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Evidences of large pyramid-like structure predating 10,000 Year BP at Mount Padang, West Java, Indonesia:
Applications of geological-geophysical methods to explore buried man-made structures

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BACKGROUND

Gunung Padang Megalithic site has been known since early 19 century but only recognized as ancient tombstone made of stacks of columnar-joint basaltic andesite on top of the mound. In fact, its exposure clearly shows that the youngest construction is built on top of an older, more sophisticated cultural rock layer. Besides, the morphology of the mound stands out as peculiarly much younger entity compared to the surrounded intensively steam-eroded, rough texture of the Tertiary volcanic rock complex. Hence, it deserves further investigations, particularly on what's lies beneath the megalithic site including suspected large chambers.

Exposed LAYER 2

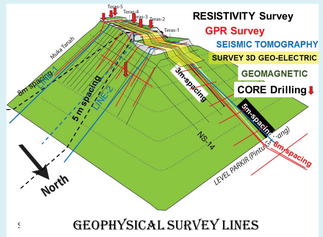
Buried LAYER 2 underneath soil fills of LAYER 1

METHOD

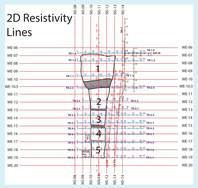
We use various near-surface geophysical methods including multi-channel resistivity, ground penetration radar (GPR), seismic tomography and geomagnetic coupled with core drilling and excavations. Hence, we are able to compare and verify the results of one method to anothe for better interpretations of subsurface structures.

MULTI-CHANNEL RESISTIVITY SURVEY
We use SuperSting R8 with 58 and 112 electrodes (www.agiusa.com); use various electrode spacing to have wide spectrum of resolutions and depth of penetrations in order to illuminate shallow and deeper objects. We conducted 3D resistivity survey particularly to scan suspected large underground chamber(s).

GROUND PENETRATION RADAR
We use SIR-2000 and 3000 of GSSI Units (www.geophysical.com) with various antenna including unshielded MLF, shielded 100Mhz and 250 Mhz; using various antenna frequency gives wide spectrum of resolution and depth of penetration for different purposes/targets. We conducted dozens of 2-D line survey



GEOPHYSICAL SURVEY LINES



SEISMIC TOMOGRAPHY SURVEY
The equipment and sofwares are developed by the Rock Fluid Imaging Lab(http://www.rock-fluid.com/). The seismic sources are generated by hammer, vibrator, and specially-design fire cracker.

CORE DRILLING
were conducted at 7(seven) sites around the top. Two sites has drilling depths 30- 33 meters, the rest is about G15-m depth . The logging as assisted by the GDA team (http://gda.co.id/)

GPR Survey

Core Drilling

Resistivity Survey

Visited by (Former) President of Indonesia and his cabinet in February 2014

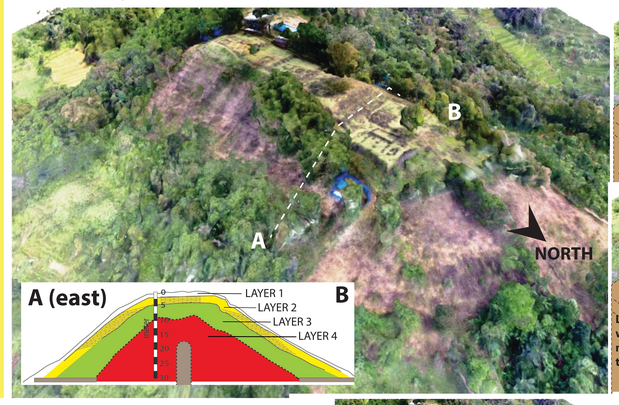
ACKNOWLEDGEMENT

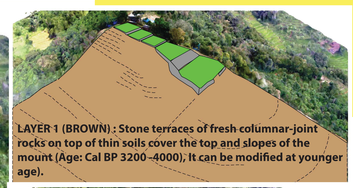
A special thank to Mr. Andi Arief, who faithfully encourages and supports the research activities; without him, this study would have never happened. We are gratefull to Gen.Dr. Soesilo Bambang Yudhoyono (The former president of Indonesia) and his cabinets, Gen. Gatot Nurmantyo, Admiral Ade Sopandi, Mr. Dedy Mizwar (former Vice Governor of West Java), and Prof. M. Nuh. We appreciate our amazing field team who help us with zeal. We are indebted to all friends in TTRM and many others that can not be all listed here.

ABSTRACT

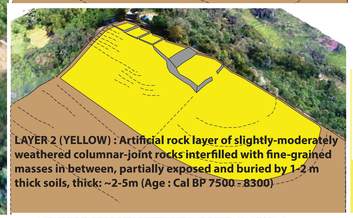
Mount Padang archeological site has been known since late nineteen century as a megalithic complex that sits on top. Our studies proves that the structure does not cover just the top but also wrap around the slopes covering about 15 ha area at least. Comprehensive geophysical surveys combining ground penetration radar (GPR) and multi-channel resistivity methods, seismic tomography augmented by bore-holes coring data and archeological excavations, show further that the structures are not only superficial but rooted into greater depth. The structures are not built at once but consisting several layers from consecutive periods. The uppermost layer on the surface consists of horizontal piles of basaltic columnar rocks forming step-structure terraces and decorated by exotic arrangements of stand-up rock columns forming walls, paths and spaces. The second layer, which had been previously misinterpreted as natural rock formation, buried 1-3 meters beneath the ground surface, is a several-meter thick fills consisting of more compact and advance arrangement of similar columnar rocks in fine-grain matrix. The third layer is also artificial arrangement of rock fragments with various kinds that extent down to about 15 meter deep. The third layer sits on fractured, massive basaltic lava tongue. The survey also reveals evidences of large underground cavities or chambers. Results of preliminary radiocarbon dating indicates that the first layer was built around Cal BP 3,000 - 3,500. The second layer was built around about Cal BP 7,500 - 8300. The third layer was built prior to Cal.BP. 9,500, and could be as old as Cal.BP.28,000.

SUMMARY: 3D AERIAL PHOTOGRAPHY OF GUNUNG PADANG PYRAMID AND INTERPRETATIONS OF ITS SUBSURFACE STRUCTURES BASED ON GPR, MULTI-CHANNEL RESISTIVITY , AND SEISMIC TOMOGRAPHY SURVEYS, CORE DRILLINGS, EXCAVATIONS, AND RADIO-CARBON DATING ANALYSIS

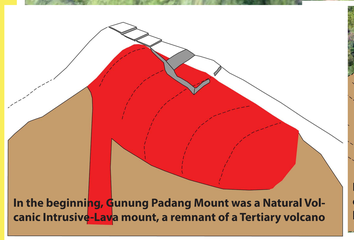




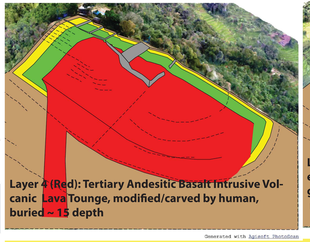
LAYER 1 (BROWN) : Stone terraces of fresh columnar-joint rocks on top of thin soils cover the top and slopes of the mount (Age: Cal BP 3200 -4000); It can be modified at younger age).



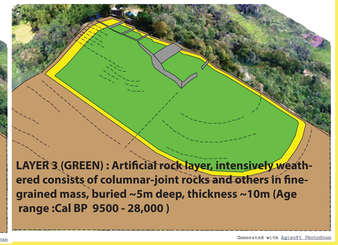
LAYER 2 (YELLOW) : Artificial rock layer of slightly-moderately weathered columnar-joint rocks interfilled with fine-grained masses in between, partially exposed and buried by 1-2 m thick soils, thick: ~2-5m (Age : Cal BP 7500 - 8300)



In the beginning, Gunung Padang Mount was a Natural Volcanic Intrusive-Lava mount, a remnant of a Tertiary volcano

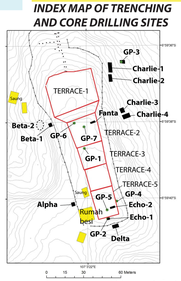


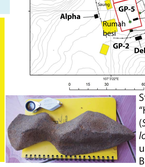
Layer 4 (Red): Tertiary Andesitic Basalt Intrusive Volcanic Lava Tounge, modified/carved by human, buried ~ 15 depth



LAYER 3 (GREEN) : Artificial rock layer, intensively weathered consists of columnar-joint rocks and others in fine-grained mass, buried ~5m deep, thickness ~10m (Age range :Cal BP 9500 - 28,000)

INDEX MAP OF TRENCHING AND CORE DRILLING SITES

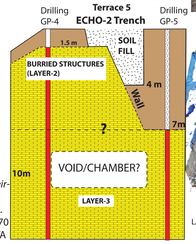




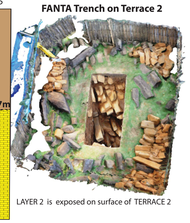
Stone artefact "KUJANG" (*Sundanese Heirloom*) buried under 3-m Cal. BP 9550 to 9770 soil fill at DELTA

ECHO-2 Trench Photo

CHARLIE-1 Trench on East Slope



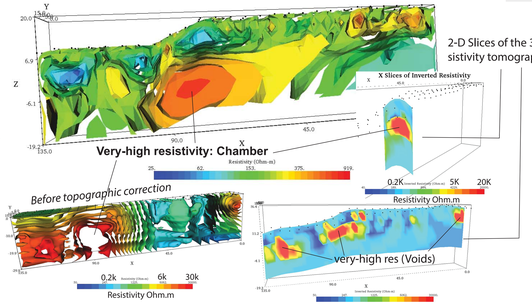
FANTA Trench on Terrace 2



LAYER 2 is exposed on surface of TERRACE 2

3-D RESISTIVITY TOMOGRAPHY - Spacing 6-m grid: Focusing on Chambers

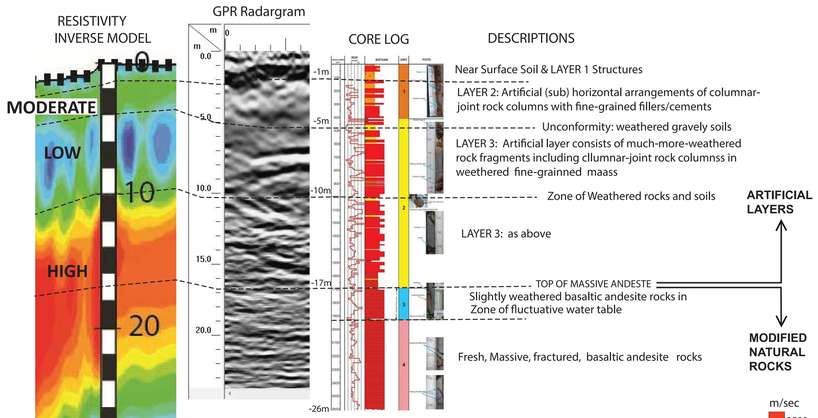
3D Resistivity Contour Plot



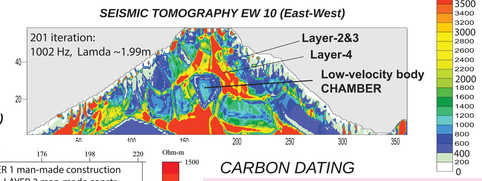
2-D Slices of the 3D resistivity tomography

RESULTS

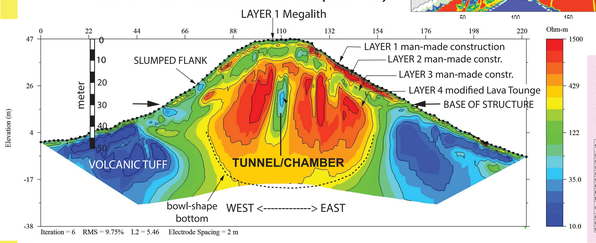
STRATIGRAPHY BASED ON CORE LOG, RESISTIVITY AND GPR DATA



SEISMIC TOMOGRAPHY EW 10 (East-West)



RESISTIVITY 2-D TOMOGRAPHY EW 10.5 (East-West)

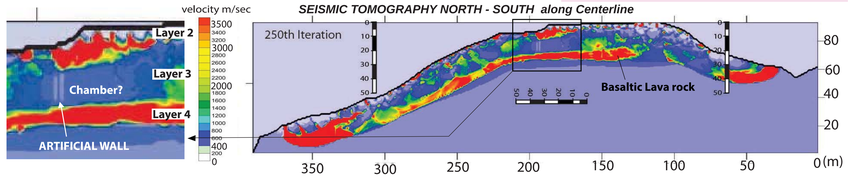


CARBON DATING

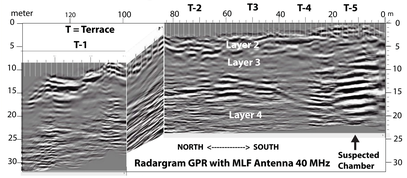
Carbon-soils in Layer 1, 2, 3 are sampled for C-14 dating assuming they were derived from bio-organic activities after constructions. Most analysis are done by Accelerator Mass Spectrometry (AMS) technique at BETA Analytic (www.radiocarbon.com/)

SAMPLE #	BETA#	SITE	SAMPLE TYPE	LAYER	CONVENTIONAL C-14 AGE	CORRECTED AGE (95.4% Probability)	Percent Modern Carbon (pMC)
GP1-295	331493	Core/Drilling #1	Soils	Near Surface	560 ± 30 BP	Cal BP 520 to 640	93.3 ± 0.4
GP1-1115	331494	Core/Drilling #1	Soil between rocks	Layer 2	13510 ± 50 BP	Cal BP 16640 to 16790	18.6 ± 0.1
GP1-290	331495	Core/Drilling#1	Filled soil	Burying layer 3	8710 ± 40 BP	Cal BP 9550 to 9770	33.8 ± 0.2
GP2-750	331496	Core/Drilling #2	Soil between rocks	Layer 3	22750 ± 120 BP	Cal BP 26990 to 27670	5.9 ± 0.1
GP2-1100	331497	Core/Drilling #2	Soil between rocks	Layer 3	25190 ± 140 BP	Cal BP 29690 to 29910	4.4 ± 0.1
ECS	A23691	Trenching Echo	Soils	Near Surface	480 ± 30 BP	Cal BP 530 to 560	94.2 ± 0.4
ES1	A23690	trenching Echo2	soil between rocks	Layer 2	7400 ± 30 BP	Cal BP 8129 to 8339	39.8 ± 0.2
EM4	A23689	trenching Echo2	soil between rocks	Layer 3	8630 ± 30 BP	Cal BP 9890 to 9559	33.6 ± 0.2
GP1-500	BATAN-INA	Core/Drilling#1	Gravelly Soils underlying Layer 2		6700 ± 70	Cal BP 7522 to 7735	45.2 ± 0.70
Charlie-3	BATAN-INA	Charlie-1	soil between rocks	Layer 3	3025 ± 30	Cal BP 3106 to 3405	69.38 ± 0.95
Charlie-4	BATAN-INA	Charlie-1	soil between rocks	Layer 3	3630 ± 60	Cal BP 3901 to 4072	64.47 ± 0.88
Charlie-5	BATAN-INA	Charlie-1	soil between rocks	Layer 2	7095 ± 60	Cal BP 7857 to 8079	41.40 ± 0.60

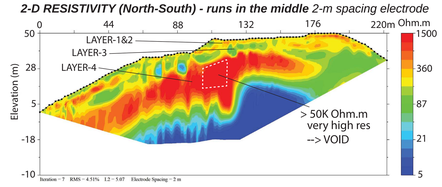
SEISMIC TOMOGRAPHY NORTH - SOUTH along Centerline



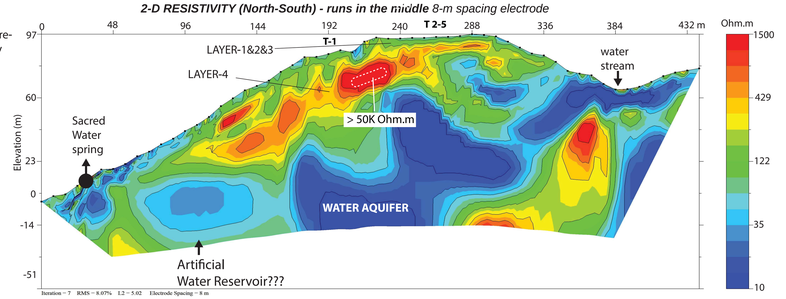
2-D GPR-Radargram North-South centerline



2-D RESISTIVITY (North-South) - runs in the middle 2-m spacing electrode



2-D RESISTIVITY (North-South) - runs in the middle 8-m spacing electrode



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