray

"SWIR hyperspectral imaging provides more detailed inner layer and under-drawing information than X-ray"

Agata Warszewska
Museum of Wroclaw,
Poland

Composition by Henryk Statewski, 1957, oil

파장별 활용분야

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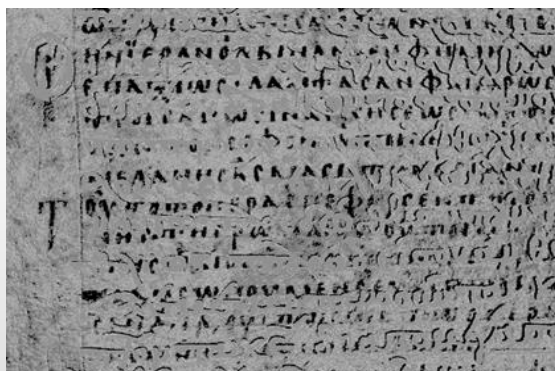
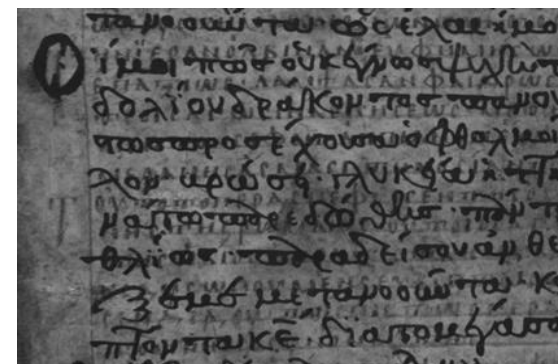
Institute of Spanish Cultural Heritage

NIR/SWIR 900-1700 nm/1000-2500 nm

Inspection of inner layers (under-drawings and retouches).

Improved chemical material identification/
discrimination.

Manuscript investigations.



파장별 활용분야

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MWIR 2.6-5 μ m

Could additional information be achieved in the infrared?

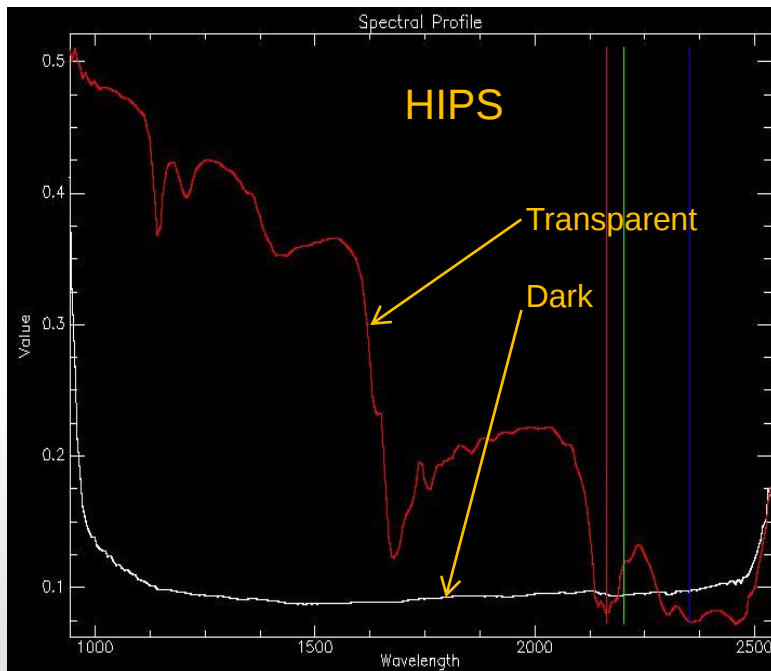
Cameras are available.

Light source needs to be optimized for reduced heat load.

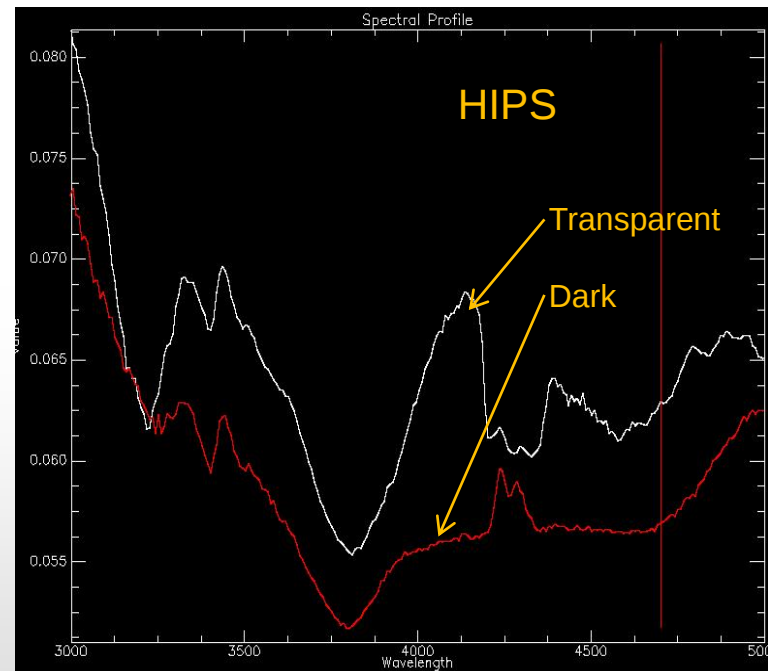
MWIR Hyperspectral Imaging

Sorting of black materials in reflection mode

SWIR(1000~2500nm)



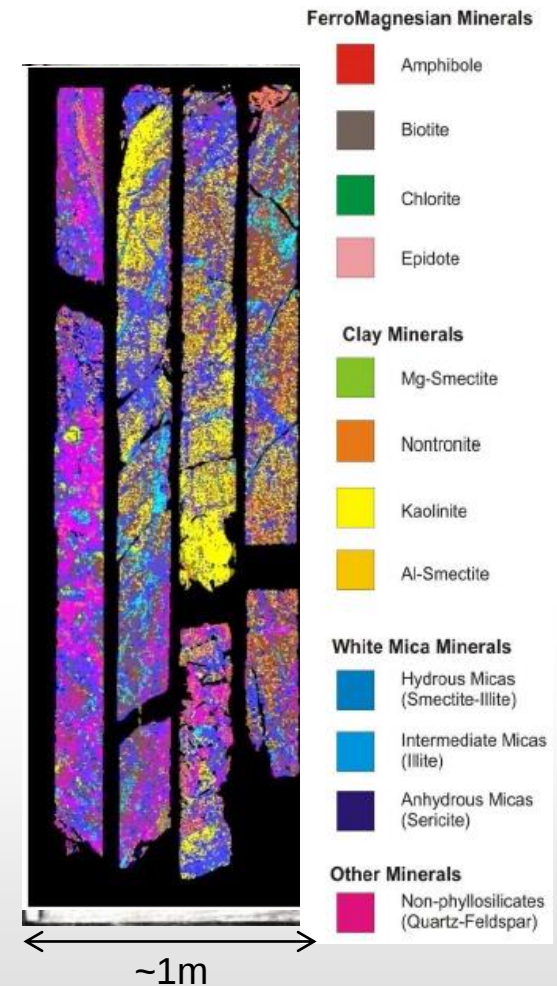
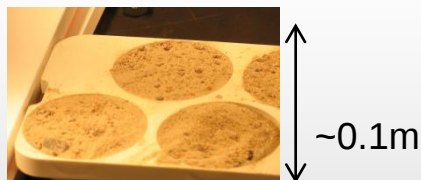
MWIR(2600~5000nm)



Stone/mineral classification

SWIR 1000-2500 nm is rich in spectral signatures of minerals (geological chemical compounds).

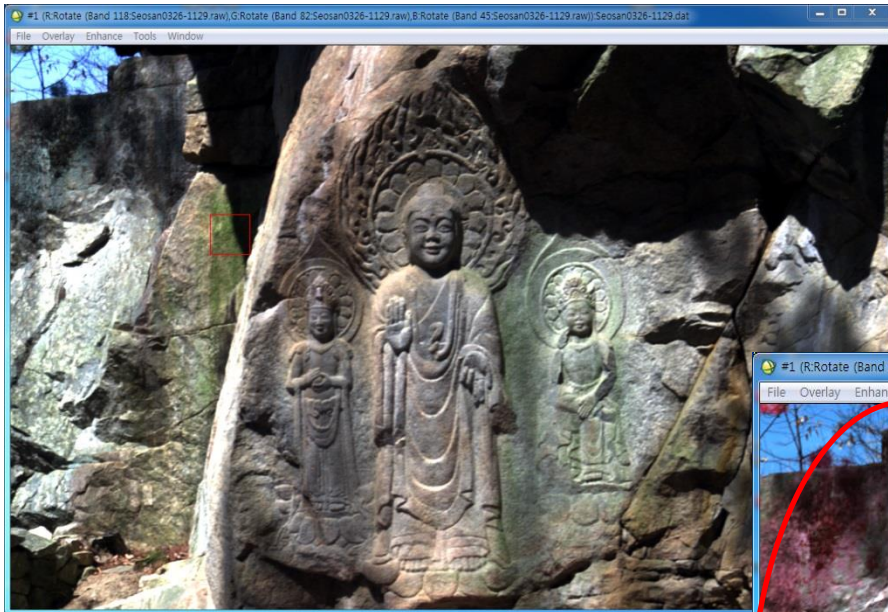
Stone classification.
Stone condition evaluation.
Drill core inspection.



Mineral identification

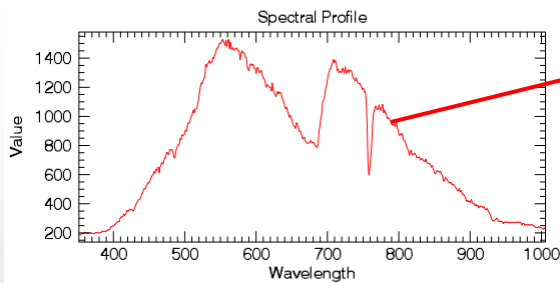
Type	Silicate Structure	Mineral Group	Example	VNIR Response	SWIR Response	LWIR Response
Silicates	Inosilicates	Amphibole	Actinolite	Non-Diagnostic	Good	Moderate
		Pyroxene	Diopside	Good	Moderate	Good
	Cyclosilicates	Tourmaline	Elbaite	Non-Diagnostic	Good	Moderate
	Nesosilicates	Garnet	Grossular	Moderate	Non-Diagnostic	Good
		Olivine	Forsterite	Good	Non-Diagnostic	Good
	Sorosilicates	Epidote	Epidote	Non-Diagnostic	Good	Moderate
	Phyllosilicates	Mica	Muscovite	Non-Diagnostic	Good	Moderate
		Chlorite	Clinochlore	Non-Diagnostic	Good	Moderate
		Clay Minerals	Illite	Non-Diagnostic	Good	Moderate
			Kaolinite	Non-Diagnostic	Good	Moderate
Non-Silicates	Tectosilicates	Feldspar	Orthoclase	Non-Diagnostic	Non-Diagnostic	Good
			Albite	Non-Diagnostic	Non-Diagnostic	Good
		Silica	Quartz	Non-Diagnostic	Non-Diagnostic	Good
	Carbonates	Calcite	Calcite	Non-Diagnostic	Moderate	Good
		Dolomite	Dolomite	Non-Diagnostic	Moderate	Good
	Hydroxides		Gibbsite	Non-Diagnostic	Good	Moderate
	Sulphates	Alunite	Alunite	Moderate	Good	Moderate
			Gypsum	Non-Diagnostic	Good	Good
	Borates		Borax	Non-Diagnostic	Moderate	?
	Halides	Chlorides	Halite	Non-Diagnostic	?	?
	Phosphates	Apatite	Apatite	Moderate	Non-Diagnostic	Good
	Hydrocarbons		Bitumen	?	Moderate	?
		Hematite	Hematite	Good	Non-Diagnostic	Non-Diagnostic
	Oxides	Spinel	Chromite	Non-Diagnostic	Non-Diagnostic	Non-Diagnostic
	Sulphides		Pyrite	Non-Diagnostic	Non-Diagnostic	Non-Diagnostic

석조 문화재 풍화작용 모니터링

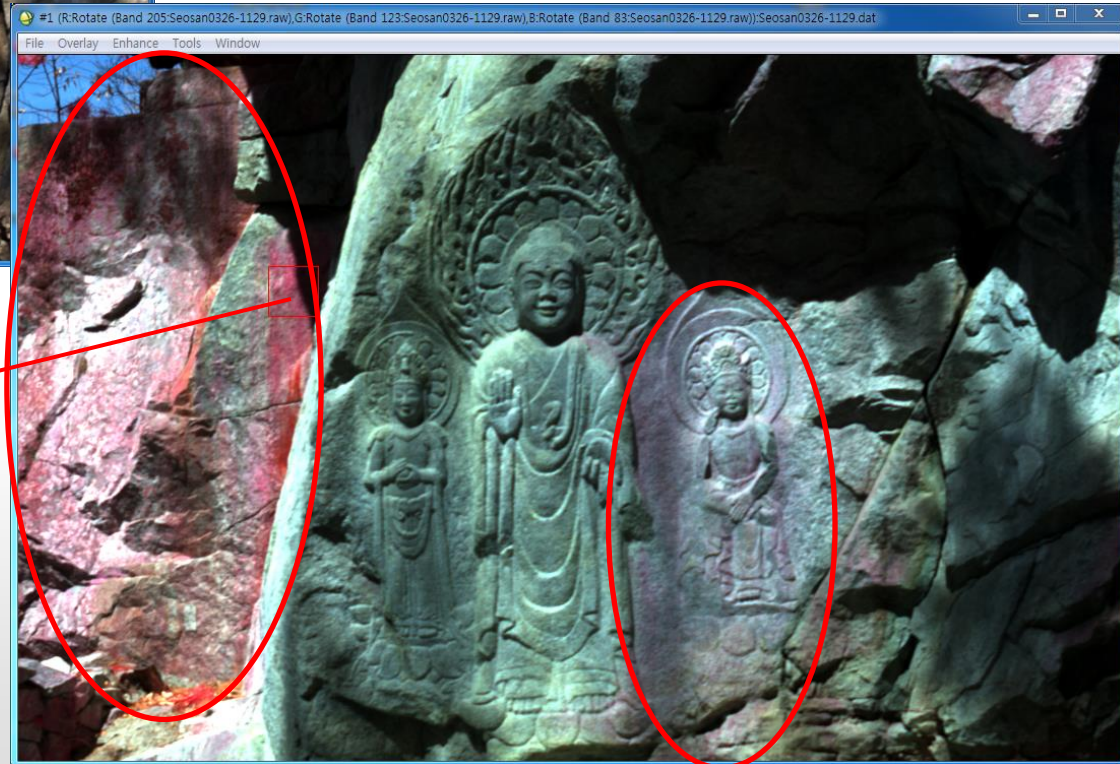


석조문화재 풍화작용의 원인이 되는 이끼 및 수분의 검출

< 충남 서산 마애삼존불상 >



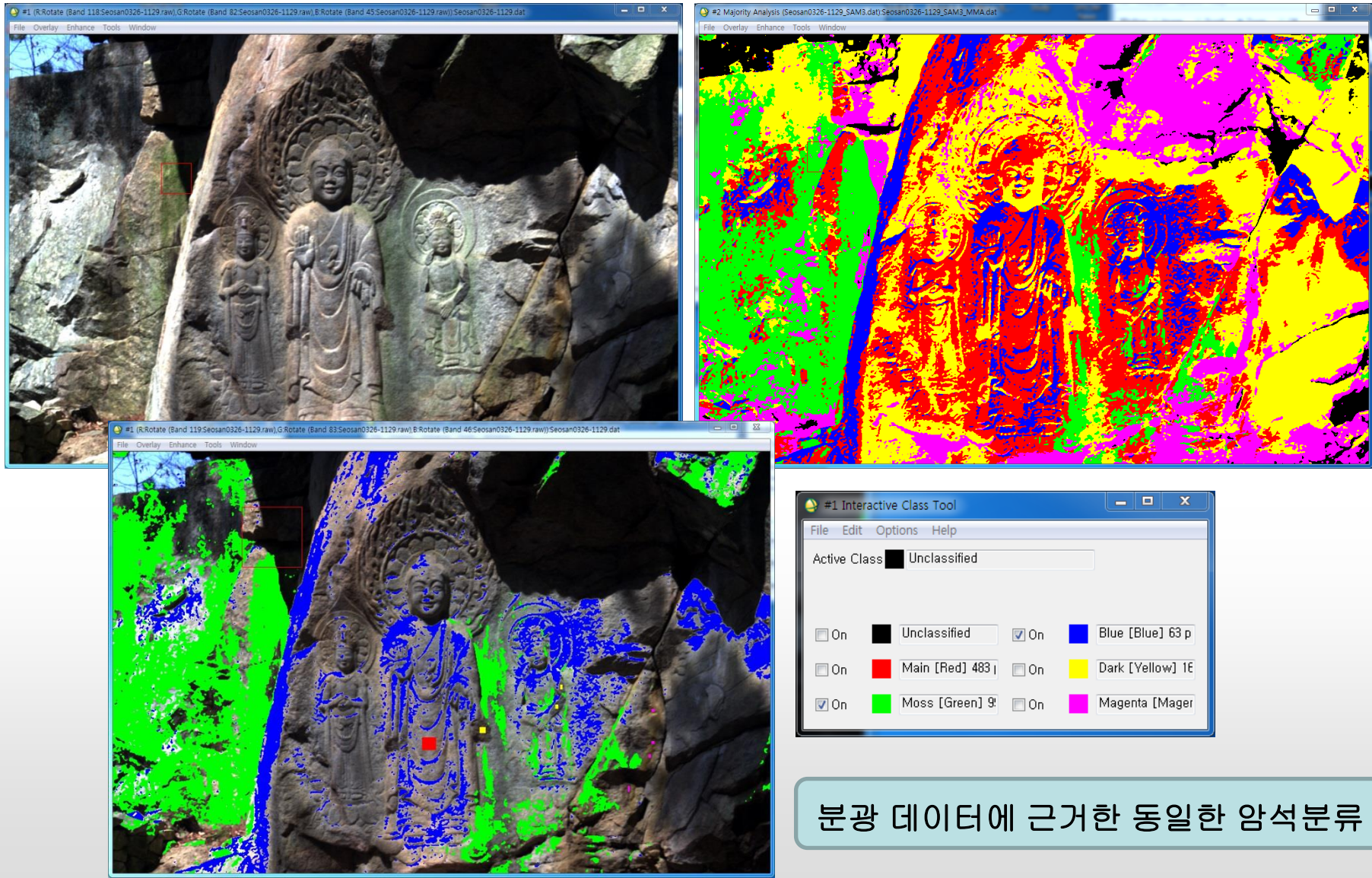
이끼 발생부분을 CIR 모드에서 보면 영상에서와 같이 붉은색 톤으로 나타남.



< CIR image >

광물 분류

풍화작용과 관련된 광물 특성 분석



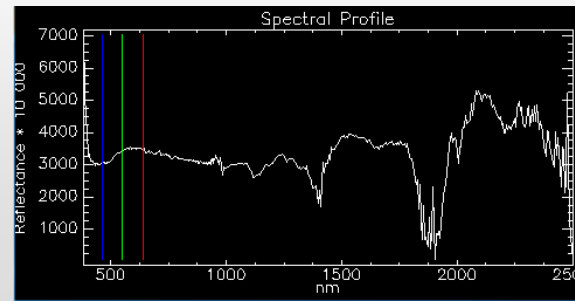
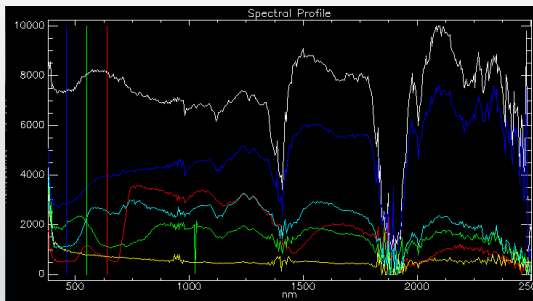
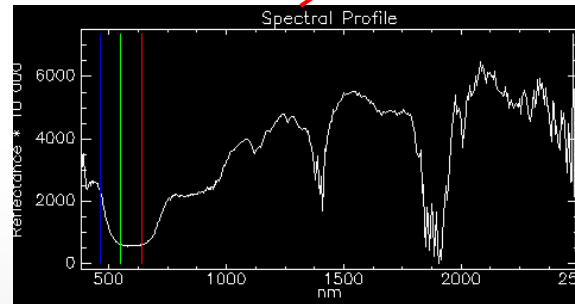
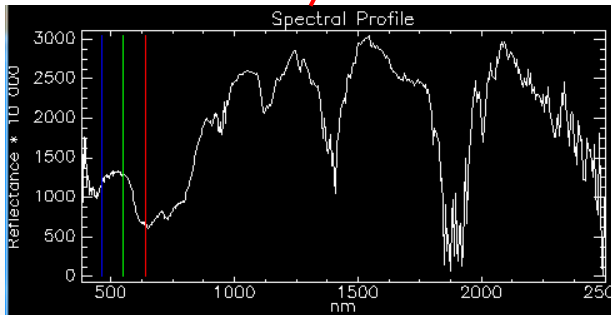
분광 데이터에 근거한 동일한 암석분류

문화재 조사 및 기록

석조문화재/단청 문양 등의 풍화상태 및 노후정도 파악 및 기록



< 경북 상주 화달리 삼층석탑 >



안료 측정 및 분석 I - 한국전통문화대학교

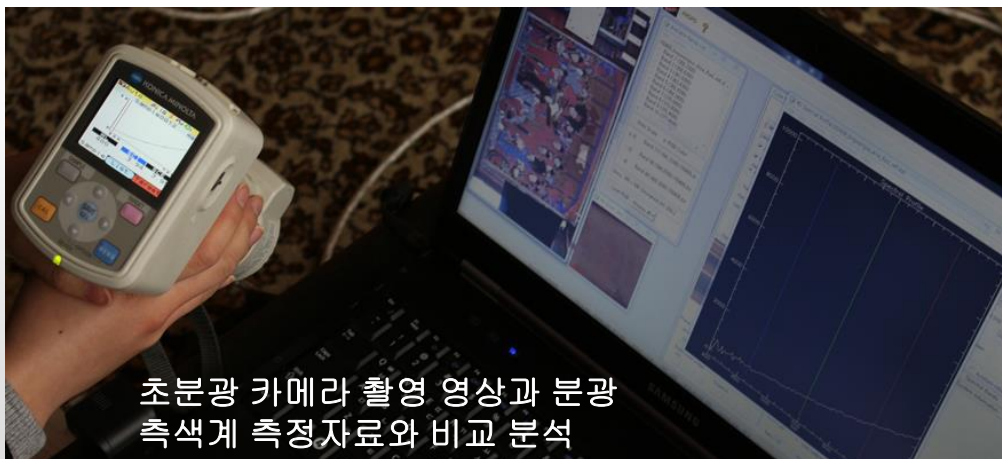
파주 보광사 대웅보전 내 불화(도석인물상 7점 중 1점) 초분광 카메라 및 분광 측색계 측정



초분광 카메라 촬영 작업



분광측색계 측정 작업

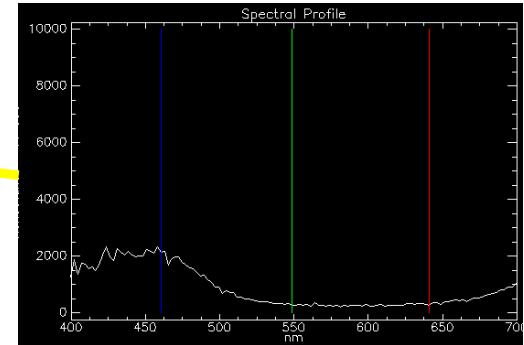


초분광 카메라 촬영 영상과 분광 측색계 측정자료와 비교 분석

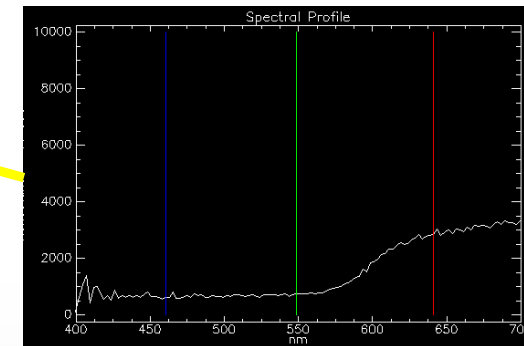
- ◆ 초분광 카메라 촬영 후 DN값을 Reflectance로 변환
- ◆ 접촉식 측정장비 인 분광측색계와 Profile 비교에서 정확하게 일치하는 결과를 보임
- ◆ 향후 초분광 카메라가 측정 시에 문화재에 훼손을 줄 수 있는 접촉식 측정장비를 대체 할 수 있을 것으로 기대됨

안료 측정 및 분석 II - 한국전통문화대학교

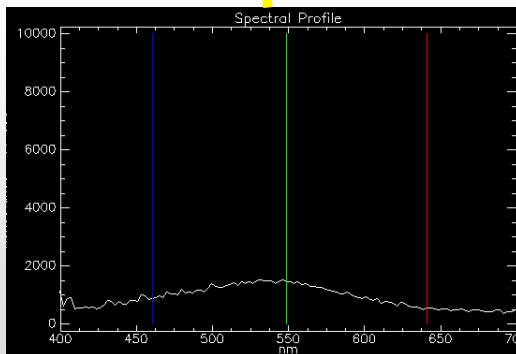
초분광 카메라 촬영 영상 반사도 처리 영상



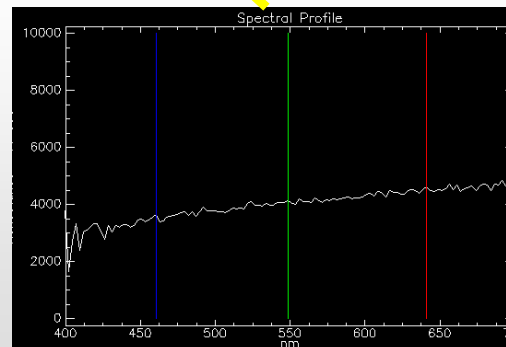
청색 안료



적색 안료



녹색 안료



백색 안료

보광사 대웅보전 내 불화
(도석인물상 7점 중 1점)
2015.4.9

◆ 초분광 영상의 반사율 측정에 의한
안료특성 분석 및 훼손에 대비하기
위한 노후 정도 파악 및 기록