The Morphotectonic And Neotectonic Response In Apaumagida, Enarotali And Pegunungan Legare Area Papua

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Abstract.

The verification of morpho-tectonic responses were indicated by changing of the lineament, the river segment azimuth, the mountain front sinuoucity, the mountain front facet in rock formation between lately and early geological period, controlled by neotectonic for bifurcation ratio and drainage density in Quarternary morphometry. There are three research areas namely Apaumagida Area represented by Permian–Triassic at coordinate 135°18'11,88" E - 135°43'20,14" E and 3°56'17,59" S - 4°8'28,44" S, Enarotali Area represented by Cretaceous–Paleocene at coordinate 136°18'45,08" E - 136°29'42,00" E and 3°53'34,75" S - 4°5'16,03" S, and Legare Mountain Area represented by Tertiary– Quarternary at coordinate 135° 28' 54,87" E - 135° 47' 16,80" E and 3° 25' 31,17" S - 3° 6' 6,25" S. Conclusion by different test and regression-correlation test for lineaments, river segments, mountain front sinousity and mountain face facet between Permian -Triassic, Cretaceous-Palecene and Tertiary - Quarternary are significant different to indicated that tectonic roled actively in geomorpho-tectonic in research area. Furthermore, by the neotectonic controlled, there is similarity between bifurcation ratio and drainage density in Quarternary indicated that tectonic roled actively to forms morphology in Central Mountain Papua.

Keywords : *lineaments, segment azimuth of rivers, mountain face sinucity, mountain face facet and neotectonic.*

I. INTRODUCTION

The rough relieves, the steep and long scarpments with the drainage pattern variatively are geomorphology phenomenon in Central Mountain Papua. The early tectonic evolution of New Guinea sinced the oblique convergent between Indo-Australian plate and Pasific plate. Generally, Central Mountain and New Guinea positioned as type location of the roceanic island arc active subducted beneath the continent plate (Hamilton, 1979; Dow, *et al*., 1988). This cases had proven by description of the oceanic plate rock spreaded in Cretaceous – Tertiary ophyolite complex and ulltrabasic contacted with Derewo methamorphic rock (figure 1).

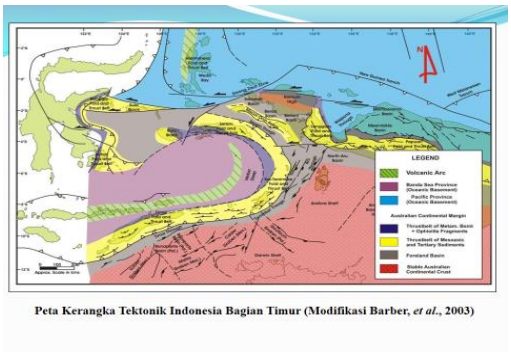


Fig 1. Tectonic setting map of Estern Indonesia (Modifikcated by Barber, *et al*., 2003).

Forward to the south from Derewo methamorphic rock forms Central Mountain 1300 km in length, 150 km in belt width with rough tophographic, more than 3000 m in height, most steeply hills arranged by foldings and faultings.

The Paleozoicum and Mesozoicum rock layering was sedimented on northen boundary of Australian continent plate passively (Cloos dkk, 2005). This zona width included thrust faults and folds subducted forward to the south included the Paleozoicum rock to the Early Cenozoicum (Terstiary) rock from Australian continent plate.

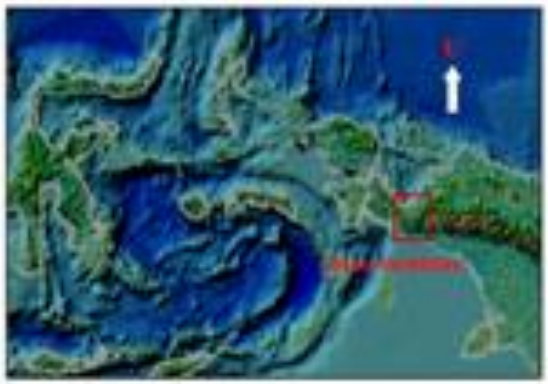


Fig 2. The research lokation map in Apaumagida, Enarotali dan Pegunungan Legare Area Papua

The morpho-tectonic research used the Enarotali and Waghete geology map sheets published by The Center of Developing and Researching Bandung in scale 1 : 250.000 (figure 2). Howconform the developing of morpholgy on the older rock formation compared to the morphology of the younger rock formation, realized by the regression - correlation of the lineaments with the river segment azimuth on the drainage basin? How index geomorphology in mountain face sinuousity and mountain face facet in boundary of rock formation in between system. How the neotectonic actively to controlled the bifuration ratio and the drainage density in the Quarternary research area? All the verification result of morpho-tectonic are very important to support the developing of land resources, exploration of metal mineral and hydrocarbon.

II. METHODS

The tophographic map interpretation necessary to indentified the drainage patterns, the system of drainage basins. Research obyect were the lineaments and the river segment azimuths which obtained from tophographic map and airphotos, image SRTM (*Shuttle Radar Tophography Mission*). Data of mountain face sinuousity, mountain face facet data, river density value, bifurcation ratio processed to analysis of morphotectonic. The Lineaments as population geology structure correlated with river segments. Mountain face sinuosity, mountain face facet analysised by statistic test. Statistic analysis used for regression – correlation, mean different test for samples couple and analysis of variance one way (One way Anova).

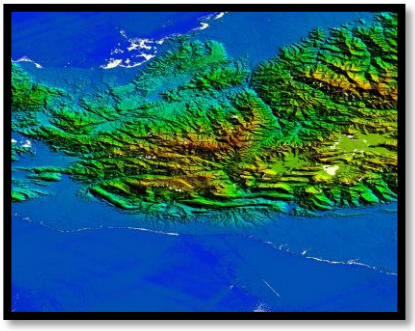


Fig 3. The satelite image of Apaumagida, Enarotali, Pegunungan Legare and surrounded.

III. RESULTS AND DISCUSSIONS

The Resfonses verification of morpho-tectonic consisted of the boundary of Permian – Triassic represented by Aiduna Formation and Tipuma Formation in Apaumagida Area, the boundary of Cretaceous – Paleocene represented by Ekmai Formation and Waripi Formation in Enarotali Area,

the boundary of Tertiary – Quartenary represented by the Konglomerat Karado and Batulumpur Bumi in Pegunungan Legare area.

The morpho-tectonic of Permian – Triassic in Apaumagida (Apowo) Area

Apaumagida (Apowo) Area lays on the coordinate 135°18'11,88"E-135°43'20,14" E dan 3°56'17,59" S - 4°8'28,44" S. Administratively into the Dogiyai Regency. The researchin focused on the several rivers eg. Mapia River, Pogi River, Pahau River. The geomorphology unit consisted of the structure mountain geomorphology unit, the steeply sediment structure geomorphology unit.

Table 1. The river segment azimuths in Aiduna Formation (Permian) and Tipuma Formation (Triassic)

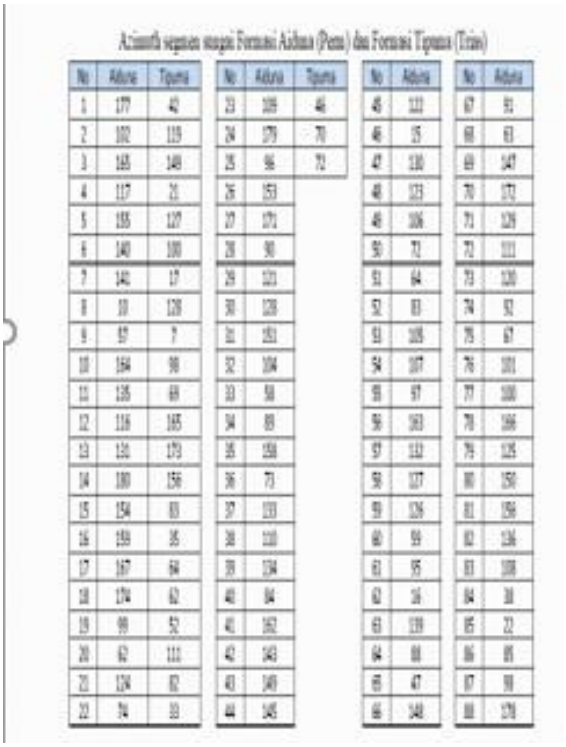
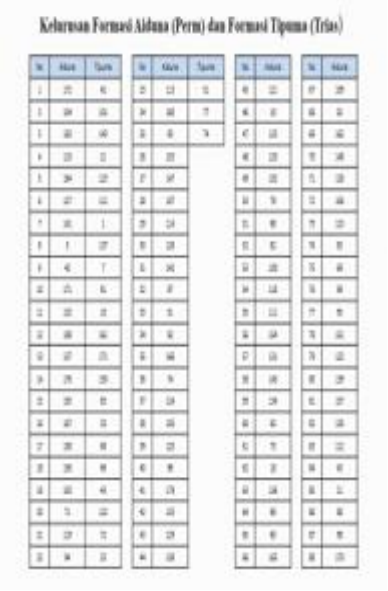


Table 2. The lineaments in Aiduna Formation and Tipuma Formation



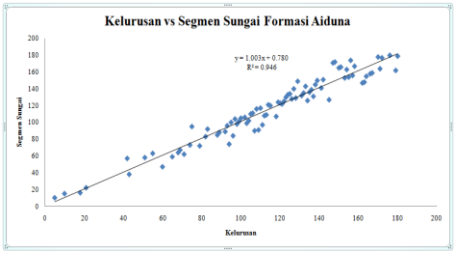


Fig 4. The scatter plot graphic of the lineaments vs the river segment azimuths in Aiduna Formation

The regression equation of the lineaments vs the river segment azimuths in Aiduna Formation :

$$\hat{y} = a + bx = 0.7808 + 1.0038x$$

The cofficient of correlation r = 0.9730 and the coefficient of determination : $r^2 = 0.9468$ means there is very strength relation between the lineaments with the river segment azimuths in Aiduna Formation means the tectonic actively in Permian Period.

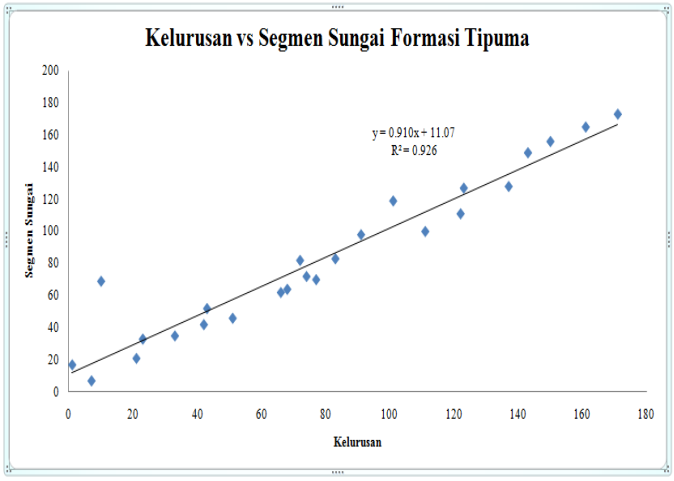


Fig 5. The scatter plot graphic between lineaments with river segment azimuths in Tipuma Formation.

The regression equation of the lineaments vs the river segment azimuths in Aiduna Formation :

$$\hat{y} = a + bx = 11.0721 + 0.9108x$$

The coefficient of correlation r = 0.9626 and the coefficient of determination : $r^2 = 0.9266$ means there is very strength relation between the lineaments with the river segment azimuths in Tipuma Formation means the tectonic actively in Triassic Period.

Table 3. The mountain face sinuousity in Aiduna Formation and Tipuma Formation

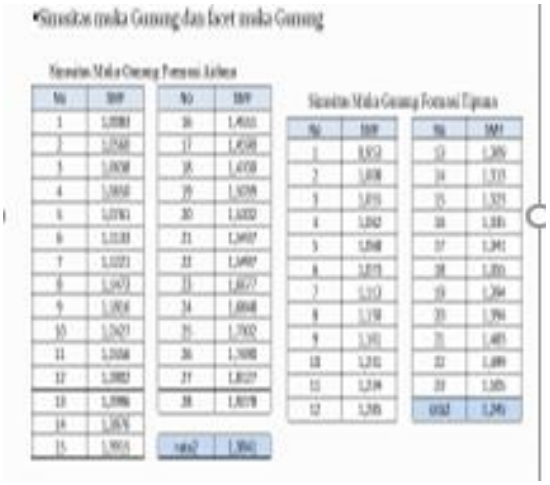
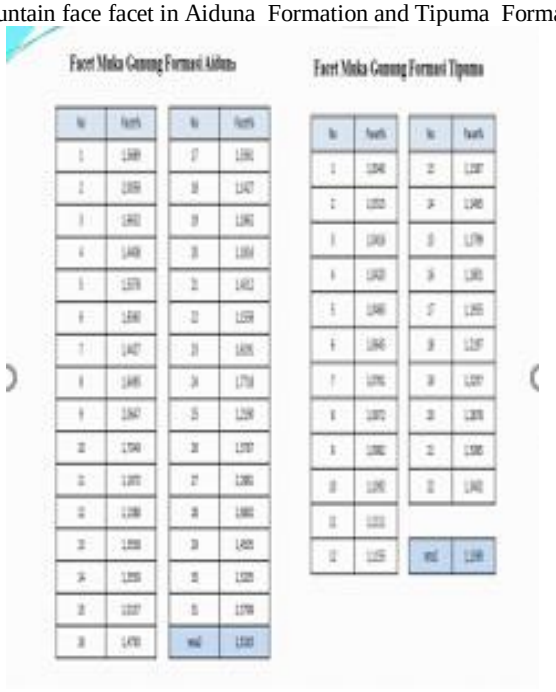


Table 4. The mountain face facet in Aiduna Formation and Tipuma Formation

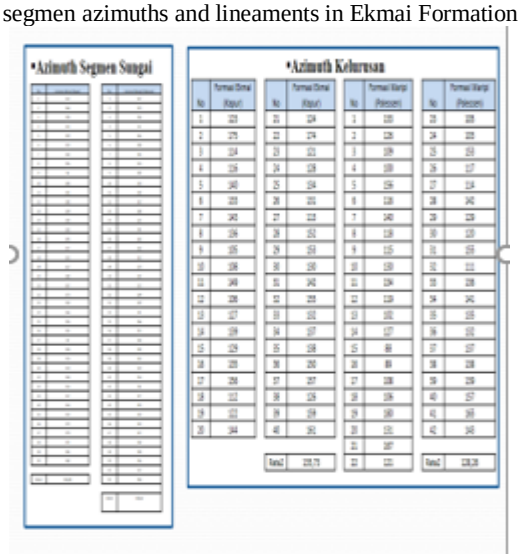


By the mean test, there are the lineaments different in Aiduna Formation and Tipuma Formation means that the tectonic is active in Permian to Triassic. By the mean test, there are the different in the river segment azimuths in Aiduna Formation and Tipuma Formation means that the tectonic is active in Permian to Triassic. The mountain front sinuousity ($\bar{x}$ = 1,3841) and the mountain front facet ($\bar{x}$ =1,5163) in Aiduna Formation and Tipuma Formation more than one, indicated that the tectonic is present in Aiduna Formation

The morpho-tectonic of Cretaceous–Tertiary (Paleocene) boundary in Enarotali Area

Enarotali area lays on 136°18’45,08” E – 136°29’42,00” E dan 3°53’34,75” S - 4°5’16,03” S. Administratively into Paniai Regency, Papua. The geomorphology map unit consisted of the lake plain geomorphology unit, the gently hills geomorphology unit, the structure hills geomorphology unit. The data of river segment azimuths and thelineaments and the rosette diagram in both formations are northwest – south east.

Table 5. The river segmen azimuths and lineaments in Ekmai Formation and Waripi Formation.



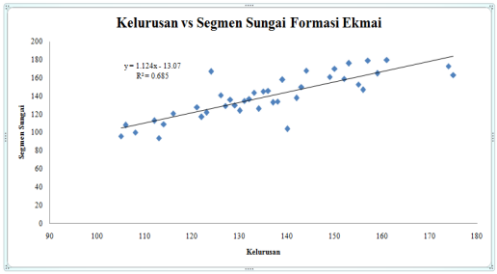


Fig 6. The *scatter plot* graphic of the lineametns and the river segment azimuths in Ekmai Formation

The regression equation :

$$\hat{y} = a + bx = 1.1240x - 13.0733$$

The cofficient of correlation r = 0.8278. and the coefficient of determination $r^2 = 0.6851$ means there is strength relation between the lineaments with the river segment azimuths in Ekmai Formation, means the tectonic is active in Cretaceous.

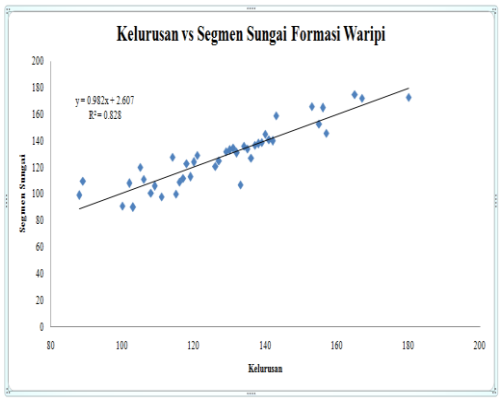


Fig 7. Graphic of *scatter plot* between lineaments and river segments in Waripi Formation

The regression equation :

$$\hat{y} = a + bx = 2.6073 + 0.9825x$$

The cofficient of correlation r = 0.9100 and the coefficient of determination $r^2 = 0.8280$ means there is very strength relation between the lineaments with the river segmentazimuths in Waripi Formation, means the tectonic is active in Paleocene.

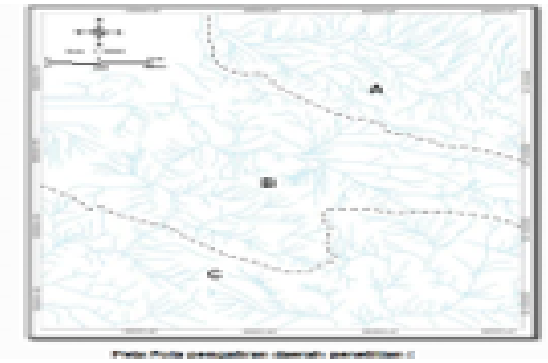


Fig 7. The rosette diagram pattern of the river segment azimuths and the lineaments Ekmai Formation and Waripi Formation

The geomorphology index in the mountain front sinuousity and the mountain front facet indicated the tectonic intensity in each system.

In Ekmai Formation, the mountain face sinuousity value is ($\bar{x}$ = 1,0602) and the mountain front facet is ($\bar{x}$ =1,2052) indicated that tectonic is active. The mountain front sinuousity value is less than in Aiduna Formation, indicated that the tectonic is less than in Enarotali area. In Waripi

Formation, the mountain front sinuousity is ($\bar{x}$ = 1,1362) and the mountain front facet is ($\bar{x}$ =1,0953) indicated that the ectonic is active. The mountain front sinuousity value is more than Aiduna Formation, indicated that the tectonic is more than in Enarotali Area.

The Morpho-Tectonic of Konglomerat Karado (Tertiary) and Batulumpur bumi (Quarternary) boundary in Pegunungan Legare Area

Pegunungan Legare area lays on coordinate 135° 28' 54,87''- 135° 47' 16,80'' E dan 3° 25' 31,17''- 3° 6' 6,25''S. Administratively into Nabire regency. The researching focused in several rivers eg. Siriwini river, Nabire river and Araudo river.

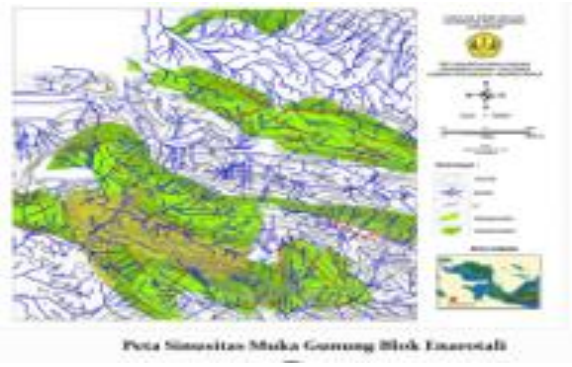


Fig 8. The Lineaments in Pegunungan Legare Nabire Regency Papua

The geomorphology unit consisted of the structure hill geomorphology unit and the stepply hills geomorphology unit. The lineaments azimuth south east – north west in Konglomerat Karado and north –south in Batulumpur Bumi. The mountain front sinuousity and the mountain front facet value more than one which indicated the tectonic is active.

The regression equation of lineaments vs river segments in Konglomerat Karado :

$$\hat{y} = a + bx = 1.1240x - 13.0733$$

The coefficient of correlation r = 0.9491 and the coefficient of determination $r^2 = 0.9007$. There is very strength relation between the lineaments and the river segment azimuths in Konglomerat Karado.

The regression equation of lineaments vs river segment azimuths in Batulumpur Bumi:

$$\hat{y} = a + bx = 2.6073 + 0.9825x$$

The coefficient of correlation r = 0.8944

and the coefficient of determination $r^2 = 0.8000$. There is very strength relation between the lineaments and the river segment azimuths in Batulumpur Bumi.

The mountain front sinuousity value ($\bar{x}$ = 1,3160) dan the mountain front facet value ($\bar{x}$ =1,4657) indicated that the tectonic continued and erosion not so strength in Konglomerat Karado. The mountain front sinuousty value is ($\bar{x}$ = 1,3662) dan the mountain front facet is $\bar{x}$ =1,3713) in Batlumpur Bumi indicated that tectonic continue and erosion is not so strength.

The neotectonic control was indicated by the bifurcation ratio values and the drainage density in drainage basin of Konglomerate Karado and Batulumpur Bumi.

The mean value of bifurcation ratio (R_b) : $\bar{x}$ = 4,711 and the mean river density (D_d $\bar{x}$ = 3,398).) in konglomerat Karado. The mean value of bifurcation ratio (R_b) : $\bar{x}$ = 3,888 and mean river density (D_d $\bar{x}$ = 3,7287).) in Batulumpur Bumi. There are no real diffrent between Konglomerate Karado and Batulumpur Bumi indicated that the tectonic is continue actively.

IV. CONCLUSION

The conclusion of the results and discussions that the morpho-tectonicc in research area from Permian to Quarternary indicated by the steeply escarpments as resulted of the plate convergent as the the vertical tectonic. The tectonic activity were indicated with very strength relation between the

lineaments and the river segment azimuths. The research had verificated that the conformity of the morphology developing in the older rock formation compared to the younger rock formation, reallyzed in relation between te lineaments with the river segment azimmuths in drainage basin, the x in the mountain front sinuousity and the mountain front facet. The neotectonic control in Quarternary can supported to developing the land resources and metal mineral and hydrocarbon exploration.

V. ACKNOWLEDGEMENTS

The authors would like to thank for Bapak Febri Hirnawan, Bapak Adjat Sudradjat, Bapak Dicky Muslim for supporting and councelling this research.

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