FIG WORKING WEEK 2017

The morphotectonic 3-D modeling of Cisadane watershed based on interpretation of satellite imagery and field survey in the region of South Tangerang, West Java, Indonesia

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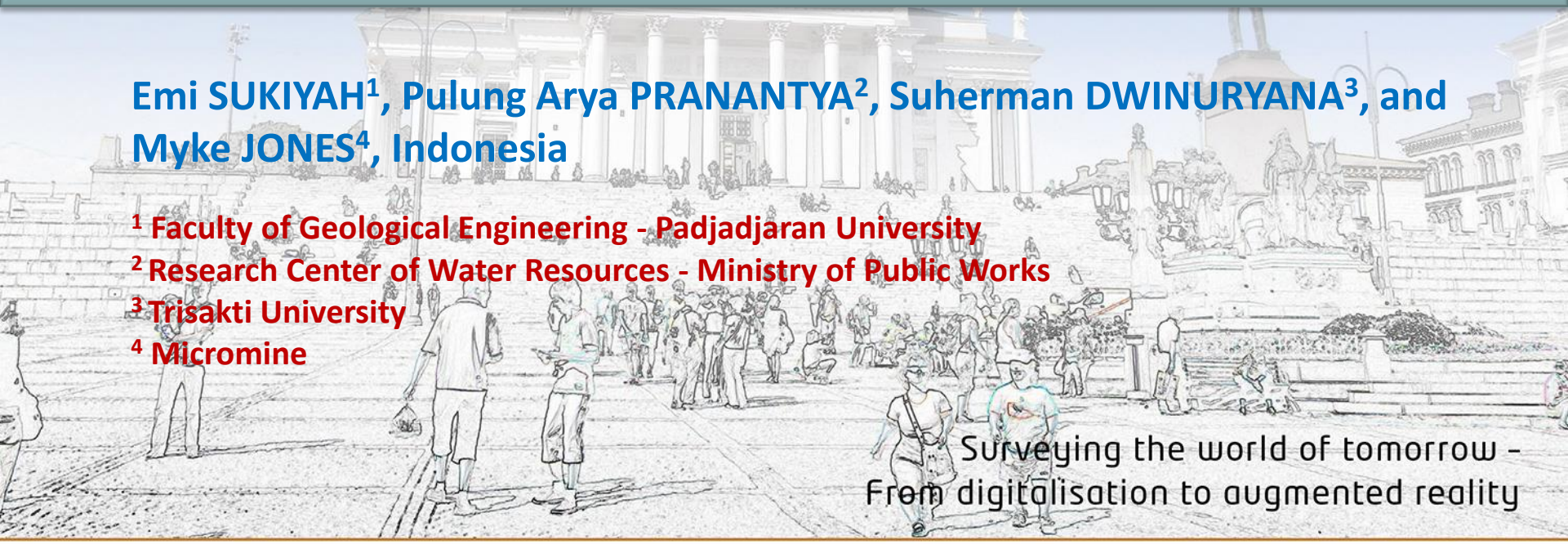

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Key words: morphotectonic, 3-D model, sag pond, active fault, Cisadane River

Introduction

Landforms ← tectonic processes

- escarpment,
- straightness of the valley,
- straightness of the ridge,
- river lineament,
- drainage patterns, etc.

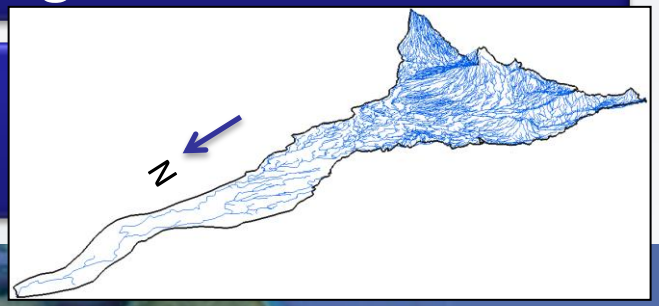
The old age rocks deformed are difficult to observe with remote sensing data. In general, they have been covered by younger sediments, even if exposed usually eroded.

Traces of tectonic product sometimes still recorded as reflected in morphometric characteristics of the watershed and drainage patterns.

The study results of morphotectonic can be one of the references to determine periods of tectonic control of an area.

Active faults in West Java is the source of earthquakes that can be grouped into three major active fault zones, i.e. Cimandiri fault, Baribis fault and Lembang fault

can be seen from the morphotectonic aspect



Cisadane watershed stretched from Bogor, Tangerang and Jakarta. The area is included in coastal plain Jakarta and Bogor Zones (van Bemmelen, 1949). Their geological setting has been mapped by Turkandi et al (1992) and Efendi et al (1998). There are 18 rock formations that make up this region, Tertiary to Quaternary.

- There are anticline, syncline, and faults that developed in the study area.
- The most significant structures is Cisadane ancient fault, trending nearly north-south.
- Given the existence of the geological structures in this region potentially are active.

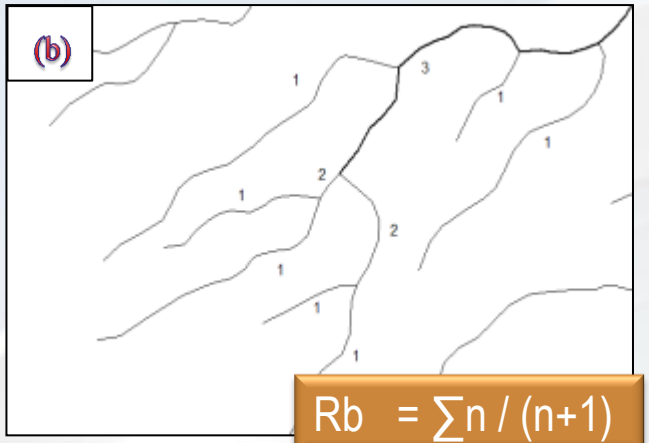
It is important to create a 3-D model of morphotectonic. The models are expected to provide further information related to the period of tectonic control of the region.

Methods

Data obtained from the interpretation of satellite imagery, topographic map and field survey

The image used is the SRTM imagery 2015 with 30 m resolution

Morphotectonic variables used to analyze tectonic activity are valley ratio (Vf-ratio), bifurcation ratio (Rb), drainage density (Dd), lineament of the valley and ridge, and sinuosity of mount front (Smf).

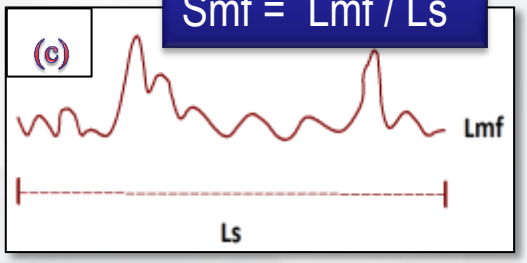


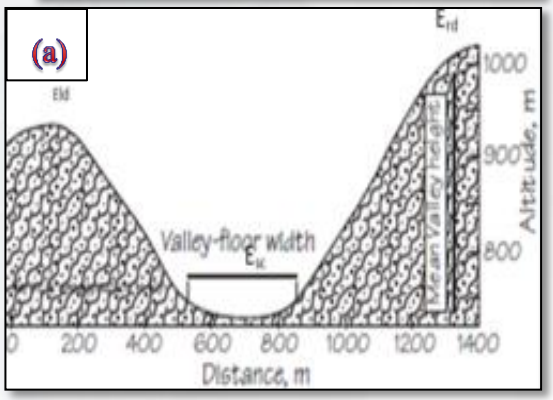
$Rb = \sum n / (n+1)$

$Dd = \sum n / A$

$Vf = 2Vfw/[(Eld - Esc) + (Erd - Esc)]$

$Smf = Lmf / Ls$

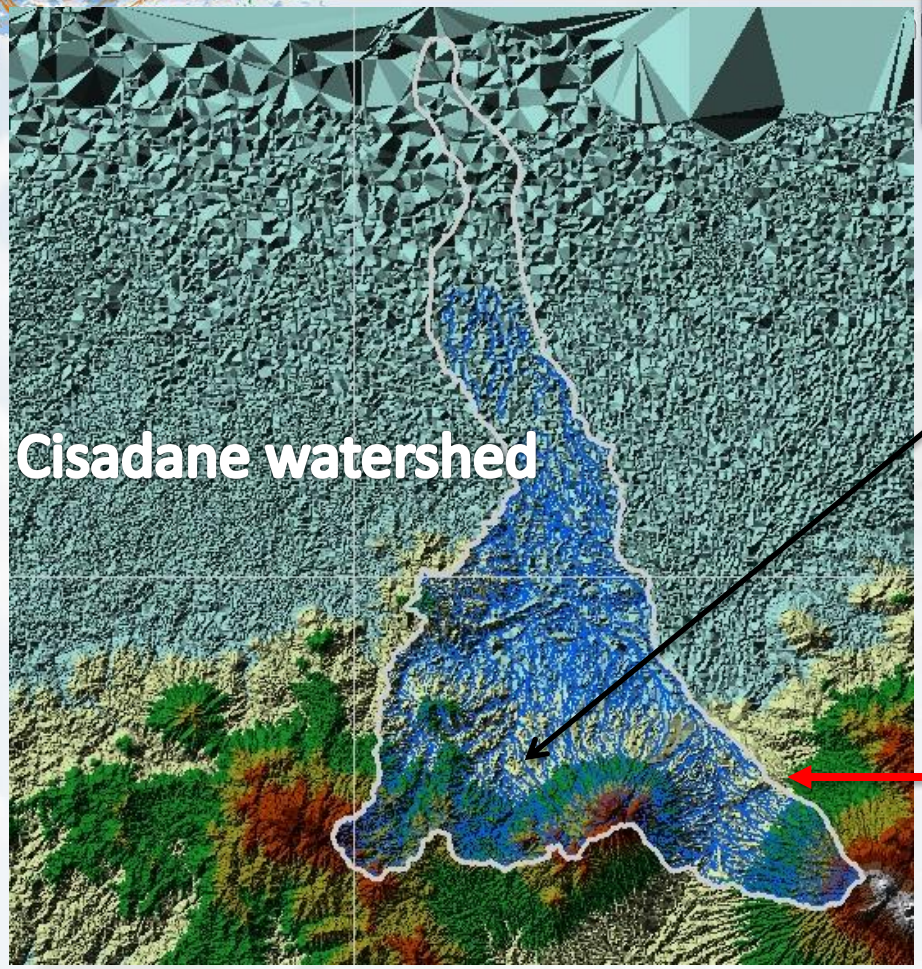


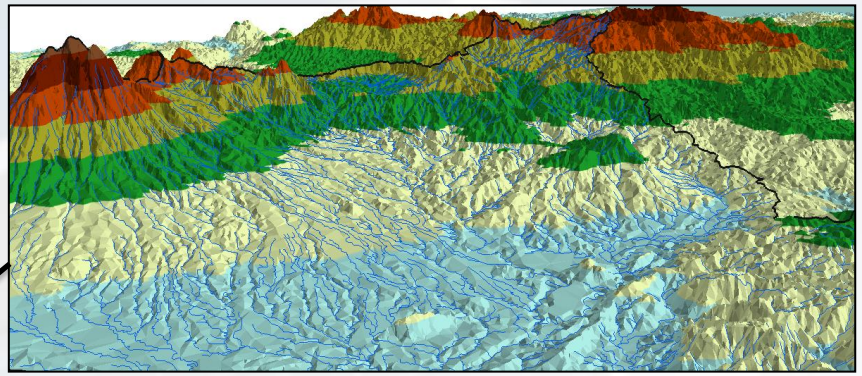


The data were then processed using Micromine software for easy construct 3-D models. Arc map and Arc scene software are also used to provide a more detailed 3-D surface models.

http://www.micromine.com (academic license)
http://www.esri.com/software/arcgis/explorer-desktop/download
http://www.esri.com/arcgis/trial

Results & Discussions

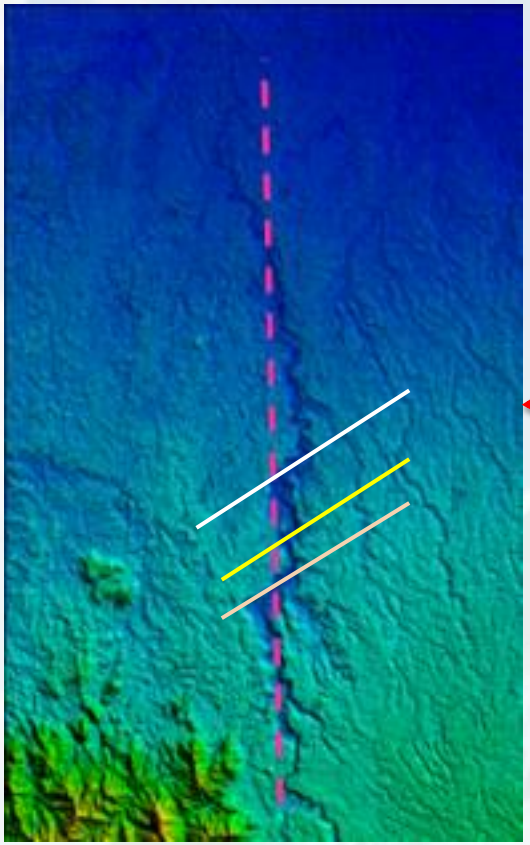


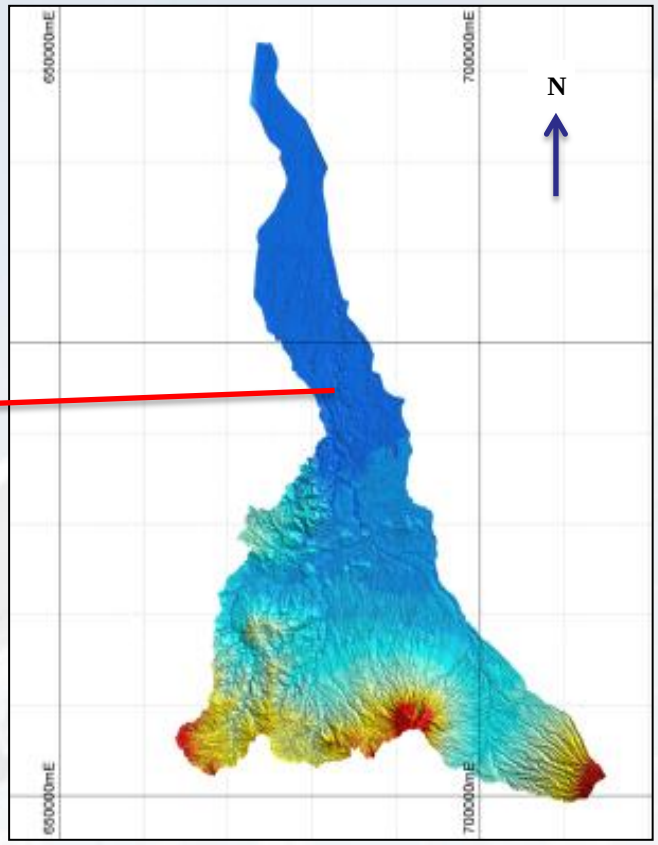


Elevation (m)

More than	2,675
2,334 -	2,675
1,992 -	2,334
1,651 -	1,992
1,310 -	1,651
968 -	1,310
627 -	968
287 -	627
0 -	287

The southern part of the hills, while in the middle and north is relatively flat.





Main channel of Cisadane river as trace of old Cisadane fault, trending almost north - south.

However, in some locations it has been segmented.

In general, the results obtained show that there is still tectonic activity in the region.
However, if compared with the existing literature turns tectonic activity that takes place in this region is low.

Classification of tectonic activity degree based on

No	Vf-ratio	Data	Class	Annotation	Interpretation (Keller & Pinter, 1996)
1	0.15- 0.50	2	I	High uplift	High uplift and V-shape valley (Vf-ratio < 0.50)
2	0.50- 1.00	4	II	Medium uplift	Medium uplift (Vf-ratio = 0.5-1.0)
3	1.00-10.00	8	III	Low uplift	Low uplift and U-shape valley (Vf-ratio >1.0)
4	>10.00	7	IV	Very low uplift	

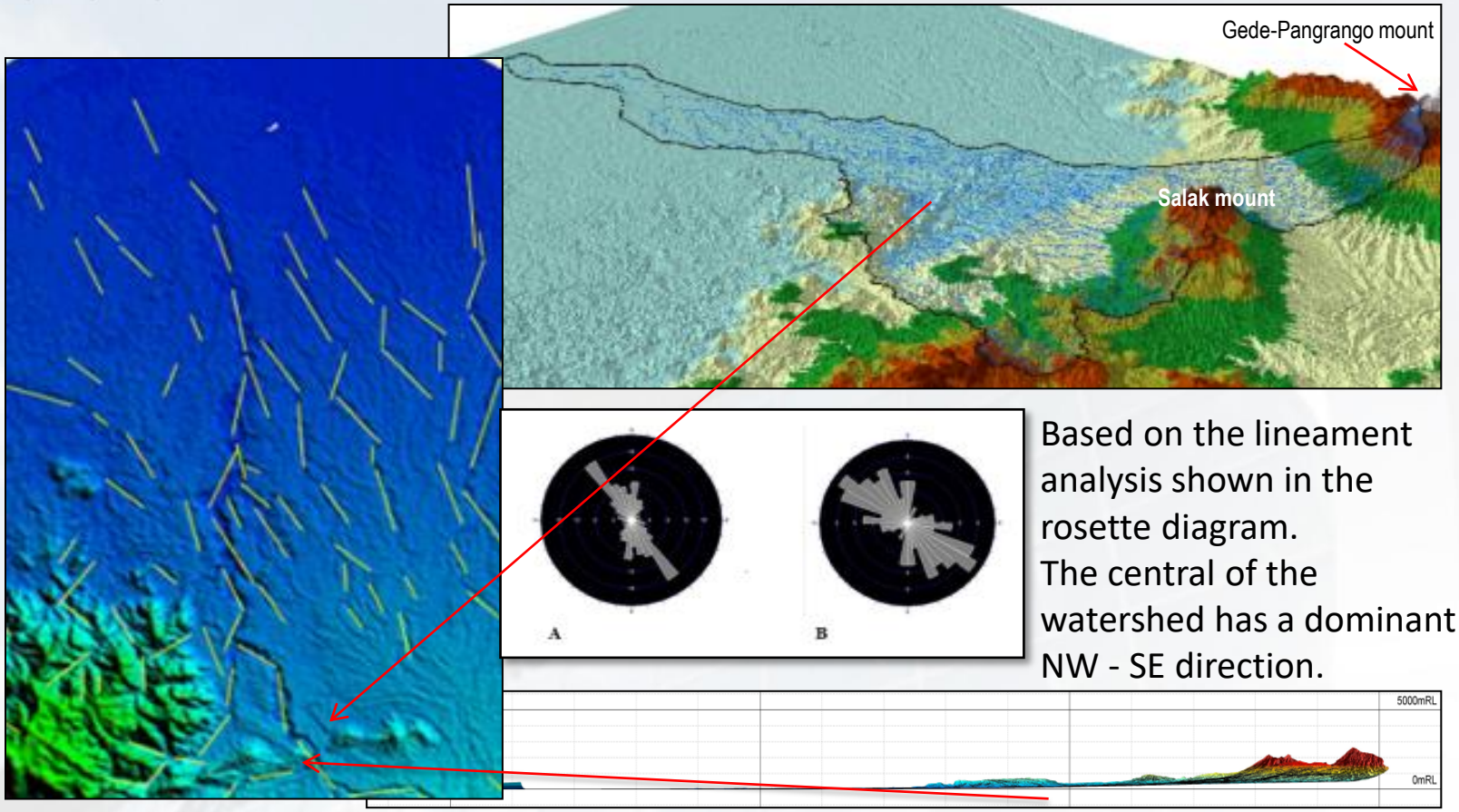
Indications of high tectonic activity levels were found in 2 locations: Cilangkap and near Cihowe. Meanwhile, medium tectonic activity is found in several locations in the south and southeast.

The rivers in the central Cisadane watershed have a range of order 1 to order 6. Rb has a range of values from 0.44 to 38.00.

Dd value ranging from 0.95 to 3.52. Lithology as the base of the region tends to have medium resistance.

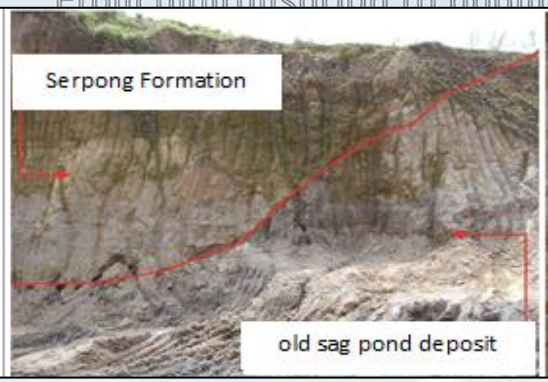
Smf calculation is performed on 27 locations distributed in the central of Cisadane watershed

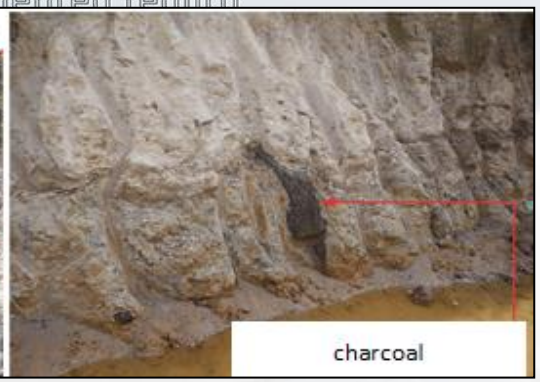
No	Lmf (km)	Ls (km)	Smf
1	1.30	1.27	1.03
2	2.92	2.71	1.08
3	5.25	4.86	1.08
4	2.57	1.98	1.30
5	4.74	3.54	1.34
6	3.56	2.88	1.24
7	2.08	1.57	1.32
8	2.80	1.99	1.41
9	1.26	1.02	1.24
10	3.07	2.03	1.51
11	3.29	1.96	1.68
12	1.32	1.12	1.18
13	3.42	2.39	1.43
14	3.19	2.64	1.21
15	3.27	2.16	1.51
16	1.19	0.95	1.26
17	1.30	1.07	1.22
18	1.71	1.26	1.36
19	1.62	1.29	1.25
20	1.35	1.11	1.22
21	1.74	1.40	1.25
22	1.22	0.99	1.24
23	3.24	2.59	1.25
24	4.13	2.97	1.39
25	2.34	2.01	1.16
26	0.15	0.13	1.13
27	5.59	3.21	1.74



Based on the lineament analysis shown in the rosette diagram.
The central of the watershed has a dominant NW - SE direction.

Distribution of lineaments and Rosette diagram; scarp lineament (A) and hill lineaments (B).





Youngest sag pond

The product of the quarter tectonic period is characterized by 3 types of sag pond; i.e. Old, young, youngest.

Conclusion

1. The product of Quaternary tectonic include sag pond, folded river terraces, lithology offset, springs, and fracture.
2. The 3 tectonic period control central Cisadane watershed in Quarter based on sag pond analysis. The mechanism of trans-tensional faults due to horizontal motion resulted in the formation of sag pond.
3. The appearance of 3-D Cisadane watershed is helpful in analyzing in more detail the existence of morphography units related tectonic. Extreme topography is very helpful to recognize the phenomenon in the field.

Thank you for your attention