Jour. Korean Inst. Mining Geol.
Vol. 20, No. 4, p. 247-260, 1987

A Study on the Structure of the Yangsan Fault in the southern part of Kyeongju

Yeonghwa Kim* and Kiehwa Lee**

Abstract: As a part of study on the structure of the Yangsan Fault, geological and VLF EM studies have been made in the fault area approximately between Kyeongju and Eonyang.

The result provides comparatively clear information on the trace of the fault and extent of fracture zone as well as the structural characteristics of the Yangsan Fault area. The location of fault trace identified from this VLF EM study coincides well in general with that expected from geological information of the area. And the extent of fault fracture zone turn out to be characterized by U shaped low resistivity zone whose width increases from north to south.

INTRODUCTION

The Yangsan Fault which is regarded as one of the most recent orogenic activities in the Korean Peninsula has lately been the subject of a great deal of geological and geophysical studies.

Subsequent to its designation as the Yangsan Fault (Lee and Kang, 1964), Kim et al. (1971) and Lee and Lee (1972) extended the existence of the fault northward near to Kyeongju from their quadrangle map survey. The presence of the Yangsan Fault was identified from a number of tectonolineament studies (Nahm, 1970; Kim et al., 1976; Kang, 1979). Lee (1974) correlated it with a dip slip fault trending from east of Taiwan through Cheju Island to Ulreung Island. Choi et al. (1980) described it as a right lateral strike slip fault. Kang and Hoshino (1984) elucidated several lineaments within the fault fracture zone.

The geophysical approach to the fault started from earthquake studies, both historical earthquake studies (Lee and Jung, 1980; Kim, 1980; Jeong, 1981) and instrumental earthquake studies (Lee and Na, 1983; Cho et al., 1984). Particularly, Lee and Na(1983) suggested that the Yangsan Fault is seismologically active. Many workers reported the remarkable resistivity anomalies which were correlated to the fault fracture zone of the Yangsan Fault (Kim, 1982; Kim and Kim, 1983; Lee et al., 1985, 1986). The indications of the Yangsan Fault was also shown on the gravity (Son, 1983; Min and Chung, 1985), magnetic (Kim, 1982; Lee et al., 1986) and radioactive profiles (Lee et al., 1985, 1986).

Despite these studies, the structure and extent of the fault has not been fully clarified. The present study has been made to clarify both the existence and the structure of the fault by geological and reconnaissance geophysical methods which comprise core resistivity mesurement and VLF EM survey.

GEOLOGY

Geology of the Yangsan Fault Area

The Yangsan Fault area which is situated in the eastern part of the Kyeongsang Basin may be approximately correlated with the Kyeongsang fracture zone (Kang, 1984). The geology of the area consists of Cretaceous sedimentary

* Department of Geology, Kangweon National University, Chuncheon 200, Korea
** Department of Geological Sciences, Seoul National University, Seoul 151, Korea

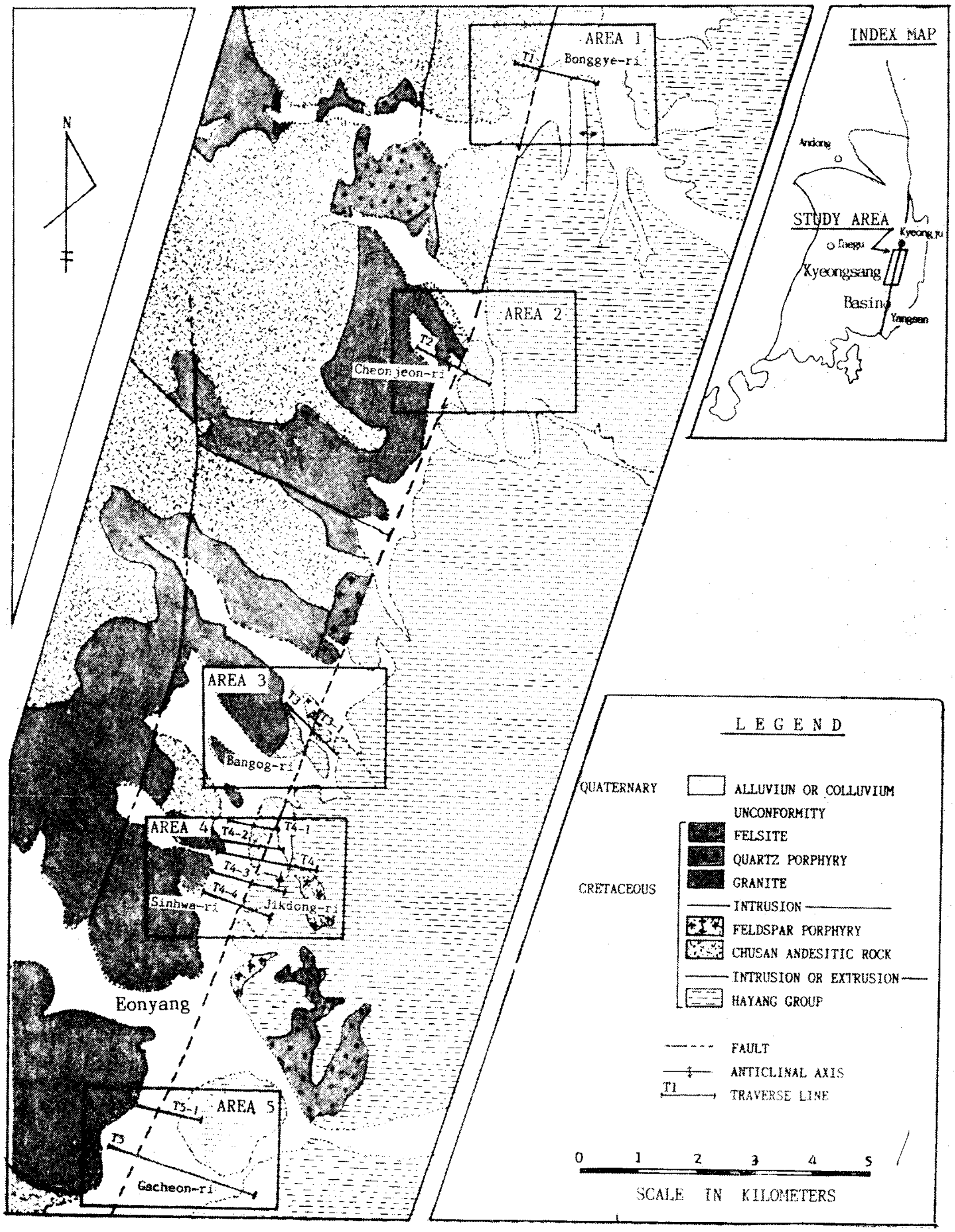


Fig. 1 Geologic map of the survey area showing location plan of VLF EM survey.

rocks, plutonic granitoid rocks and volcanic rocks (Fig. 1). The Cretaceous volcanic and granitoid rocks are distributed in general in the western part of the Yangsan Fault, while the sedimentary rocks are limited in the eastern part of the Fault. The sedimentary rocks in the area are correlated to the Sayeonri Formation, a tentatively determined stratigraphic unit in Ulsan area (Choi et al., 1981). The Sayeonri Formation is correlated to the Chilgog Formation, Silla Conglomerate and Haman Formation of Chang's (1978) stratigraphic classification for the southwestern part of Kyeongsang Basin.

The survey area is one of the most severely disturbed area in Korean Peninsula with several episodes of extrusion and intrusion of igneous rock bodies in Late Cretaceous fault movements. And the area is characterized by remarkably high density of lineament, especially of NNE trend (Fig. 2). However, lineaments trending WNW, another major lineament trend in the basin is not prevalent in the Yangsan Fault area.

Fig. 2 Lineament map of the Kyeongsang Basin (after P.J. Kang, personal communication).

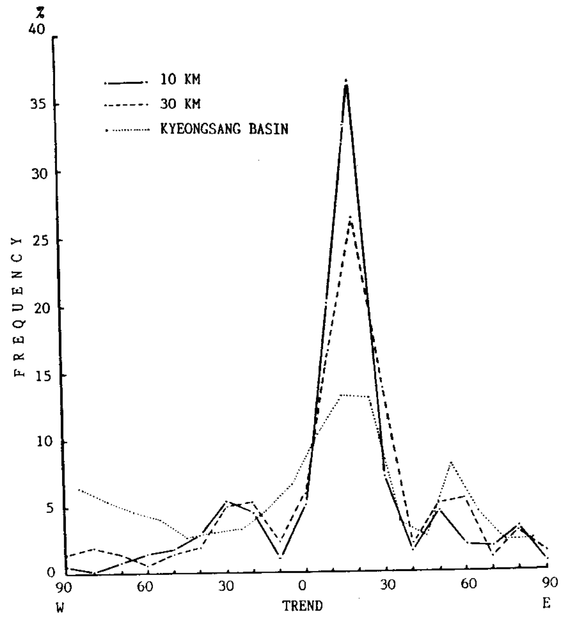


Fig. 3 Cartesian histograms of lineaments. Solid and broken lines represent the lineament distributions in length percentage of the areas limited within 10km and 30km, respectively, on both sides of the Yangsan Fault. Dotted line represents the lineament distribution of the whole Kyeongsang Basin.

The distribution of lineaments is shown well in the cartesian histogram of lineament (Fig. 3) obtained from the lineament map of the Kyeongsang Basin. The three cartesian histograms made from the whole basin, areas within 10 and 20km distance from the Yangsan Fault clearly reveal the predominance of NNE trend in the fault area.

This pattern of lineament distribution extends eastward to the East Sea which is known as the youngest tectonic region in and around the Korean Peninsula. Um et al. (1983) reported that several N60-80W trending faults were dissected by the N10-30E trending faults in the Yangsan Fault area. Chang(1978) also suggested that the culmination of WNW trending fault activities was during the Sindong Perion and a few of them were reactivated by the late Cretaceous volcano-tectonic depression in places. Fur-

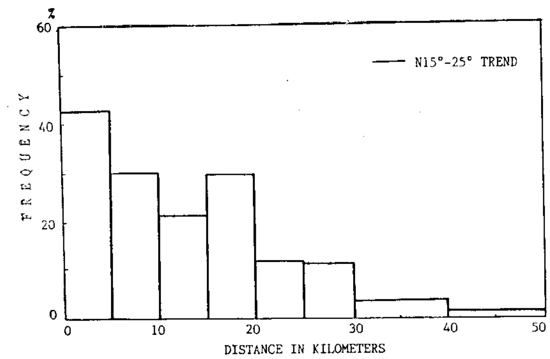


Fig. 4 Frequency variation of the N15-25E trending lineaments with the distance from the Yangsan Fault. The frequency variation was obtained from lineament map of the Kyeongsang Basin. The ordinate represents frequency in length percentage and the abscissa the distance from the Yangsan Fault.

(A)

(B)

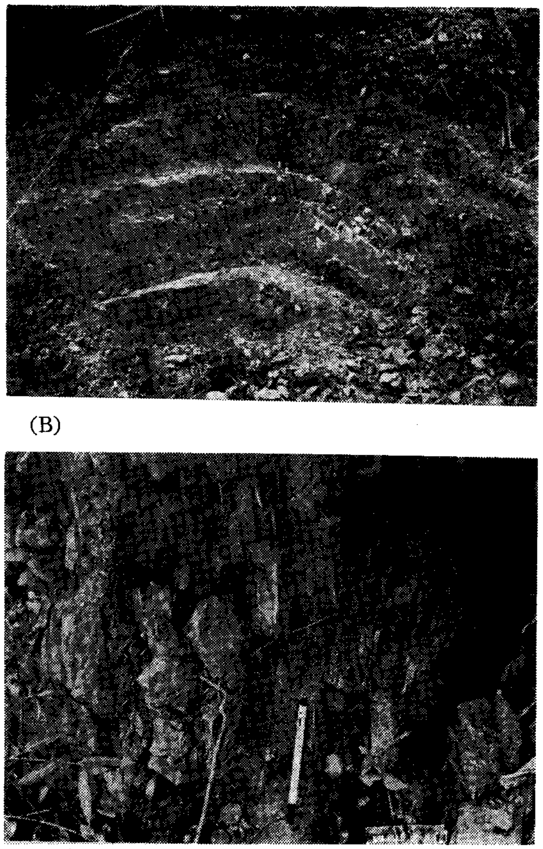


Fig. 5 Fold structures which are observed in the vicinity of the Yangsan Fault, A in Bonggye-ri and B in Jikdong-ri.

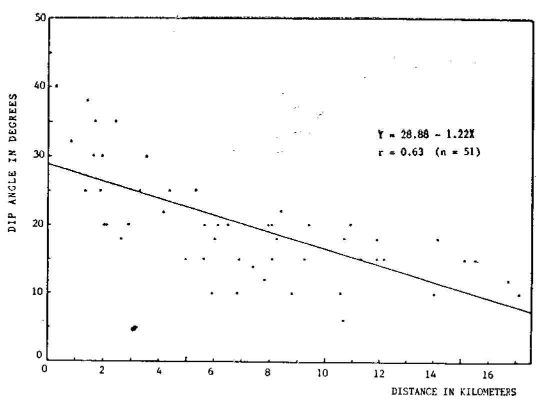


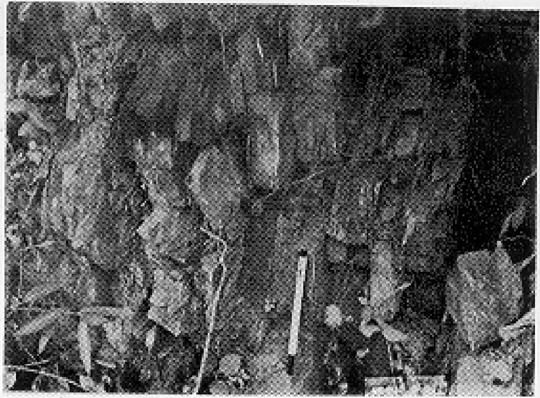
Fig. 6 Variation of westerly dip angles with the distance from the Yangsan Fault. Dip angles used in statistical treatment were taken from the quadrangle geological maps (scale 1/ 50,000) of Eonyang (Lee and Lee, 1972) and Ulsan Sheets (Park and Yoon, 1966).

thermore, epicenters of earthquakes show comparatively marked linear distribution along the NNE trending faults (Lee et al., 1984). Above mentioned facts suggest that the NNE trend in the area is closely related with relatively young tectonic activities in the Korean Peninsula.

Another notable point in the lineament analysis is that the proportion of NNE trending lineaments decreases with the distance from the Yangsan Fault as can be seen in Fig. 4. It indicates that the Yangsan Fault is the most important structural object in the Kyeongsang fracture zone, and the area roughly within 20km distance from the Yangsan Fault on both sides can be considered to belong to the same lineament system in view of the abrupt change in length percentage at about 20km from the fault. The Yangsan Fault is also known to be a tectonic boundary between the high and low heat flow regions to the east and west of the fault respectively (Chang, 1970).

The geology in the vicinity of the fault reveals severe disturbance. Particularly in the sedimentary rocks, some fold structures are identified frequently in the vicinity of Bonggye-ri and

(B)



Jikdong-ri (Fig. 5). The fold structures whose axes are nearly parallel or make an acute angle to the fault may be correlated to en echelon folds in a wrench zone. The Yangsan Fault area south of Kyeongju is characterized by the presence of wide alluvial plains, stream terrace, and the absence of volcanics which cut across the fault. These points suggest the possibility that the Yangsan Fault area, at least south of Kyeongju, were under the influence of compresive stress field (Reading, 1980). The presence of compressive stress field in the area is supported by the fact that the variation trend of dip angles of bedding plane in the area shows a gradual decrease of dip angles with distance from the Yangsan Fault despite severe regional disturbance (Fig. 6).

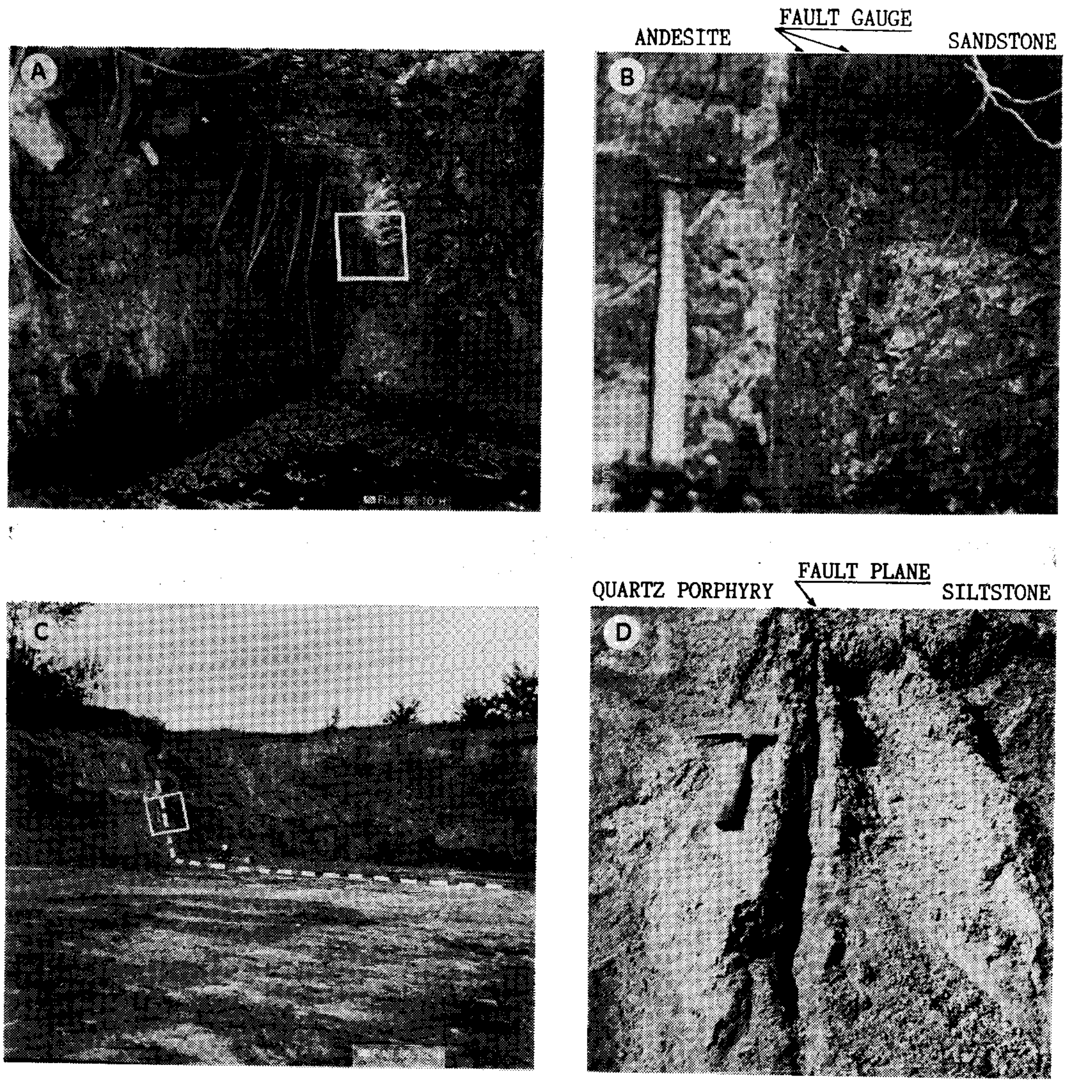
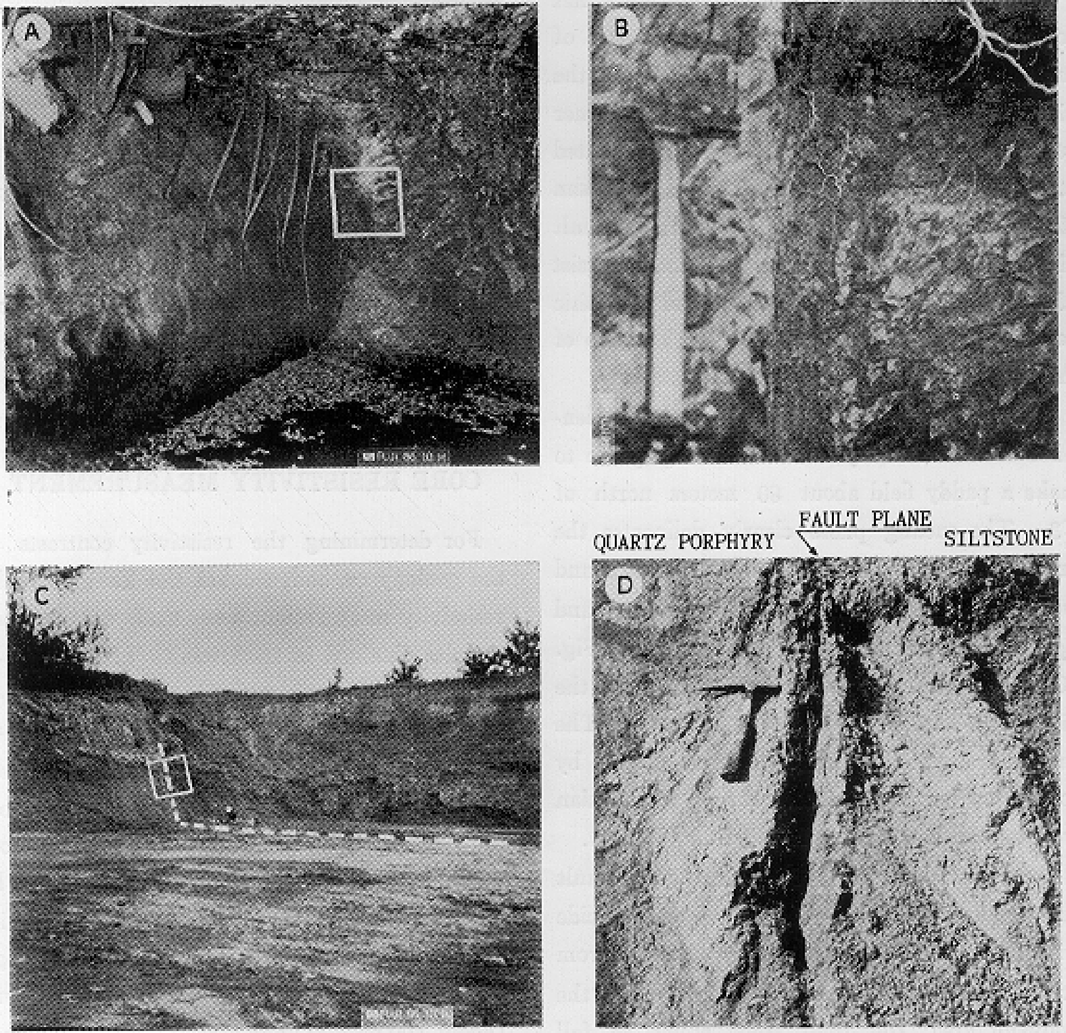


Fig. 7 Outcrops of the Yangsan Fault.

A. Fault plane exposed in the vicinity of traverse Tl.
B. Enlarged view of the boxed area in Picture A.
C. Fault plane exposed in the vicinity of traverse T2.
D. Enlarged view of the boxed area in Picture C,


A
B
C
D
QUARTZ PORPHYRY
FAULT PLANE
SILTSTONE

Fault Location from Geological Evidences

Several shear zones and slikensides are developed along the conspicuous lineament between Bonggye-ri and Eonyang where the trace of the Yangsan Fault is obscured by Quarternary sediments and weathered soils as a whole. Generally the fault trace can be roughly delineated from the geological boundaries expected from abrupt changes in rock phases on either side of the fault.

Particularly the existence of the fault has confirmed during the study by the presence of fault outcrops which were identified in the vicinity of Bonggye-ri and Bangog-ri. The former outcrop in the vicinity of Bonggye-ri is located at about 30 meters due east of the Seoul-Pusan Highway on T1 and it shows clearcut fault plane whose eastern and western blocks consist of reddish fine-grained sandstone and andesitic porphyry, respectively (Fig. 7A). The dip of the fault plane is shown as nearly vertical.

The fault outcrops near Bangog-ri were identified from the newly formed cutting plane to make a paddy field about 60 meters north of T3. The cutting plane clearly delineates the presence of Yangsan Fault whose eastern and western blocks consists of reddish siltstone and light brown quartz porphyry, respectively (Fig. 7C). The strike of the fault is N25E, and the dip is NW at an angle of 75 degrees. The surface trace of the fault could be drawn by connecting two fault outcrops and an artesian well located just on the fault plane (Fig. 8).

Generally the trace of the Yangsan Fault obtained from the study is proved to conincide with the location approximately expected from previous geological information. However in the Eonyang area, the fault trace seems to fall roughly on the Kyeongju-Pusan National Road, more than 400 meters due west of the Seoul-Pusan Highway which was regarded as the fault trace; some small outcrops of sedimentary rocks and feldspar porphyry which can be correlated to the geology in the eastern blocks of the fault in Jikdong-ri area are observed in the area between the highway and the national road. As the result of this study, rather a simple fault trace which is approximated to a straight line was revealed as shown in Fig. 1.

Fig. 8 An artesian well just on the fault trace in the bulldozed area shown in Fig. 7C. The broken line represents the location of fault trace which is covered by paddy field.

CORE RESISTIVITY MEASUREMENT

For determining the resistivity contrasts of the geology on both sides of the Yangsan fault, resistivity measurement was made on the rock samples obtained in the vicinity of Bonggye-ri (Area 1), Cheonjeon-ri (Area 2), Bangog-ri (Area 3), Sinhwa-ri (Area 4) and Gacheon-ri (Area 5). 33 samples were taken for the measurement; nine from the Area 1, eleven from the Area 2, two from the Area 3, seven from the Area 4 and four from the Area 5. The results summarized in Table 1 show that granite and andesitic rocks are most resistive geology (about 5,000 ohm-m), while feldspar porphyry (about 400 ohm-m) and sedimentary rocks (about 600 ohm-m) are rather conductive geology in the area. Among the sedimentary rocks, shale turns out to be more conductive than others.

In case of andesitic and sedimentary rocks,

Table 1 Result of rock core resistivity measurements in the Yangsan Fault area.

Rock type	Location	Core resistivity in ohm meters	
		Population	Mean
Granite	Area 2 Area 5	9, 628, 5, 267, 3, 060 4, 557, 3, 430	5, 188
Andesitic Rocks	Area 1 Area 2	8, 820, 8, 618, 2, 760 2, 897, 1, 576	4, 934
	Area 3	1, 330	1, 330
	Area 4	439, 270, 135	—
Feldspar Porphyry	Area 4 Area 5	356 467	412
Sandstone	Area 1 Area 2	1261, 1100, 780, 680, 482 1115, 1104, 965	936
	Area 3 Area 4 Area 5	475 428, 325 435	416
Shale	Area 1 Area 2	555 774, 554, 474	589
	Area 4	453	453

Table 2 Result of rock core resistivity measurements outside the Yangsan Fault area.

Formation	Rock type	Core resistivity in ohm meters	
		Population	Mean
Haman Formation	Sandstone Shale	1150, 812, 760, 580 1200, 980	825 1, 090
Silla Conglo.	Sandstone Conglomerate	756, 700, 263 302	573 302
Chilgog Formation	Sandstone	690, 600, 491, 465	562
Jinju Formation	Sandstone	770, 755, 428, 330	571
Hasandong Formation	Sandstone	388	388
Nakdong Formation	Sandstone Conglomerate	380, 269 186	325 186

measured core resistivities reveal comparatively large variation within the same rock type depending on the location. It is to be noted that resistivities of the rocks in the areas 1 and 2 are considerably higher than those of the rocks in the Areas 3, 4 and 5. Particularly, shaly rocks in the area were too much disturbed to be cored, and the presented resistivity values in Table 1 seem to represent the highest value expected from outcrops in the areas.

The result of core resistivity measurements of sedimentary rocks in the study area was compared with that of 22 Cretaceous sedimentary rocks taken between Koryeong and Taegu, outside the Yangsan Fault area (Table 2). It turned out that the resistivities in these two different areas are compared well with each other in general; resistivities obtained from the areas 1-2 are correlated to those from the Haman Formation, and those from the areas 3-5 to those from the Silla Conglomerate and Chilgog Formation, respectively.

VLF EM SURVEY

Field Procedure

As a reconnaissance survey to locate the Yangsan Fault, the VLF EM meausurements were made on 11 traverses and at some scattered points. The locations of traverse lines were selected so as to cover the typical geological contrasts of the area as much as possible.

The instrument used in this survey is Geonics EM16R which measures the phase angles and apparent resistivities by means of two ground probes spaced 10m apart. The measurement was made by orienting the instrument so that the coil is maximally coupled to the tangential magnetic field and inserting the ground probe along the direction indicated by the instrument orientation. Radio signals used for electromagnetic measurements was NWC transmitter of North West Cape, Australia which is working in 22.3 KHz radio band. The transmitter azimuth is approximately parallel to the strike of the Yangsan Fault. Accordingly, the traverses were made more or less perpendicular to the strike of the Yangsan Fault. Station intervals were 15 to 30 meters near the expected fault

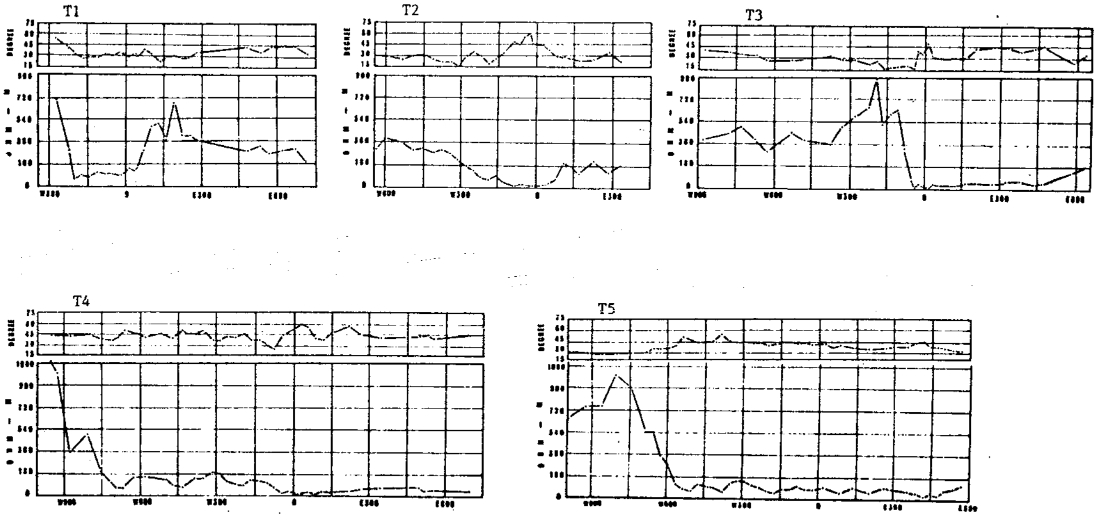


Fig. 9 VLF EM profiles of 5 traverses (T1 to T5). Upper profiles represent phase angle and lower apparent resistivity. Distances are shown in meters from the dividing line (0 point) of the Seoul-Pusan Highway. E and W represent east and west, respectively.

trace and greater intervals were taken with the distance from the Yangsan Fault.

VLF EM Profiles

The results of VLF EM survey are summarized in terms of phase angles and apparent resistivities. Fig. 9 reveals 5 VLF phase angle and apprent resistivity profiles of 5 primary traverses which cover the typical geological contrasts of the areas. The supplementary traverses also showed nearly the same resistivity characteristics as those of the primary traverses. The results yield outstanding VLF resistivity anomalies in each traverse and phase angles turned out to be somewhat inversely proportional to the corresponding apparent resistivities. In order to represent the location, distances on a traverse are shown in meters from the center of the median strip of the Seoul-Pusan Highway with the initials of east or west.

Although the VLF data yield little quantitative information in general, measured phase angles as well as apparent resistivities may be interpreted quantitatively in some degree by using two layer interpretation curves. And the inversely proportional relationship between phase angle and apparent resistivity distributions yields more characteristic resistivity profiles as shown in Fig. 10. However the overall resistivity trend is still nearly the same to that of corresponding apparent resistivity profile.

In the use of the two layer interpretation curves, the resistivities of upper layer were assumed to be 30 ohm meters in general and 100 to 300 ohm meters in places as well. The thickness of upper layer turned out to be less than 10 meters as well.

Traverse T1

The resistivity profile T1 is characteristic of single fault type. The Cretaceous sedimentary and volcanic rocks are related to the resistivity highs and lows in the area, respectively. The volcanic rocks in the area appears to be severely fractured considering the very high resistivity values of more than 3000 ohm-m obtained from rock core resistivity measurement. On the other hand, the sedimentary rocks in the area is shown as the most resistive among the sedimentary rocks in the fault area. Particularly, the resistivity values

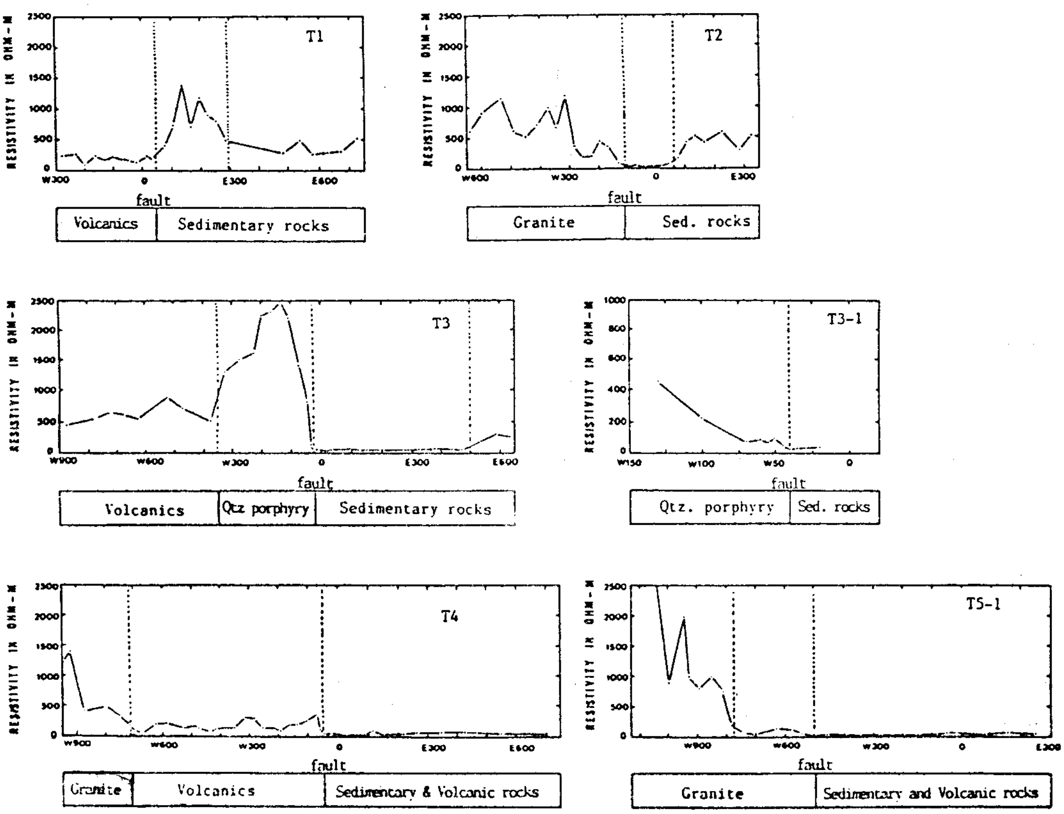


Fig. 10 Interpretation of VLF EM profiles by vertical fault models. Close correlations can be seen between the VLF resistivity contrasts and the corresponding rock types.

obtained between E50 and E270 are close to those of fresh bedrocks. This point seems to imply that the eastern block of the fault in the area is not so much affected by the fault movement. In fact, the area of pronounced resistivity highs coincides with the areas where comparatively undisturbed bedrocks crop out. Somewhat lower resistivities over sedimentary areas are shown east of E270. It seems to reflect the concomitant effect of fault movement such as the en echelon fold structure in the area. The resistivity of upper layer was assumed to be 30 ohm-m as a whole.

Traverse T2

True resistivity distribution of substrata across T2 is characterized by 3 groups, i.e., the resistivity level of 200 to 1400 ohm-m in the western part, 50 ohm-m or less in the central part and 200 to 600 ohm-m in the eastern part. The resistivity boundaries fall on W115 and E50. The central lower resistivity bed correlates to the fault fracture zone. The sedimentary rocks in the area also show high resistivities of comparable level with the granite near the fracture zone. The resistivity of upper layer was assumed to be 30 ohm meters throughout the area and the thickness of upper layer was shown as mostly 2 to 5 meters.

Traverse T3

The geoelectric structure is characterized by remarkably low resistivities in the east (about 30 ohm-m) and high resistivities in the west (more than 400 ohm-m). The boundary of the extraordinary sharp resistivity contrast falls on

W30 of T3. This resistvity boundary is identified to coincide with the surface trace of the Yangsan Fault by comparision with the VLF EM traverse T3-1 which crosses the outcrops of fault plane. The presence of somewhat lower resistivities in the west of resistivity highs is believed to be due to the existance of volcanic rocks. Extremely low resistivities in the sedimentary rocks seem to be attributable to the presence of shaly joint and higher content of clay minerals as well. While rather resistive sedimentary rocks are revealed from about E500, and more resistive beds is expected to lie farther east.

Traverse T4

The VLF EM profile T4 was chosen among five VLF EM profiles which give similar resistivity variation to represent the geoelectric structure of the area. And the result reveals close correlation with the geology of the Sinhwa-ri area: The highest (more than 400 ohm-m) and lowest resistivity levels (less than 80 ohm-m) correlate well with the granite and sedimentary bedrocks, respectively, while somewhat low resistivity level of about 200 to 300 ohm-m in the central part of the traverse correlates with the volcanics. On the other hand, the vocanic rocks in the east of the highway yield rather lower resistivities, similar to the surrounding sedimentary rocks. The most conspicuous resistivity boundary falls on W50.

Traverse T5-1

The two VLF resistivity profiles, T5 and T5-1, show the similar trend of resistivity distribution except that the profile T5 chiefly reflects the effect of thick alluvial to colluvial overburden. The resistivity distribution in the area can be characterized by simple resistivity highs and lows in the west and east, respectively, with the boundary at about W500. This boundary coincides with a national road which is one of the important lineaments in the area. Considering the small granite outcrops found in the west of W500, the presence of higher resistivities is easily correlated to the granite. And the lower resistivity area seems to be related with the small outcrops of feldspar porphyry and sedimentary rocks which were identified in the vicinity of the traverse T5-1.

Fault Location from the VLF Resistivity Mapping

Both apparent and true resistivity profiles delineate the presence of the Yangsan Fault.

The presence of VLF EM anomalies for locating the fault boundary is attributed to the fact that the position of resistivity highs and lows depends clearly upon the geological boundaries. Granitoid rocks and andesitic rocks are shown as the most resistive and comparatively resistive geology, respectively. While the sedimentary rocks, especially shaly rocks, are shown as conductive geology in the area. However, in case of andesitic rocks, significant resistivity variation is noted depending on the location. The result coincides well with that of core resistivity measurements as a whole.

The resistivity variation is shown more clearly in the iso-resistivity contour map in Fig. 11 constructed from the data on 5 traverses and at scattered points in the vicinity of Sinhwa-ri. The iso-resistivity countours reveals comparatively linear trends approximately parallel to the strike of the Yangsan Fault; the zone of resistivity less than 30 ohm meters seems to relate to the Yangsan Fault trace. And the trace which runs along the highway begins to fall apart from the highway from this area. The iso-resistivity contour map suggests that the strike of the fault in the area is about N20E.

On the other hand the presence of three subsidiary resistivity lows is also noted. The positions are known to coincide in general with those of the lineaments delineated from the Landsat imagery study (Kang, 1984). Consequently,

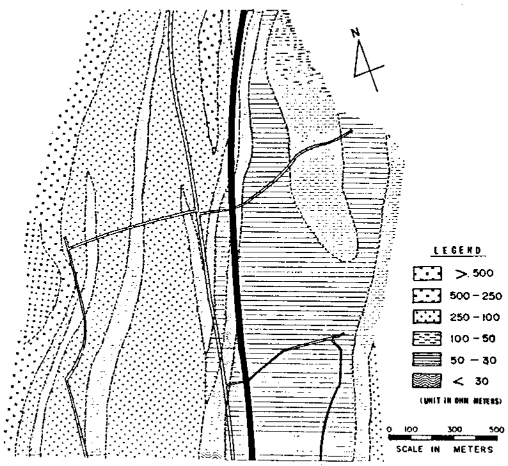


Fig. 11 Iso-resistivity contour map determined from VLF EM measurements. NNE trending lineation is outstanding and the zone of resistivity less than 30 ohm meters coincides with the surface trace of the Yangsan Fault. Thick solid line represents the Seoul-Pusan highway.

these lower resistivity zones seem to be related to the subsidiary fracture zones in the area. Particularly, clay deposits are frequently found along the subsidiary resistivity low zone located about 600 to 700 meters due west of the highway. Considering that the clay deposits are formed from hydrothermal alteration process of volcanic rocks, the western limit of this conductive beds is considered as the bounday between the granite and the volcanics.

The sedimentary rock area in eastern part of the expected fault trace shows comparatively uniformly low resistivity level of 50 ohm meters or less. While somewhat higher resistivities (between 50 and 70 ohm-m) are shown in the area mapped as volcanics. On the other hand the resistivity increases with distance from about 500 meters due east of the highway, approximately on the foot of eastern rugged mountain.

The result indicates that the apparent resistivity distribution can comparatively clearly reveal the geoelectric structure in the area. Furthermore, considering that the overall apparent resistivity trend is nearly the same as the corresponding true resistivity distribution of substrata in most of the traverses, Fig. 12 which depicts all the VLF resistivity profiles is considered to delineate well the trace of the fault as well as the variation pattern of resistivies across the fault. The expected surface trace of the Yangsan Fault is represented by solid triangles. The trace approximately runs along the highway between T1 and T4 deviates from the highway from T4-3 as shown in Fig. 1. The locations are in general agreement with the geological information in the area. Particularly the boundaries identified in the VLF traverses T1, T3-1 and T3 were confirmed as fault contacts.

Most of the resistivity profiles show the overall U shaped anomalies in view of the resistivity increases which fall approximately on the foot

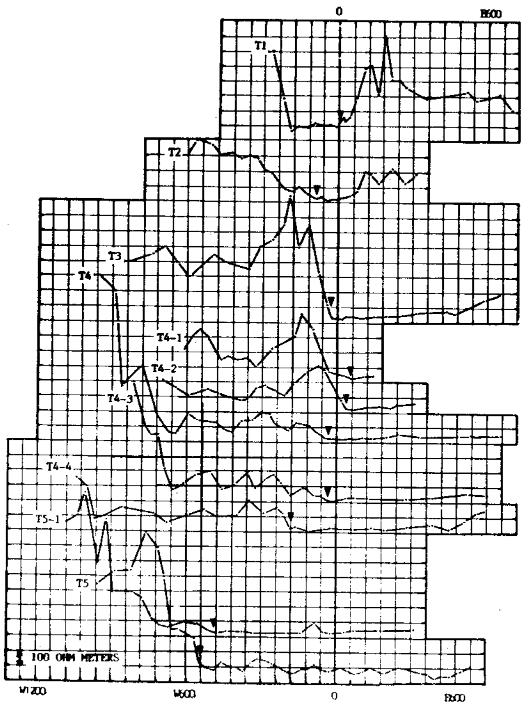


Fig. 12 Variation of VLF apparent resistivities across the Yangsan Fault. The solid triangles represent the locations of the surface trace of the fault. Distance between traverses is not in exact scale in the figure.

of eastern rugged mountain. And the corresponding lower resistivity zones on both sides of the fault seem to reveal the presence of the fault fracture zone. The fracture zone seems to be variable between hundreds and several thousands of meters in width and the areal extent of the fracture zone grows up from north to south.

CONCLUSIONS AND DISCUSSIONS

The Yangsan Fault area in a narrow sense of the word may be defined as the area covering the Yangsan Fault itself and the associated fracture zone. On the other hand, the Yangsan Fault area in a broad sense can be correlated with the Kyeongsang Fracture Zone or the so called Yangsan Fault System which comprises the Milyang Fault and the Dongrae Fault as well as the Yangsan Fault. Since the NNE trending lineaments of the Kyeongsang Basin prevail in a zone within 20km from the Yangsan Fault, the zone may be regarded as the Yangsan Fault area in a broad sense. Generally geophysical studies have to be limited to the Yangsan Fault area in a narrow sense of the word, mainly due to the topography of the area.

A fairly close parallelism is revealed between the topography and the VLF resistivity distribution of the area, i.e. higer resistivity in the areas of steep slope. Particularly, this parallelism is evident in the areas of sedimentary rocks which bear in general much wider fracture zones compared to those of igneous rocks. It can be said that the rugged mountainous regions where the survey could not be made correspond to the electrically more resistive areas. The geoelectric structure of the Yangsan Fault area can be characterized after all by the significant resistivity decrease toward the fault. And this resistivity decrease toward the fault is believed to reflect the increase of fractured degree due to the fault movement. On this supposition, The extent of fault fracture zone in a narrow sense of the word can be defined as the area of lower resistivity on both sides of the Yangsan Fault.

Generally the geophysical anomalies expected from a fault area originate either from the difference in geological formations or the difference in fractured degree (and/or weathered degree). In the Yangsan Fault area, the result of core and VLF resistivity measurements indicates that difference in geological formations plays a decisive role in creating the geoelectrical contrasts. Furthermore, it governs even the fractured or weathered condition of bedrocks. In this regard, the geoelectric method has an advantage over other kinds of geophysical methods in the Yangsan Fault area where the heavy traffic is the main sources of noises mainly in seismic and magnetic measurements, and the geology in both sides of the fault does not give conspicuous density contrasts (Lee et al., 1984).

All in all, the studies comparatively clearly delineated the presence of the Yangsan Fault as well as structural characteristics. And the major finding of this study are summarized as follows.

(1) The Yangsan Fault area in a broad sense of the word can be defined as the structural zone of prevailing NNE trending lineaments within about 20km from the Yangsan Fault on both sides.

(2) The fault fracture zone which is the Yangsan Fault area in a narrow sense turns out to differ both in size and fractured degree. Generally the fracture zone reveals broader areal extent from north to south.

(3) Remarkably sharp resistivity contrast was shown between the geology on either side of the fault. The plutonic granitoid rocks are shown as being electrically more resistive than volcanic and sedimentary rocks, and particularly shaly formation among sedimentary rocks is shown as the most conductive geology in the area.

(4) The geology of bedrocks seems to have a desicive influence not only upon the electrical property of fresh bedrocks but also upon the fractured condition of the bedrocks in the area. The plutonic granitoid rocks turn out to be the most competent geology and shaly formation the most incompetent against tectonic forces in the area.

(5) The surface trace of the fault approximately coincides with that expected from previous geological information, while significant deviation is revealed in the vicinity of Eonyang. Particularly in Gacheon-ri, South of Eonyang, the location of the fault plane turns out to lie at about 500 meters due west of the highway which corresponds to the previously expected fault trace.

ACKNOWLEDGEMENTS

The authors with to express their sincere thanks to Professors Sang Man Lee, Byung Doo Kwon, Kwang Ho Kim and Chang Eob Baag for their critical readings and helpful comments. Dr. Pil Jong Kang deserves special thanks for kindly allowing them to use the unpublished data.

Appreciation is also expressed to Professor Jeong Hwan Kim and Dr. Jong Hwan Han for their valuable comments on the geology. The authors desire to express their deep appreciation to the students of Gephysics Lab., Department of Geology, Kangweon National. University for their assistance in field works.

REFERENCES

Chang, C.H. (1970) Heat flow in Korea. Ann. Review Korean National Committee for IUGG, p. 1-7.

Chang, K.H. (1978) Late Mesozoic stratigraphy sedimentation and tectonics of Southeastern Korea. Jour. Geol. Soc. Korea, v. 14, p. 120-135.

Cho, D.H., Kim, S.K., Chun, M.S. and Jeong, B.H. (1984) Research on earthquake resistant design-The implication of the G value adopted for the Korean nuclear power plant site and the seismic activity of the Kyeongsang Basin. Research on Applied Geology of Korea, v. 83-5-08, p. 183-277.

Choi, H.I., Son, J.D. and Oh, J.H. (1981) Sedimentology and stratigraphy of the Cretaceous Gyeongsang Strata. United Nations ESCAP, CCOP Technical Bulletin, v. 14, p. 1-15.

Jeong, B.I. (1981) A study on the historical earthquakes in Korea. Jour. Geol. Soc. Korea, v. 17, p. 257-268.

Kang, P.J. (1979) Geological analysis of landsat imagery of South Korea (1). Jour. Geol. Soc. Korea, v. 15, p. 109-126.

Kang, P.J. (1984) A study on remote sensing application for the tectonic-framework of the Korean Peninsula. Ph. D. thesis, Dept. Geology, Korea University.

Kang, P.J. and Hoshino, K. (1984) Research on interpretation of geological structure by remote sensing technique. Report of International Research and Development Cooperation ITIN Project, Final Report. p. 28-32.

Kim, I.S. and Kim, J.Y. (1983) Electrical resistivity survey in the Eon-Yang Fault area, south eastern Korean Peninsula. Jour. Kor. Inst. Mining Geology, v. 16, p. 11-18.

Kim, N.J., Kweon, Y.I. and Jin, M.S. (1971) Explanatory text of the geological map of Moryang sheet (1/50,000). Geological Survey of Korea.

Kim, S.K. (1980) Study on earthquake of Korea based on the local data of 1926~1943. Jour. Kor. Inst. Mining Geology, v. 13, p. 1-19.

Kim, J.H., Kang, P.J. and Lim, J.U. (1976) A study of the relation between geologic structures and ore deposits in Ryeongnam Province using landsat-1 images. Jour. Geol. Soc. Korea, v. 12, p. 79-89.

Kim, Y.H. (1982) A geophysical study of the geologic structure on Eonyang area, South-eastern Korea. M.Sc. thesis, Department of Geological Sciences, Seoul National University.

Lee, K.H. and Jung, H.O. (1980) A study of instrumental earthquake data of the Korean Peninsula. Jour. Geol. Soc. Korea, v. 16, p. 32-45.

Lee, K.H., Jeong, B.I., Kim, Y.H. and Yang, S.J. (1984) A geophysical study of the Yangsan Fault area. Jour. Geol. Soc. Korea, v. 20. p. 222-240.

Lee, K.H., Jeong, B.I. and Kim, Y.H. (1985) A geophysical study of the Yangsan Fault Area(II). Jour. Geol. Soc. Korea, v. 21, p. 79-89.

Lee, K.H. and Na, S.H. (1983) A study of microearthquake activity of the Yangsan Fault. Jour. Geol. Soc. Korea, v. 19, p. 127-135.

Lee, M.S. and Kang, P.J. (1964) Explanatory text of the geological map of Yangsan Sheet(1/50,000). Geological Survey of Korea.

Lee, S.M. (1974) The tectonic setting of Korea with relation to plate tectonics. Jour. Geol. Soc. Korea, v. 10, p. 25-36.

Lee, Y.J. and Lee,I.K. (1972) Explanatory text of the geological map of Eongyang Sheet(1/50,000). Geological Survey of Korea.

Min, K.D. and Chung, C.D. (1985) Gravity survey on the subsurface structure between Weakwan-Pohang in Kyeongsang Basin. Jour. Kor. Inst. Mining Geol., v. 18, p. 321-329.

Nahm, K.Y. (1970) The tectonics in Korean Peninsula shown on the 1/250,000 scale relief maps. Jour. Geol. Soc. Korea, v. 6, p. 53-60.

Reading, H.G. (1980) Characteristis and recognition of strike-slip fault systems. Special publication of International Association of Sedimentologists, No. 4, p. 7-26.

Son, H.W. (1983) A study on the subsurface in the Pohang area by gravity survey. M.Sc. Thesis, Yonsei University.

Um, S.H.. Choi, H.I., Son, J,D,, Oh, J,H,, Kwak, Y,H., Shin, S.C. and Yun, H.S. (1983) Geological and geochemical studies on the Gyeongsang Supergroup in the Gyeongsang Basin. KIER Bulletin-36.

Won, C.K., Kang, P.J. and Lee, S.H. (1978) Study on the tectonic interpretation and igneous pluton in the Gyeongsang Basin. Jour, Geol. Soc, Korea, v. 14, p. 79-92.

경주 남부지역의 양산단층의 구조에 관한 연구

金 永 和·李 基 和

요약 : 양산단층의 구조를 밝히는 연구의 일환으로 경주 남쪽지역을 대상으로하여 지질 및 저주파 전자탐사방법에 의한 단층탐사를 실시하였다.

그 결과 양산단층지역의 구조적 특성에서부터 파쇄대의 규모, 단층선의 위치 등에 대한 새로운 사실들이 밝혀졌으며, 단층파쇄대의 규모와 단층면의 위치에 있어서 지질 및 지전기학적 연구성과가 서로 일치됨이 확인 되었다.