Table 7　Evaluation of Faults which does not Consider in the Anti-earthquake Design (faults around the site)

Kashiwazaki Kariwa Nuclear Power Station

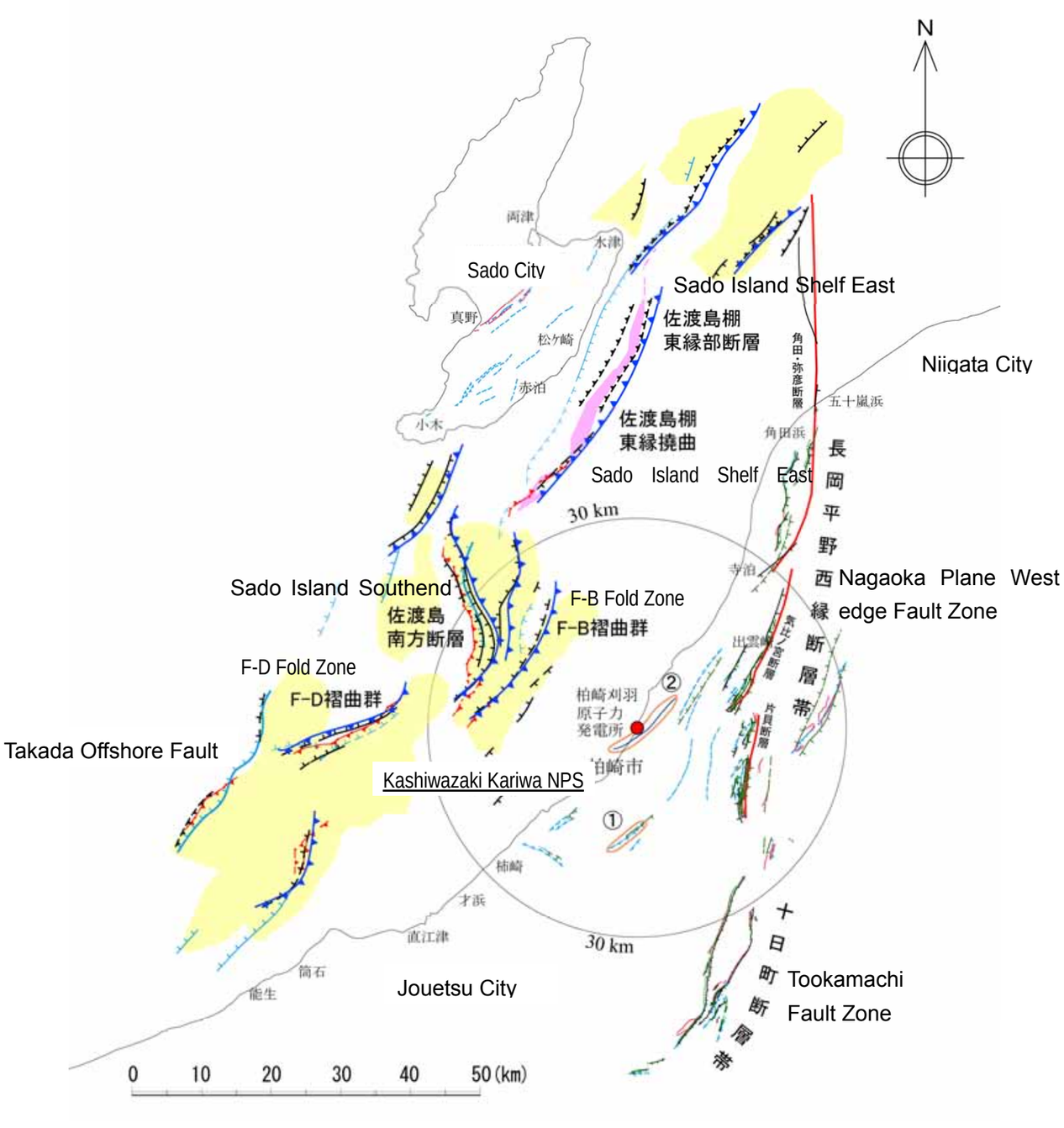
No.	Name	Area	Length	Distance from the Site□3	Reason which Denies Activeness of the Fault	Remark
①	Hosogoe Fault	On-shore	7 km□1	15.5 km	Erosion land, No displacement and transformation in Kume layer	Figure 2 and Attachment 12
②	Madonosaka Syncline	On-shore	11.5 km□2	1.5 km	No displacement and transformation in Yasuda layer, Ohminato sand layer and Tefla layer distributed in Yasuda layer	Figure 2 and Attachment 13

□1：Length described in the past documents, □2：Length identified by the geological survey, □3：Distance between the center of power station site and the center of the fault

Table 8　Evaluation of Faults which does not Consider in the Anti-earthquake Design (Inside the site)

Kashiwazaki Kariwa Nuclear Power Station

No.	Name	Reason which Denies Activeness of the Fault	Remark
①	α・β Faults	The fault exists in only the low angle small fault in Yasuda layer. The fault does not extend to the upper part.	Table 9, Figure 3 and Attachment 14
②	V System Fault	There is no displacement in the boundary between Yasuda layer and Nishiyama layer. The fault does not extend to Yasuda layer.	Table 9, Figure 3 and Attachment 15
③	F System Fault	The fault gives some displacement in the upper face of Nishiyama layer. However, the displacement disappears when it comes in Yasuda layer. F system fault and V system fault are crossed each other.	Table 9, Figure 3 and Attachment 16
④	①・② Fault	It is a land sliding fault and there is no displacement in the boundary between Yasuda layer and Nishiyama layer. The fault does not extend to Yasuda layer.	Table 9, Figure 3 and Attachment 17
⑤	L_1・L_2 Fault	The fault does not extend to Yasuda layer.	Table 9, Figure 3 and Attachment 18



No.	Name
①	Hosogoe Fault
②	Madonosaka Syncline

Legend

Tokyo Electric Power Company
- Nagaoka Plane East Edge Fault Zone
- Madonosaka Syncline

The Headquarters for Earthquake Promotion (2005)
- Active Fault (activity certain after late Quaternary)
- Active Fault (activity uncertain after late Quaternary)

Active Fault Detailed digital Map (2002)
- Active Fault (incl. estimated fault)

New Edition Active Fault in Japan (2002)
- Certainty Ⅰ
- Certainty Ⅱ
- CertaintyⅢ

Quaternary Reverse Fault Atlas (2002)
- Fault location certain
- Fault location uncertain
- Displacement not visible

Active Structure Niigata (1984)
- Active Fault
- Estimated Active Fault

① Fault, not considered its activity, No.

Legend

Tokyo Electric Power Company
- Reverse Fault
- Saphenous Fault
- Active Anticline
- Active Flexure

Northern Sado Island Sea Bed Geological Map (1995)

Southern Sada Island Sea Bed Geological Map (1994)

Eastern Noto Peninsula Sea Bed Geological Map (2002)
- Reverse Fault (dash line saphenous)
- Gravity Fault (dash line:saphenous)
- Non Segmented Fault
(fuzzy side: descent side, dash line: saphenous)

New Edition Active Fault in Japan (1991)
- Active Fault (relative elevation more than 200m)
- Active Fault (relative elevation less than 200m)
- Estimated Fault (relative elevation more than 200m)
- Estimated Fault (relative elevation less than 200m)

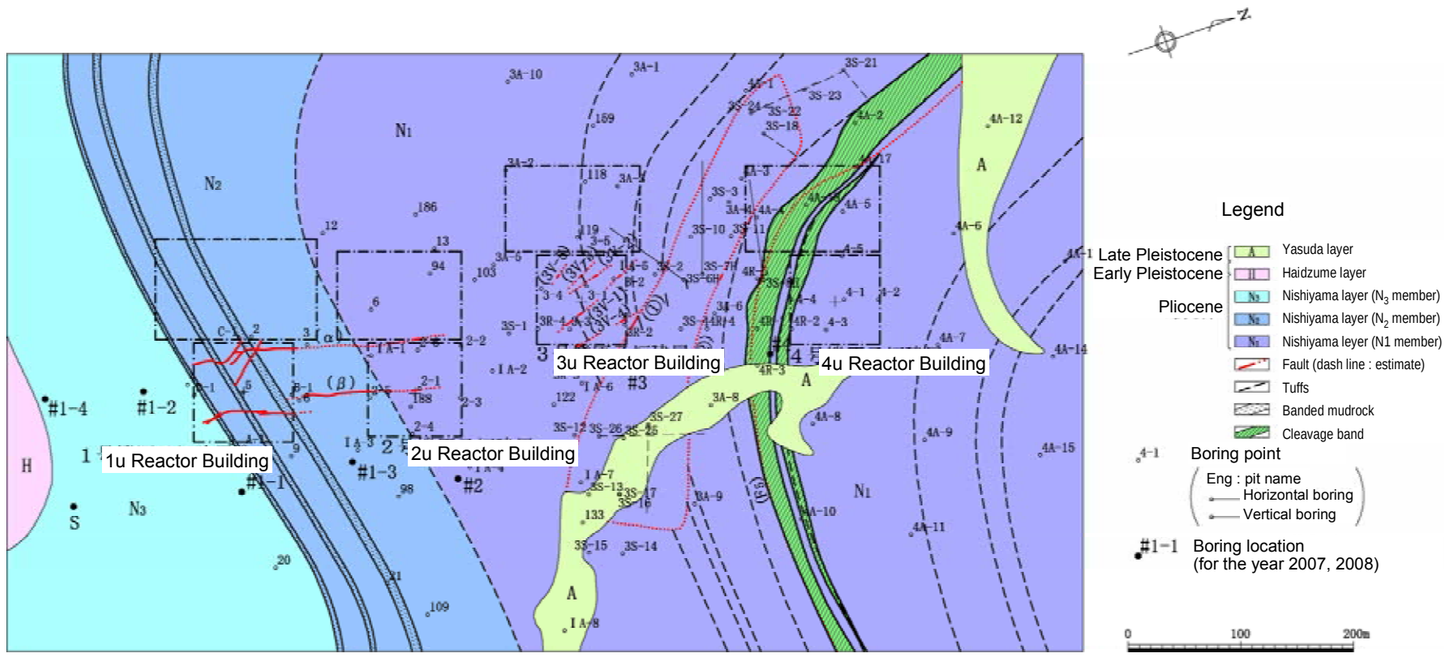
Around Japan Sea Area Quaternary Construction Map (2001)
- Reverse Fault

Figure 2　Map of Faults and Lineament around the Site of KK Nuclear Power Station

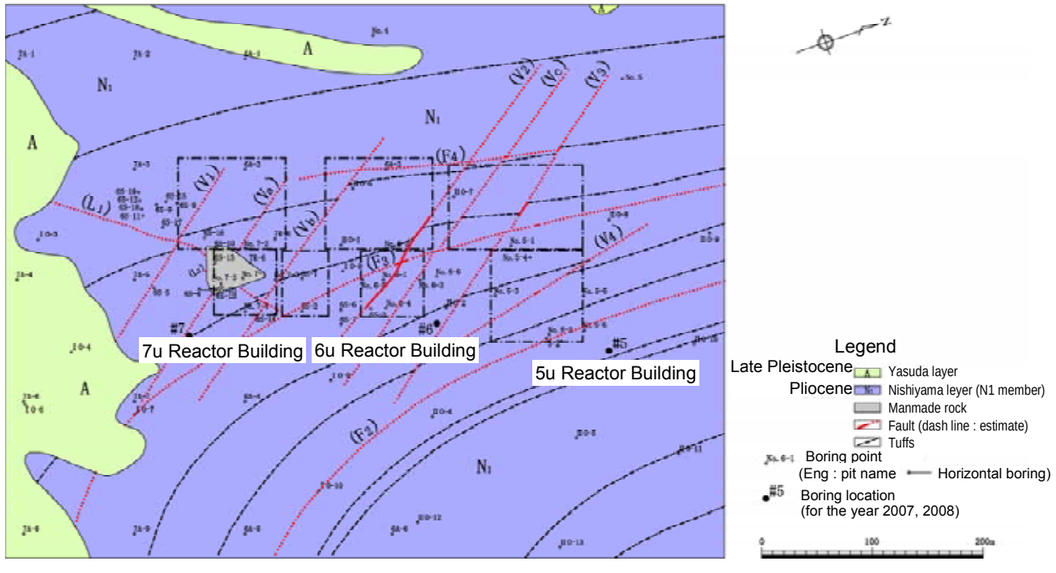
Table 9　List of Layers in the Site

Era			Bed Name		Major Facies/Lithological character
Quaternary	Helocene		Younger Stage Layer of Sand		Upper: gray colored small to medium sand Lower: brown colored small to medium sand, humic matter contained
	Pleistocene	Late	Banjin layer of Sand		Gray to red rust colored harsh sand
			Oominato layer of Sand		Bister to yellow bister colored medium to harsh sand, includes thin layer of shilt
			Yasuda layer	A_4 layer	Sand covered surface Cray to shilt, clip many sands
				A_3 layer	Clay to shilt, clip many sands Streaky clay, organic matter, sandy shell fossil
		Middle		A_2 layer	Clay to shilt, clip many sands Sand, thick sand gravel, organic matter
				A_1 layer	Clay to shilt, clip many sands Sand, thick sand gravel
		Early	Haidsume layer		Tuffaceous mudstone, tuffaceous sandstone, tuffaceous rock
the Neocene	Pleiocene	Late	Nishiyama layer	N_3 layer	Sandy mudstone Sandstone, tuffaceous rock, clip nodjule shell fossil
				N_2 layer	Shilt mudstone Streaky mudstone, tuffaceous rock, many nodjule
		Early		N_1 layer	Shilt to clay mudstone Sandstone, tuffaceous rock, clip nodjule siliceous sponge fossil
	Miocene	Late	Suitani layer		Sandstone, Sandstone-mudstone layer, clip granule rock
		Middle	Teradomari layer		Black mudstone, sandstone-mudstone layer

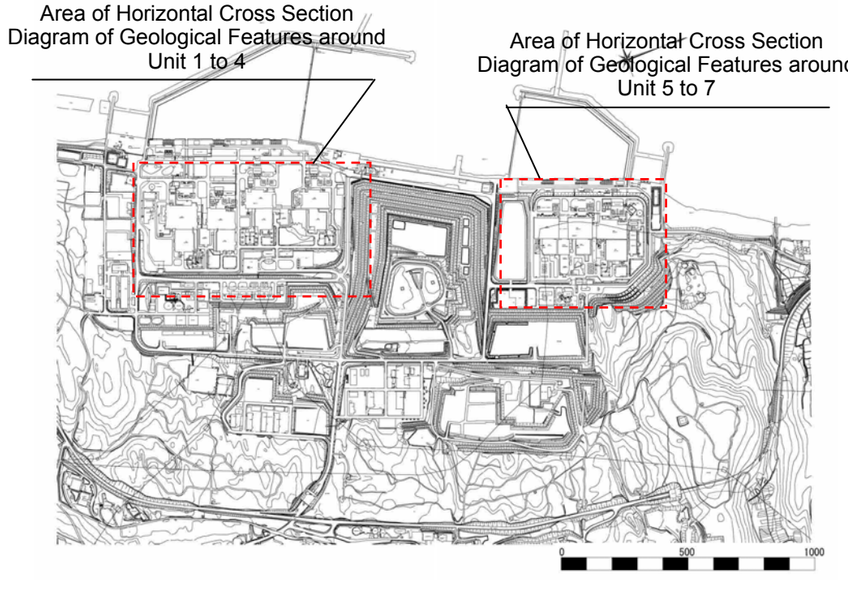
nonconformity
interfinger



(a) Horizontal Cross Section Diagram of Geological Features around Unit 1 to 4（At －40m elevation）



(b) Horizontal Cross Section Diagram of Geological Features around Unit 5 to 7 （At －25m elevation）



No.	Name
①	α・β Fault
②	V System Fault
③	F System Fault
④	①・② Fault
⑤	L_1・L_2 Fault

Figure 3 Distribution Map of Fault within the site

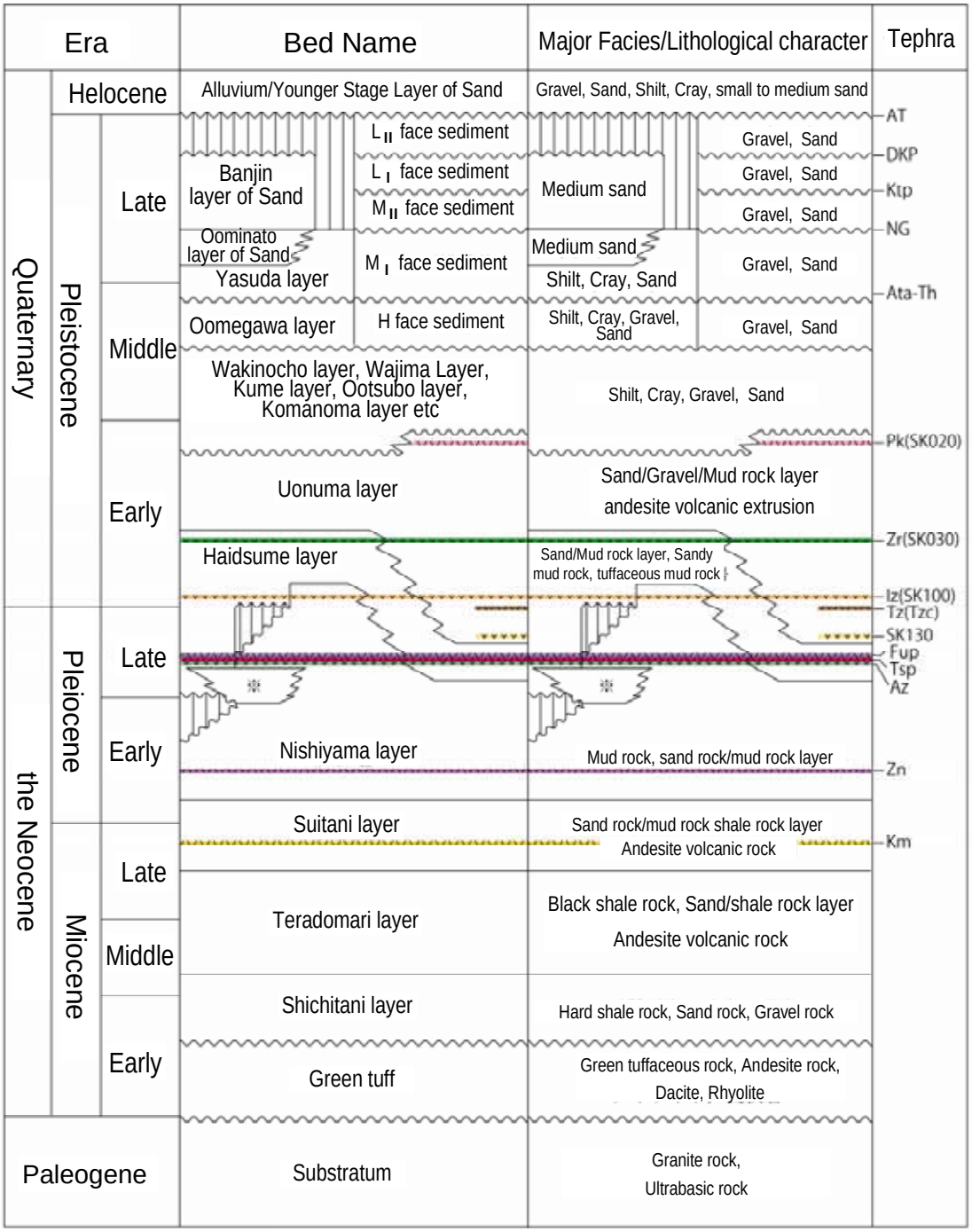
Faults, etc. around the Site

① Hosogoe Fault

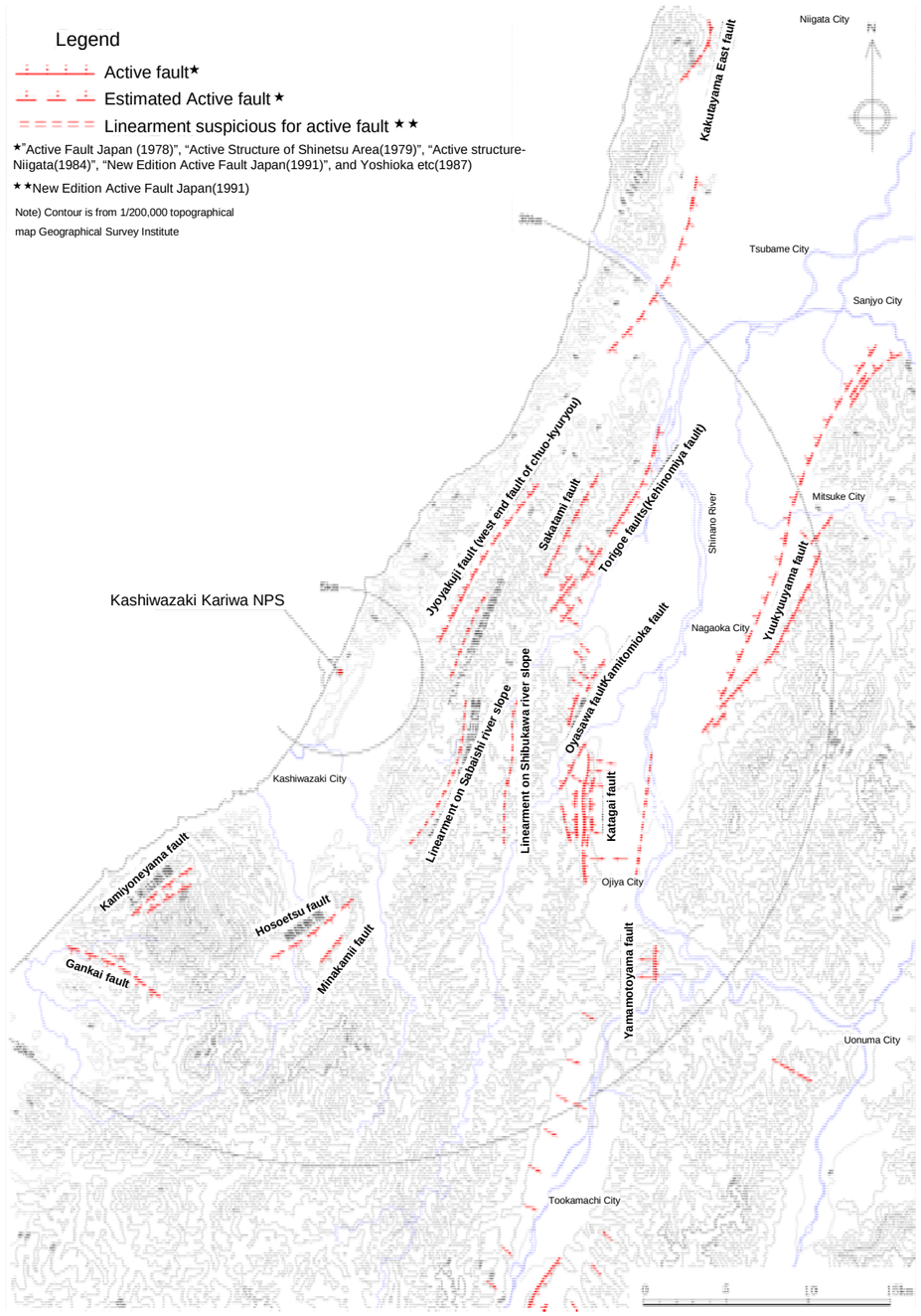
Items	Research Method	Research Results	Remarks
Literature search	—	[New] Active Faults in Japan（1991）： Length: Approx. 7km, Likelihood: □, Activitiy: Class B	Attachment 1Figuire 12－1
		Detailed Digital Maps of Active Faults（2002）: N/A	
		Active Structure Map- Niigata（1984）: N/A	
Geomorphological Research	Aerial Photographic Interpretation	Lineament□： Length Approx. 2, Direction: NE-SW, Category: L_C・L_D	Attachment Figure 12－2
Surficial geology research	Ground Surface Exploration	- A part of lineament is erosive. - North-western upper flexure structure on the Haizume layer is identified In the south-east side of the fault shown in the literature. However, the Kume layer widely distributing on the ground surface with the same structure has almost flat structure.	Attachment Table 12
Comprehensive evaluation	○ A part of lineament is erosive. ○ North-western upper flexure structure on the Haizume layer is identified in the south-east side of the fault shown in the literature. However, the Kume layer widely distributing on the ground surface with the same structure has almost flat structure. ○ It is judged from the above that it has not been active at least after the sedimentation of the Kume layer.		

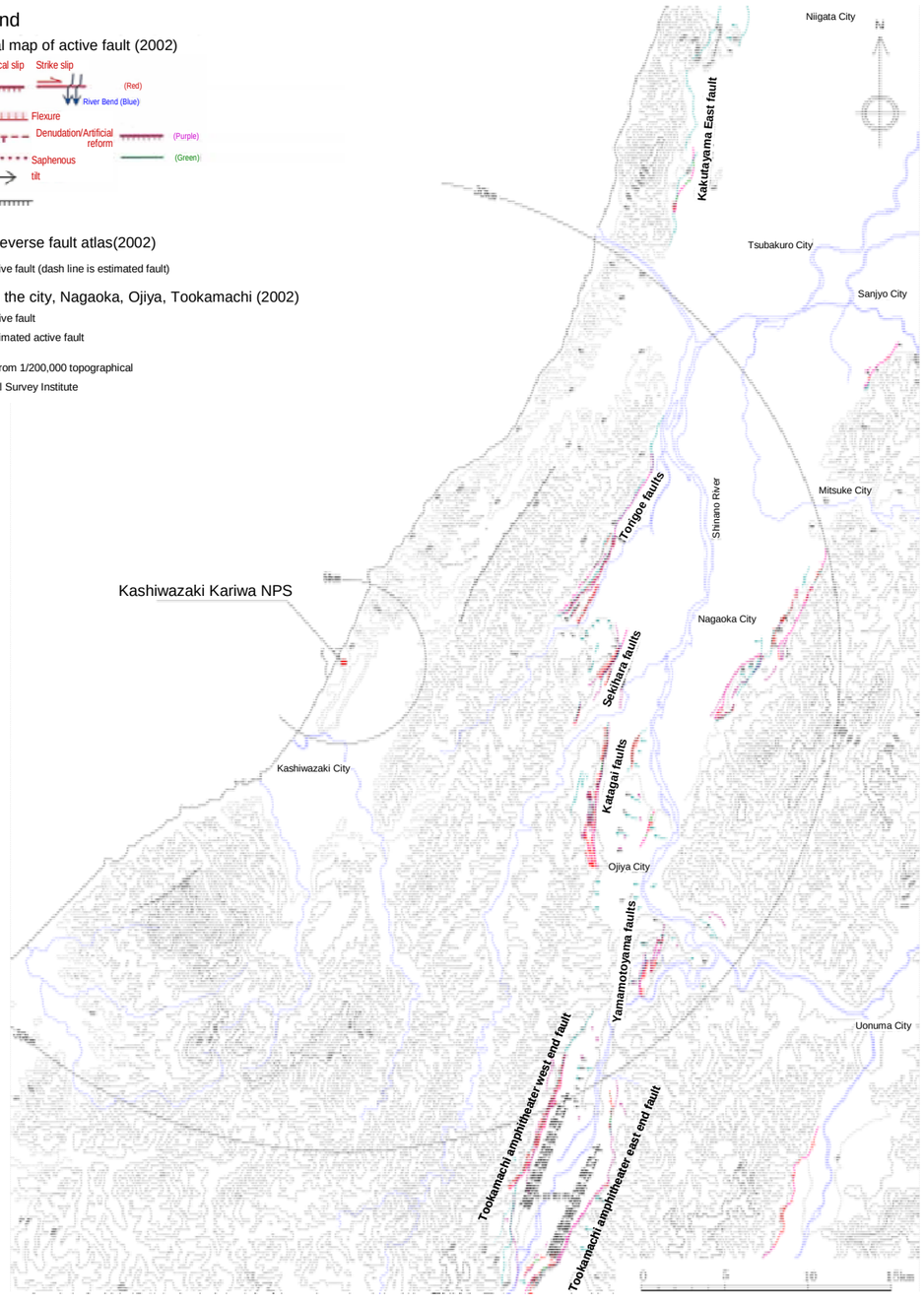
※：Terrain which has geomorphological deformation or its possibility

Attached Table 12　List of Geological Layer around the Site

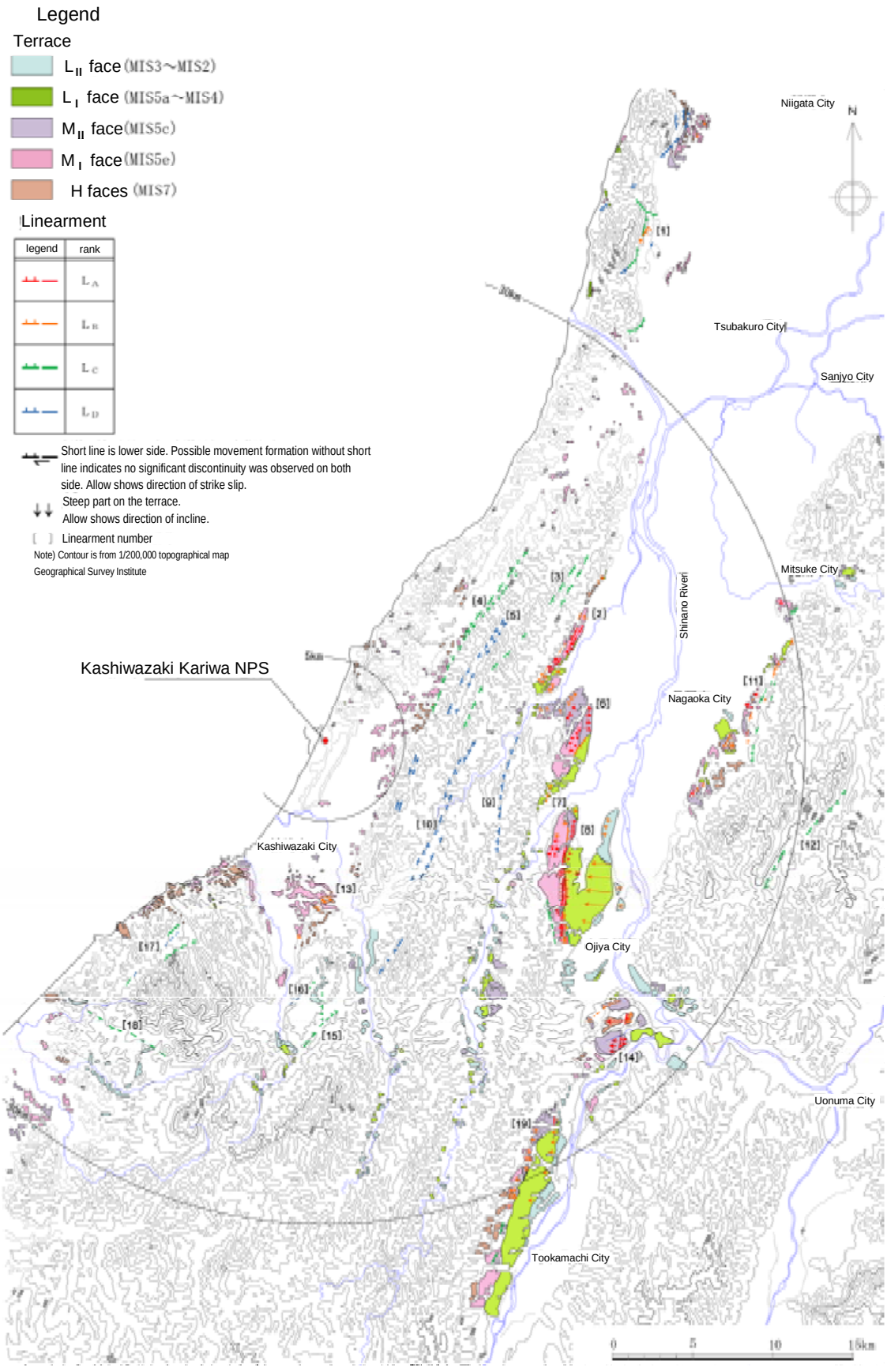


*For Wanatsu layer, northern part was included in Haidsume layer, south in Uonuma Layer.





Appendix Figure 12-1　Active Fault Distribution Map of Neighboring Terrestrial Area according to Literature



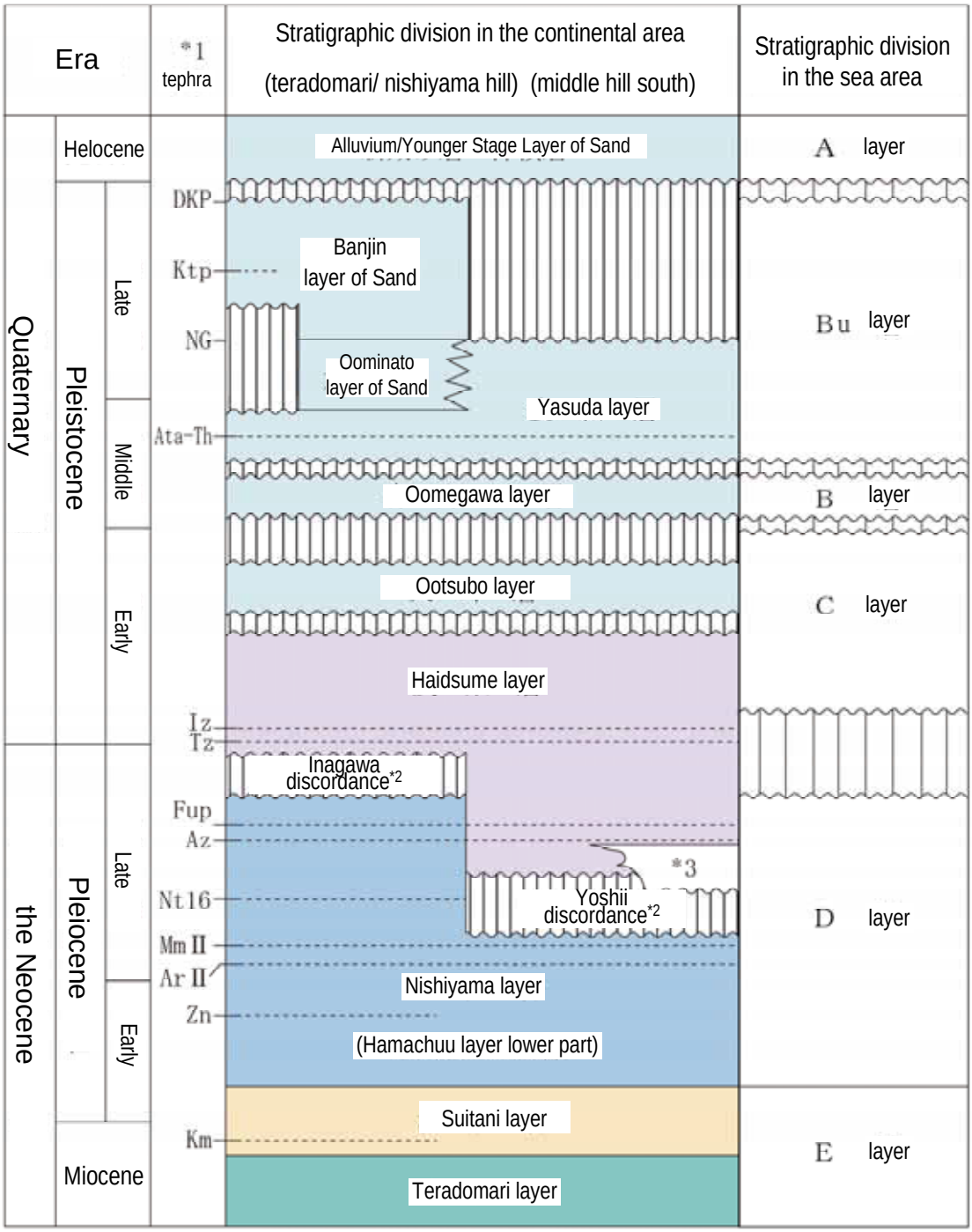
Appendix Figure 12-2 Interpretation of Aerial Photograph of Neighboring Terrestrial Area

Faults, etc. around the Site

② Madonosaka Syncline

Items	Research Method	Research Results	Remarks
Literature search	—	[New] Active Faults in Japan（1991）： N/A	Attachment Figure 12－1
		Detailed Digital Maps of Active Faults（2002）: N/A	
		Active Structure Map- Niigata（1984）: N/A	
		Komatsu, Watanabe（1968）： West-upper Reverse fault of the frame of the Madonosaka syncline (No mention of the length)	
Geomorphological Research	Aerial Photographic Interpretation	Lineament: N/A	Attachment Figure 13-1
	geomorphic analysis by DEM	No relation between flexure structure（syncline and anticline） and terrain	Attachment Figure 13-2
Surficial geology research	Ground Surface Exploration	There are north-western upper reverse fault in the Nishiyama layer and the Shiitani layer or asymmetrical syncline structure (the Madonosaka Syncline) whose geological layer of the frame I steep slope.	Attachment Table 13 Attachment Figure 13-3
Geophysical research	Seismic exploration by reflection method		
Surficial geology research	Drilling survey	The Yasuda layer unconformably covering the Madonosaka syncline, layers' boundaries of the Ominato sand layer, etc., the Atatorihama Tephra narrowly existing in the Yasuda layer has slight slope toward the east. However, they accumulated almost horizontally and do not have deformation according to flexure structure before the Nishiyama layer or other old layers.	
Comprehensive evaluation	○ The Nishiyama layer and the Shiitani layer have asymmetrical syncline structure (the Madonosaka Syncline) of steep slope, however the tephra layer narrowly existing in the Yasuda layer and the Ominato sand layer, which unconformably cover the syncline, do not have deformation. ○ north-western upper reverse fault in the Nishiyama layer and the Shiitani layer or asymmetrical syncline structure (the Madonosaka Synclin ○ It is judged from the above that asymmetrical syncline structure which the Madonosaka is estimated to have has not been active at least after the sedimentation of the Yasuda layer.		

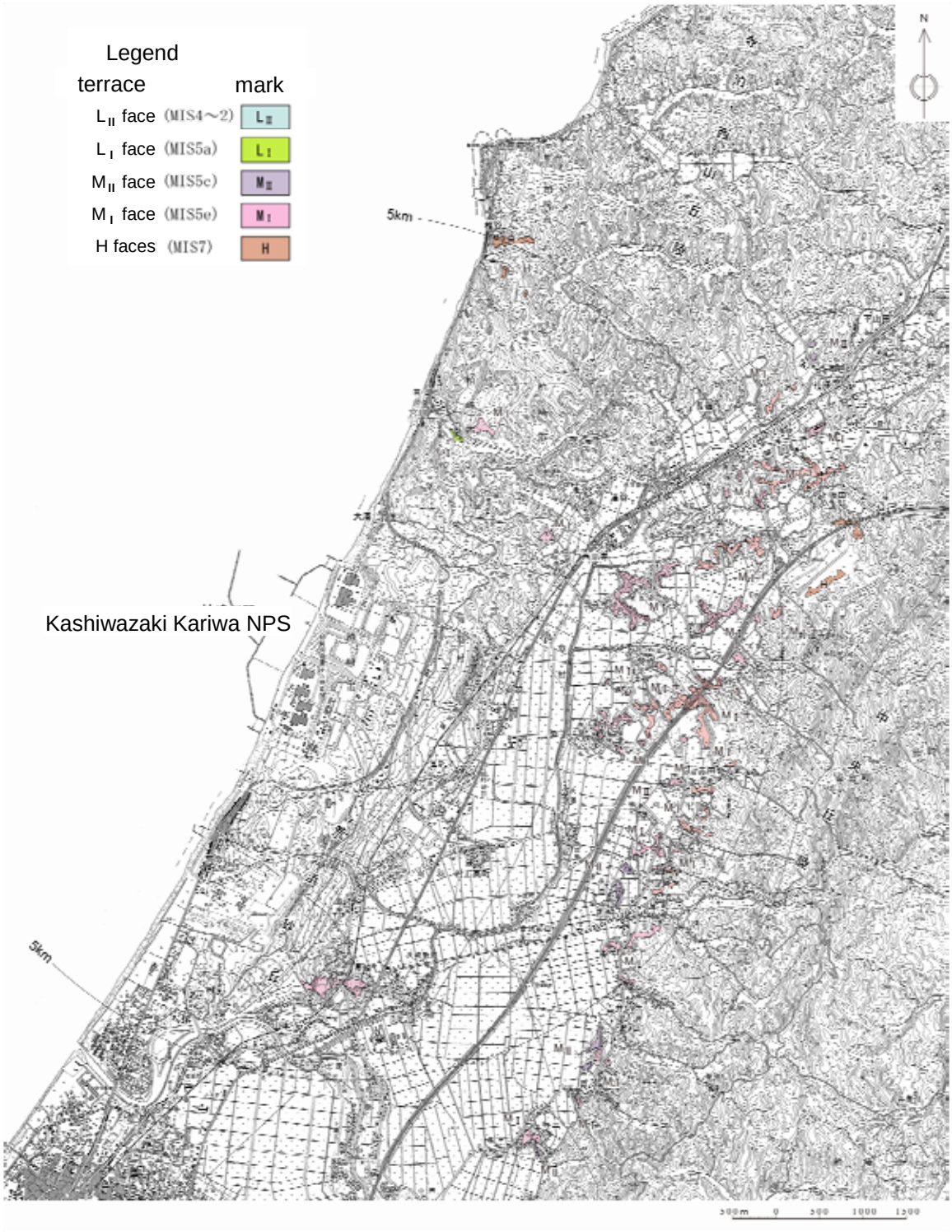
Appendix chart 13　Stratigraphic Profile of Neighboring Area



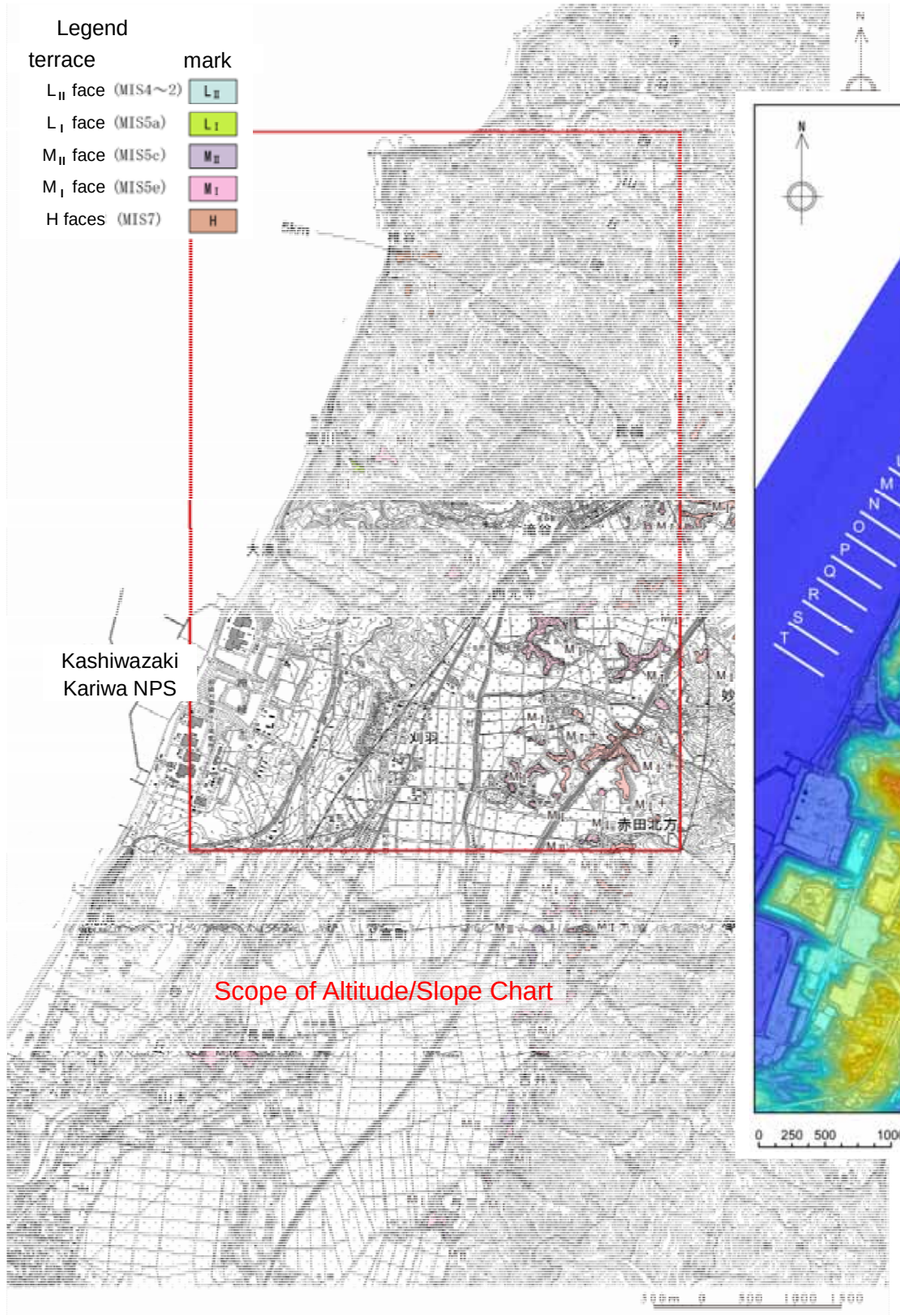
*1 Name and ara of tephra is from Kishi etc (1996)

*2 Name of discordance if from Kishi etc (1996)

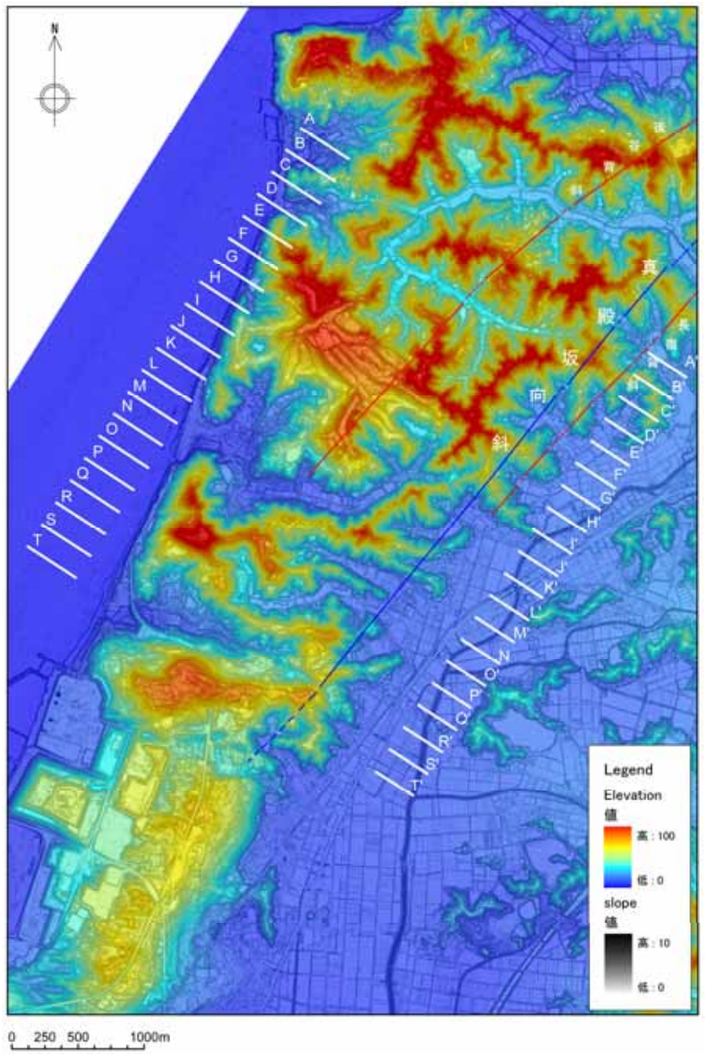
*3 Yoneyama volcanic rock/dou volcanic rock widely locate on Yoneyama shore and in the Nishiyama layer south of Kashiwazaki City.



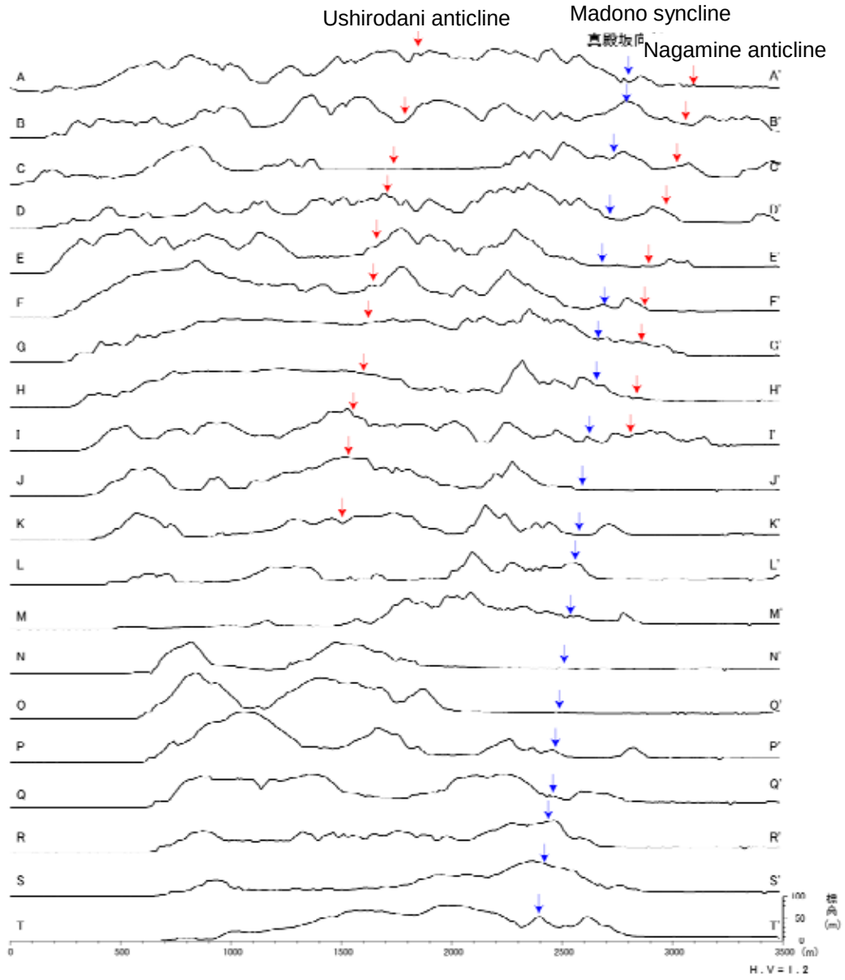
Appendix Figure 13-1　Interpretation of Aerial Photograph of Neighboring Terrestrial Area



[1] Interpretation of Aerial Photograph around Madonosaka Syncline

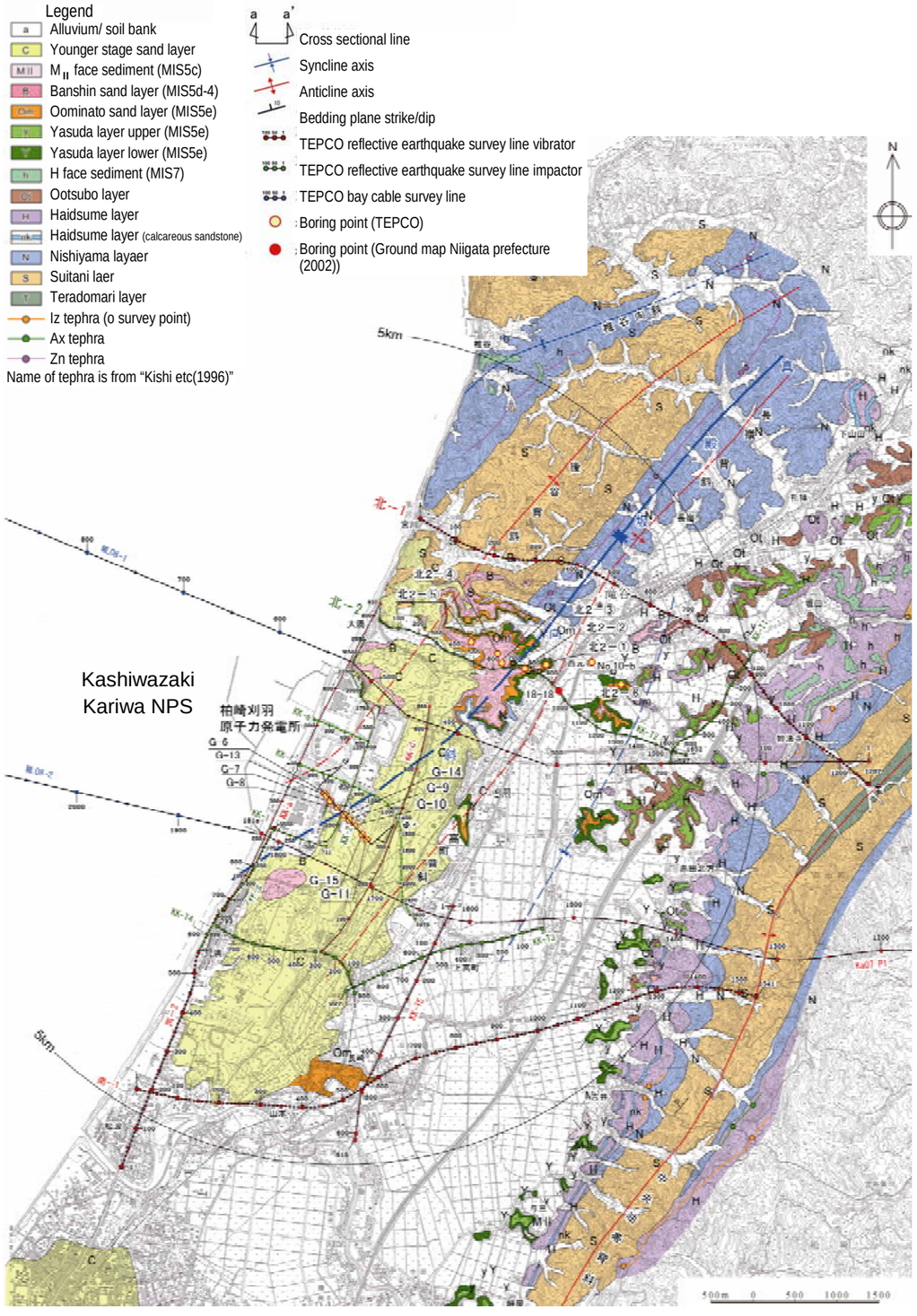


[2] Altitude/Slope Chart around Madonosaka Syncline

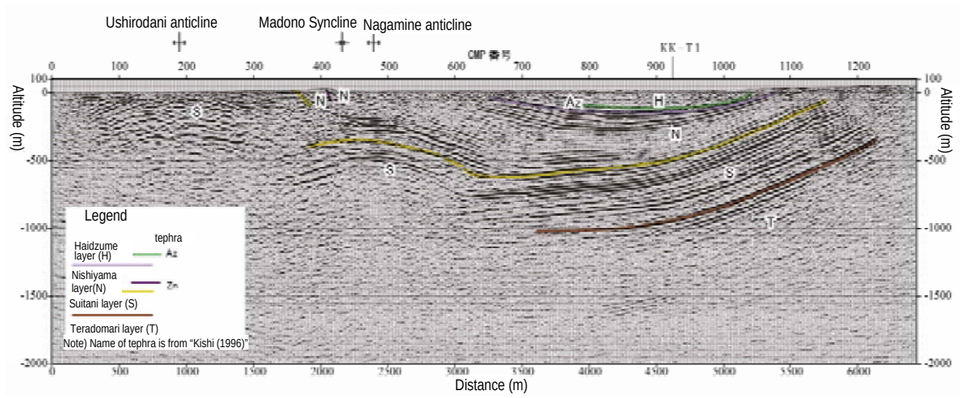


[3] Geological Cross-section around Madonosaka Syncline

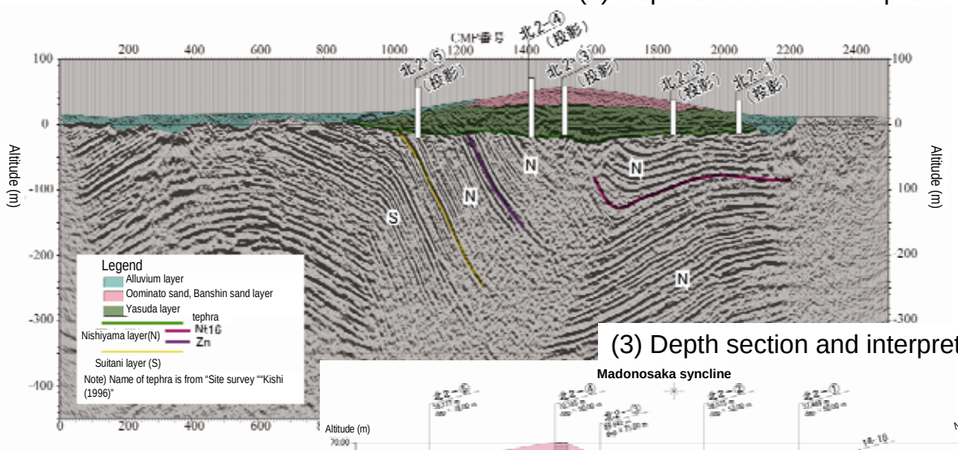
Appendix Chart 13-2 Results of Survey on Madonosaka Syncline



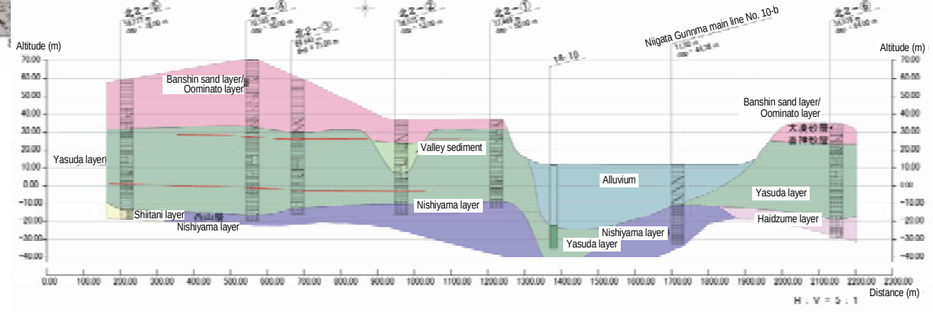
(1) Geological map and geological investigation location map around Madonozaka Syncline



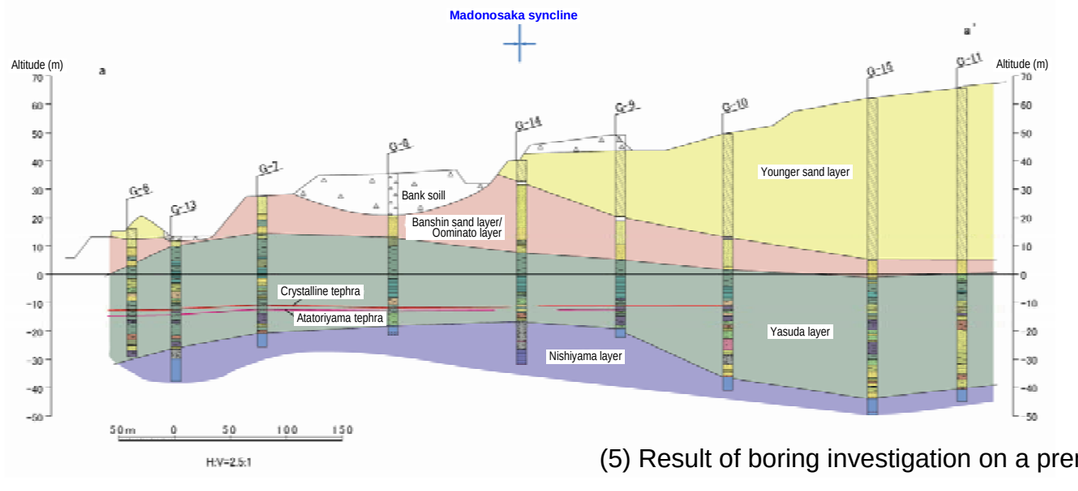
(2) Depth section and interpretation of N-1 survey line



(3) Depth section and interpretation of N-2 survey line



(4) Result of boring investigation along N-2 survey line



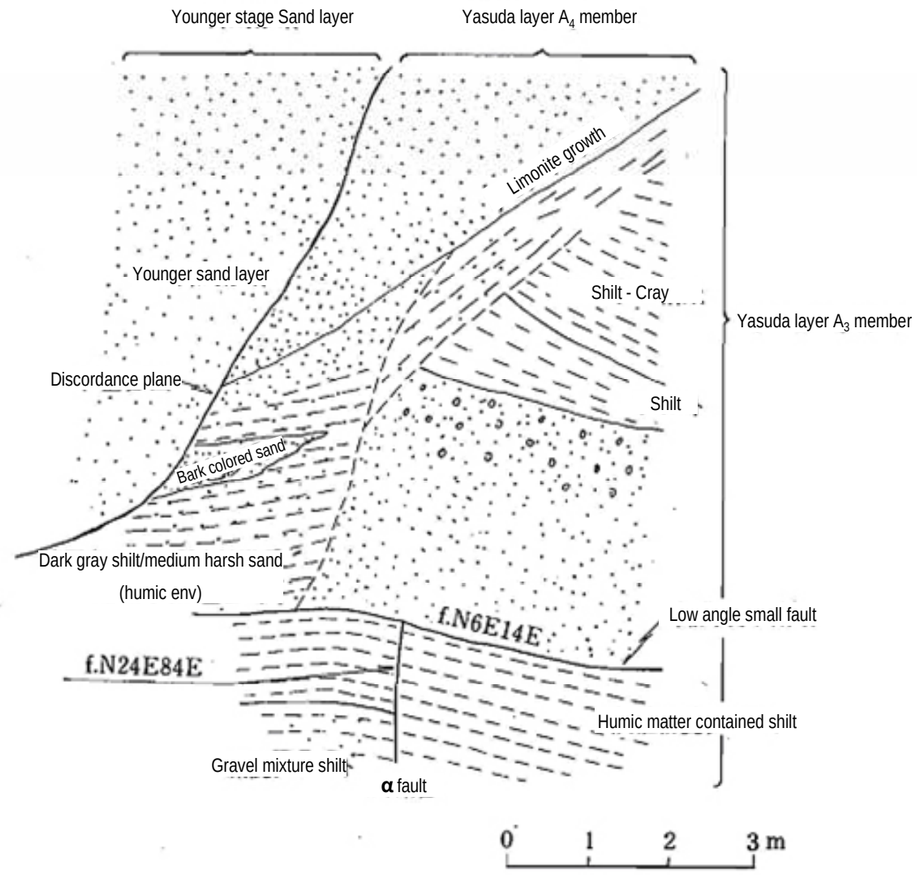
(5) Result of boring investigation on a premise

Appendix Figure 13-3 Investigation Result of Madonozaka Syncline

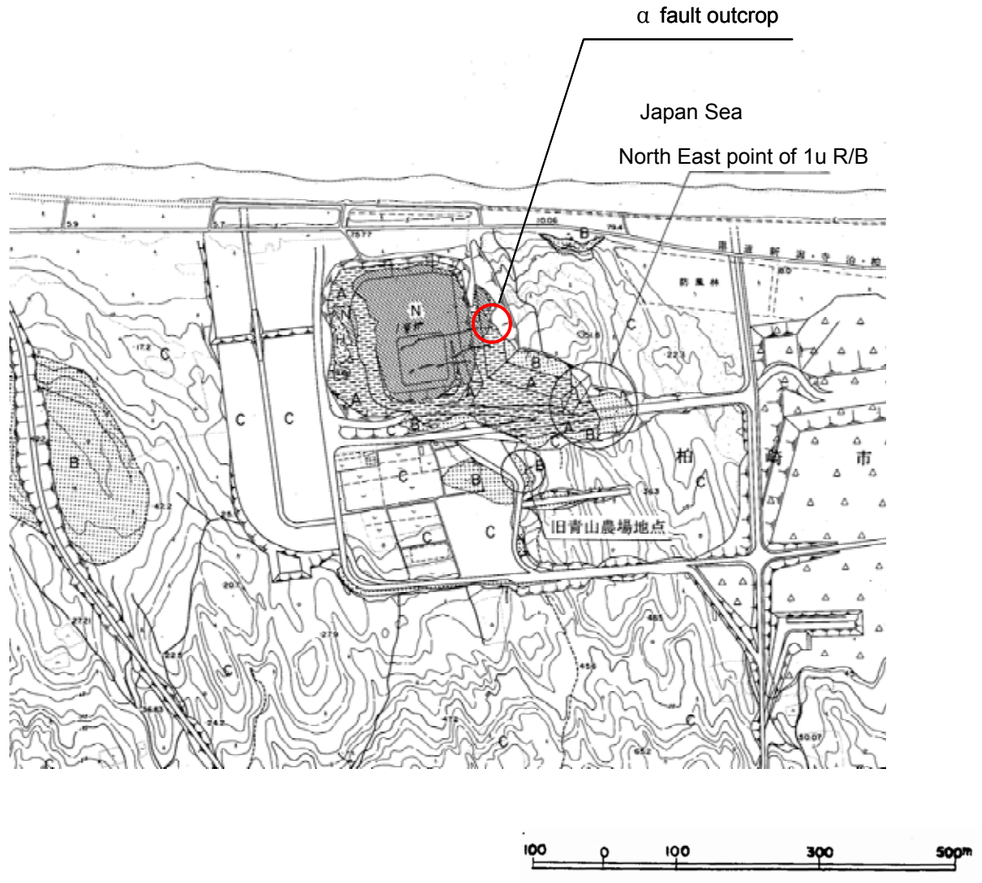
Fault etc. in the site

① α・β fault

Survey Item	Survey Method	Survey Result	Remarks
Bibliographic Survey	—	Fault Description : N/A	
Geomorphological Survey	Aerial Photograph Interpretation	Lineament : N/A	
Ground Surface Geological Survey	Ground Surface Exploration	Fault Outcrop : N/A	
Developed Slope Survey	Slope Geological Observation	Stopped at low angle fault of Yasuda Layer, no upper continuation	Attachment Drawing 14-1 Attachment Drawing 14-2
Vertical Shaft Survey	Shaft Wall Geological Observation	On β fault, no slip in the crushed stone or asphalt of the temporary yard for construction at the time of Chuetsu Oki earthquake	Attachment Drawing 14-3
General Evaluation	○ α fault is stopped at low angle fauld of Yasuda Layer and no upper continuation is recognized, so we evaluated that at least there is no activity after the deposition of Yasuda Layer. ○ β fault is stopped at low angle fauld of Yasuda Layer and no upper continuation is recognized, so we evaluated that at least there is no activity after the deposition of Yasuda Layer.		

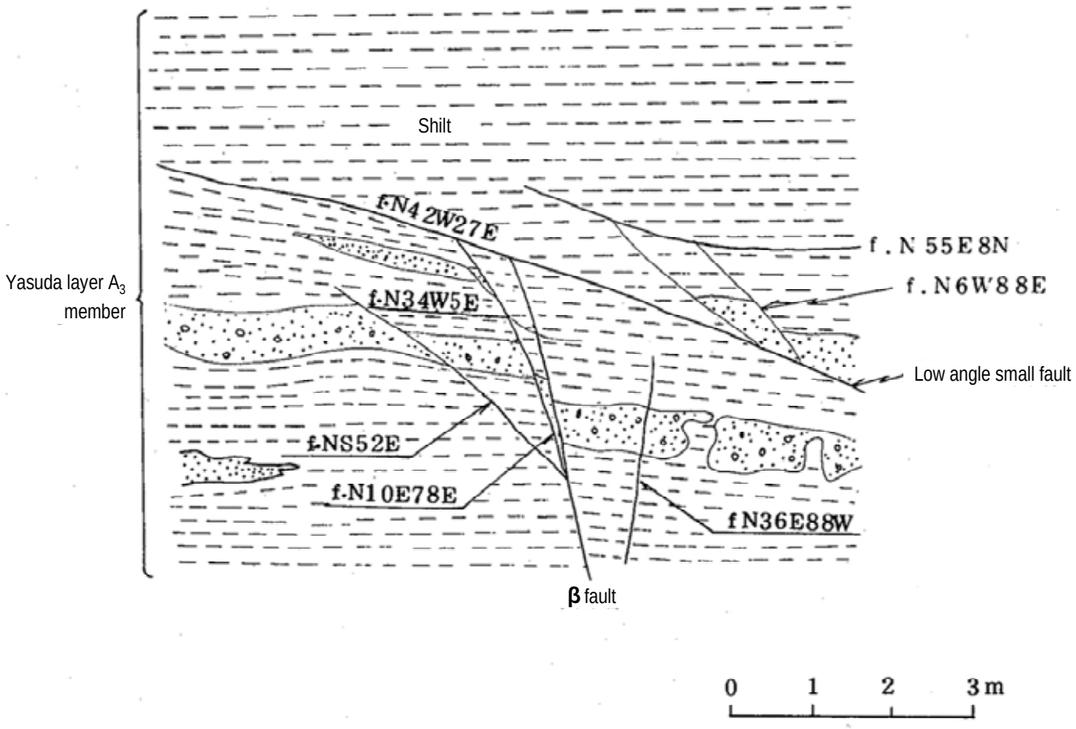


(1) Outcrop Sketch of α Fault (Northern developed slope of Unit 1 Reactor)

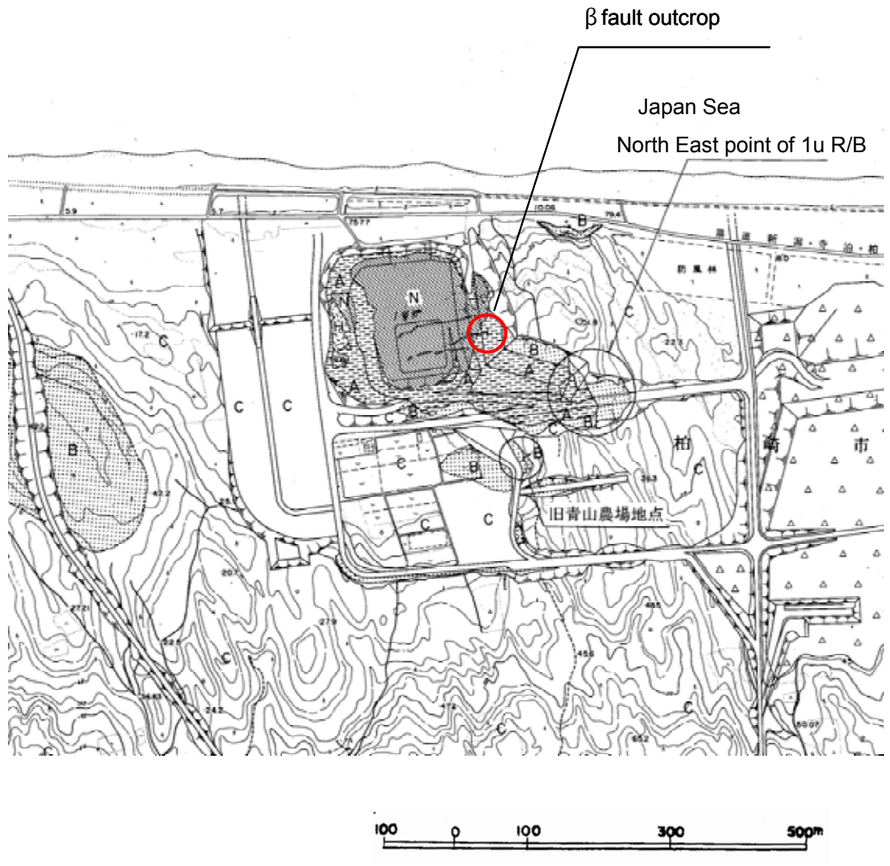


(2) Location Map of α Fault Outcrop

Attachment Drawing 14-1 Developed Slope Survey Result of α Fault



(1) Outcrop Sketch ofβ Fault (Northern developed slope of Unit 1 Reactor)



(2) Location Map of β Fault Outcrop

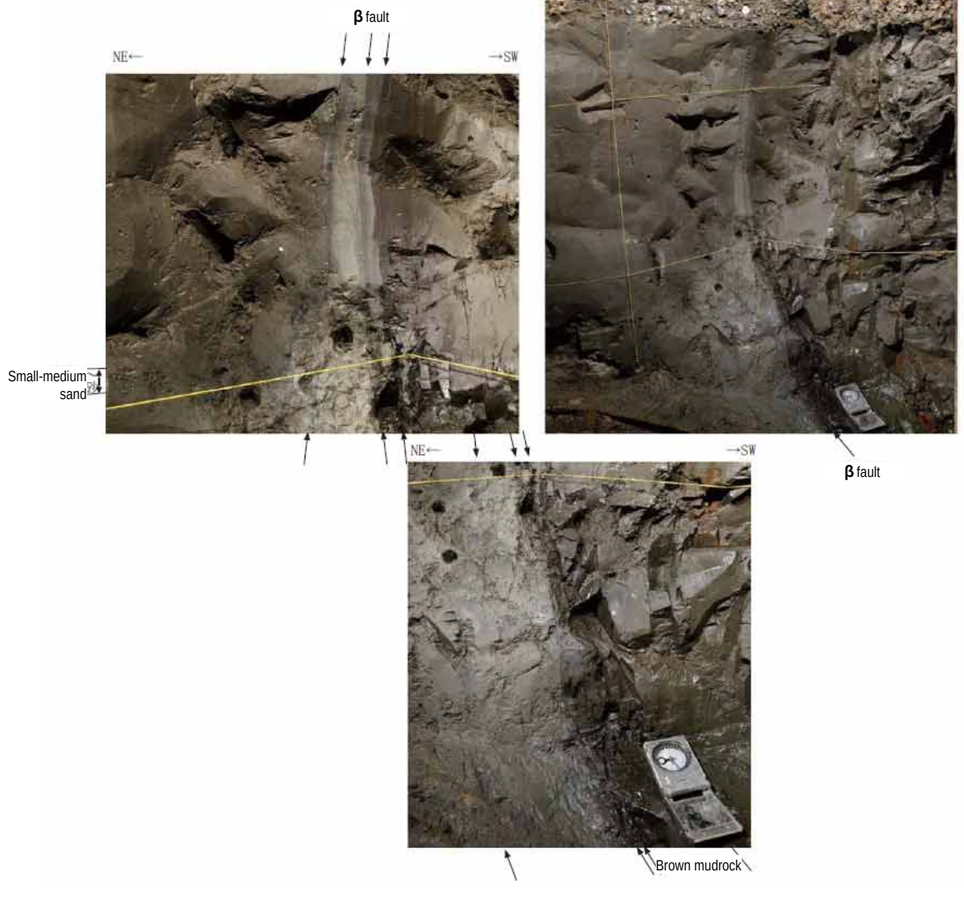
Attachment Drawing 14-2 Developed Slope Survey Result of β Fault

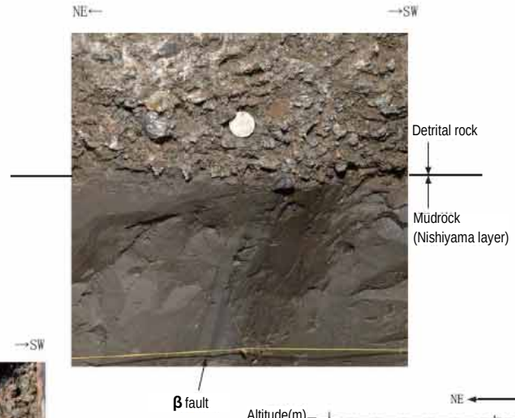
Legend

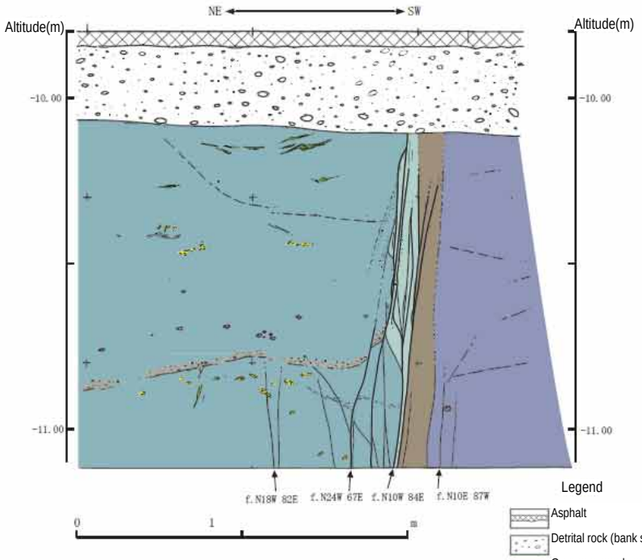
- Crack
- Falling
- Sand boiling

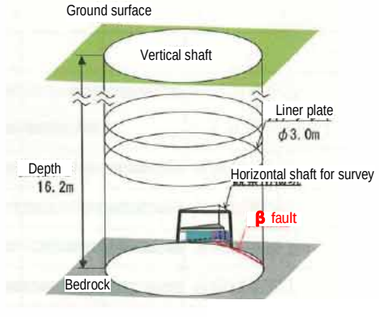
Fault considered not active at the time of approval

- Downdip projection of the Fault recognized at basement construction on the ground surface
- Downdip projection of the estimated Fault found boring survey on the ground surface
- Vertical projection of the low angule Fault recognized at basement construction
- Vertical shaft survey point
- Trench survey point









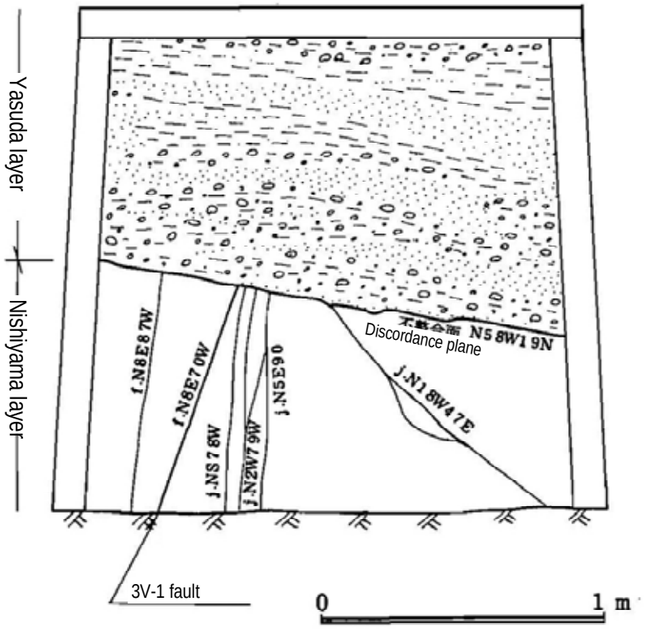
Attachment Drawing 14-3

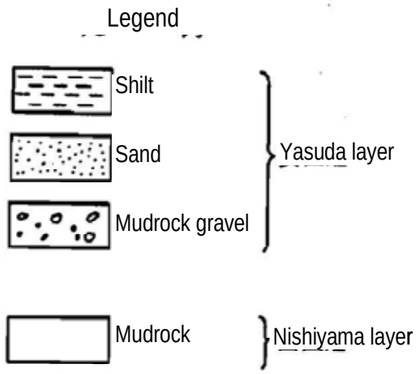
Vertical Shaft Survey Result of β Fault

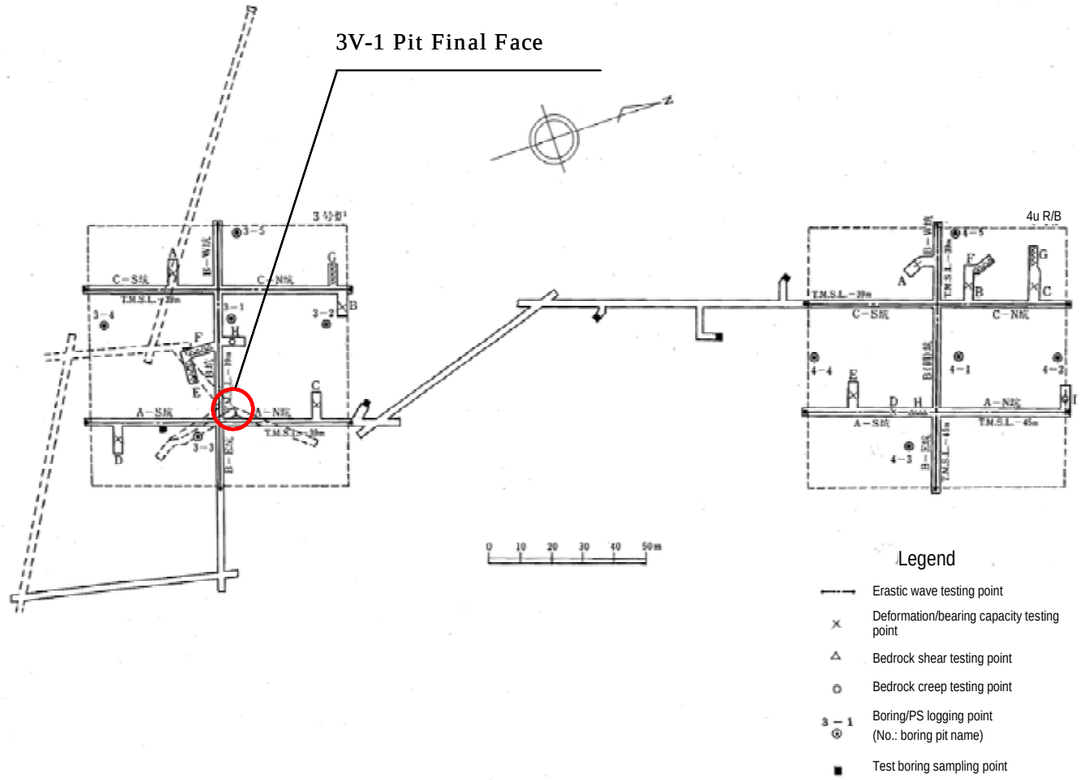
Faults etc. in the Site

② V Faults

Survey Item	Survey Method	Survey Result	Remarks
Bibliographic Survey	—	Fault Description： N/A	
Geomorphological Survey	Aerial Photographic Interpretation	Lineament： N/A	
Ground Surface Geological Survey	Ground Surface Exploration	Fault Outcrop： N/A	
Test Pit Survey	Test Pit Geological Observation	As the result of the survey on 3V-1 and V_2 layers where they have relatively wider fracture surface and greater drop, there is no displacement at the boundary face between Yasuda layer and Nishiyama Layer, and no continuation in Yasuda Layer.	Attachment Drawing 15-1 Attachment Drawing 15-2
Vertical Shaft Survey	Vertical Shaft Wall Geological Observation	There is no displacement at macadam and asphalt in temporary yard for construction even at the time of Chuetsu Oki Earthquake.	Attachment 15-3
Comprehensive Evaluation	○ 3V-1Fault has no displacement at the boundary face between Yasuda and Nishiyama Layer, and no continuation in Yasuda Layer. ○ V_2 Fault has no displacement at the boundary face between Yasuda and Nishiyama Layer, and no continuation in Yasuda Layer. ○ From the above, we evaluated that at least there is no activity of V Faults after the deposition of Yasuda Layer.		



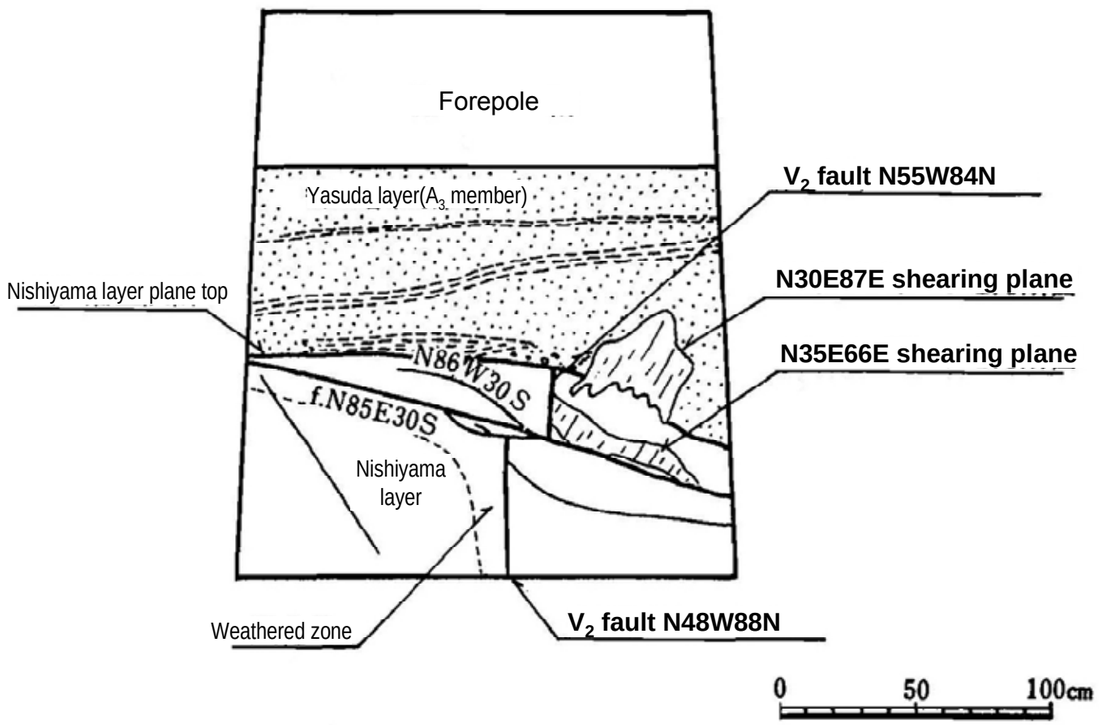




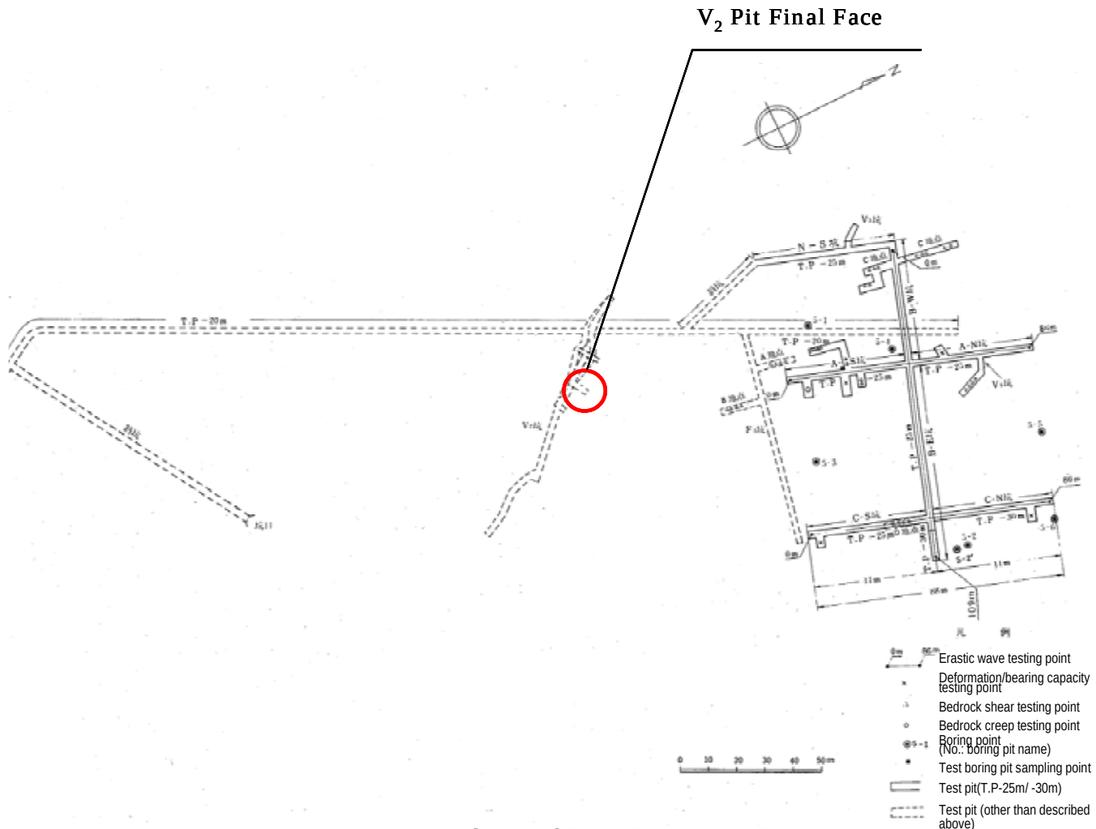
(1) Sketch of Final Face at 3V-1 Pit

(2) Location Chart of Final Face at 3V-1 Pit

Attachment drawing 15-1: Result of Test Pit Survey of 3V-1Fault

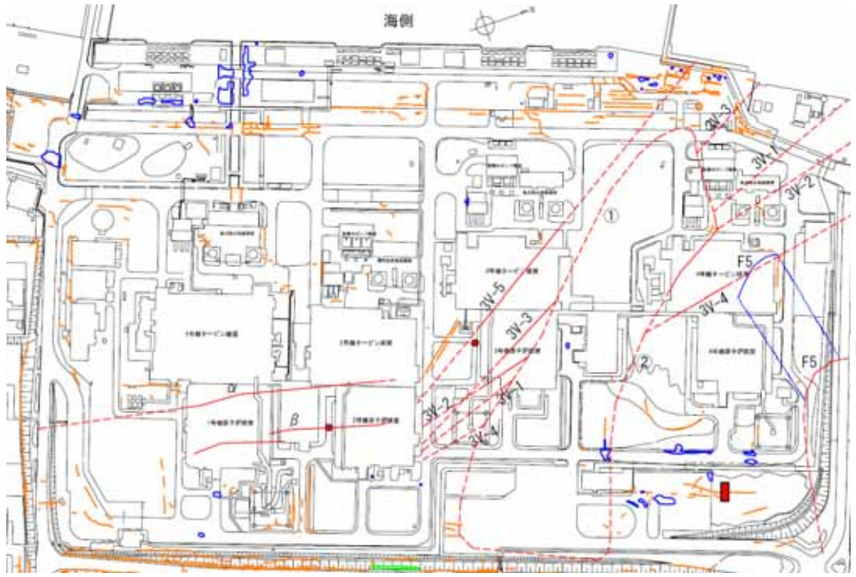


(1) Sketch of Final Face at V_2 Pit

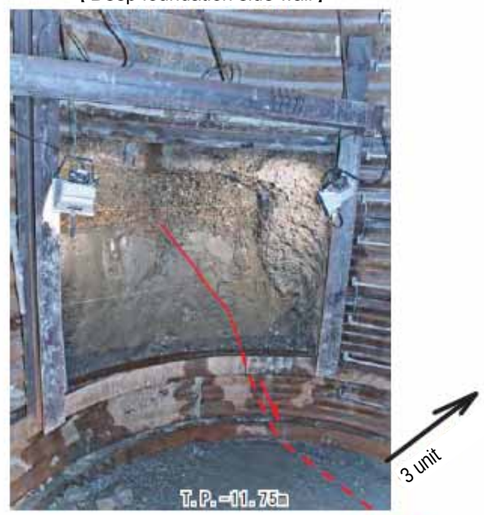


(2) Location Chart of Final Face at V_2 Pit

Attachment 15-2: Result of Test Pit Survey of V_2 Fault



【 Deep foundation side wall 】



3V-5 fault

Legend

Crack

Falling

Sand boiling

Fault considered not active at the time of approval

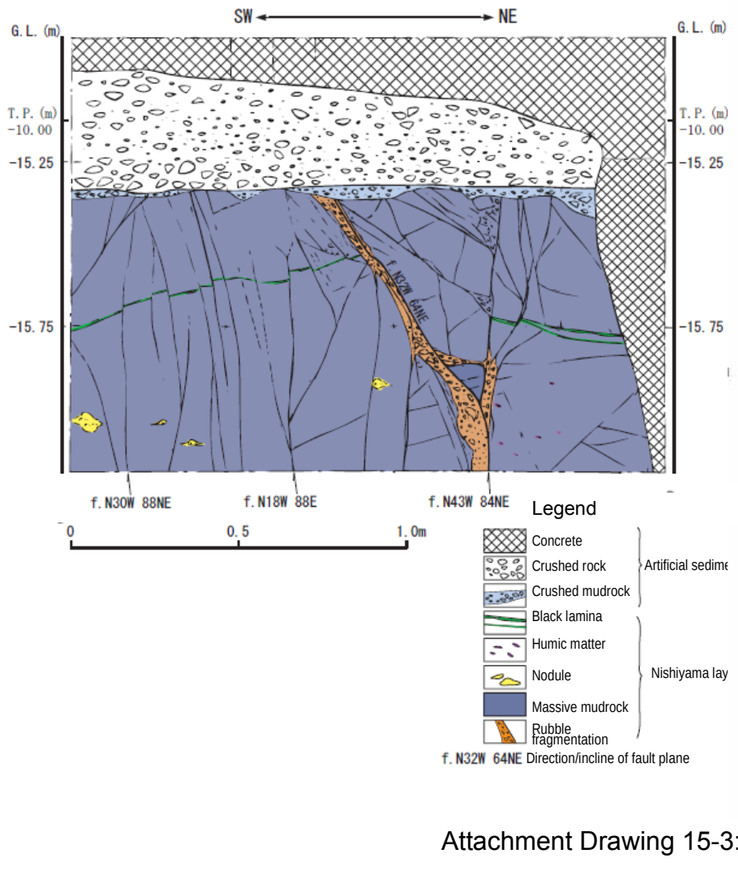
Downdip projection of the Fault recognized at basement construction on the ground surface

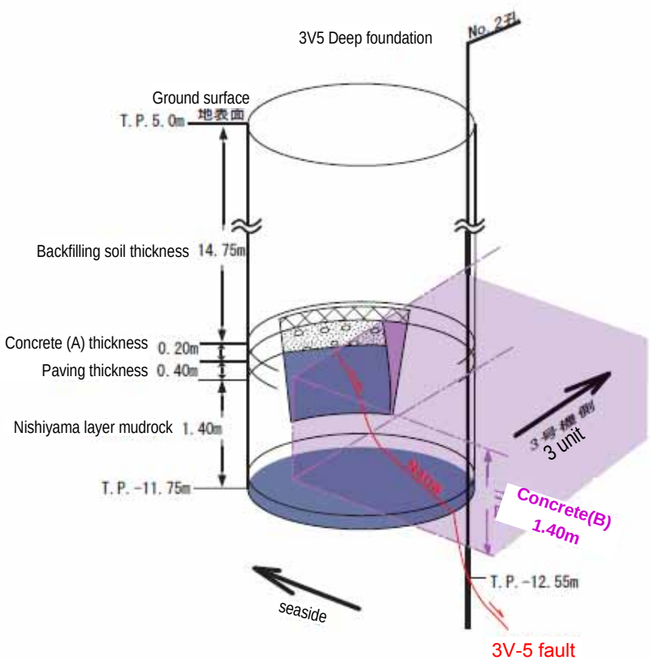
Downdip projection of the estimated Fault found boring survey on the ground surface

Vertical projection of the low angule Fault recognized at basement construction

Vertical shaft survey point

Trench survey point



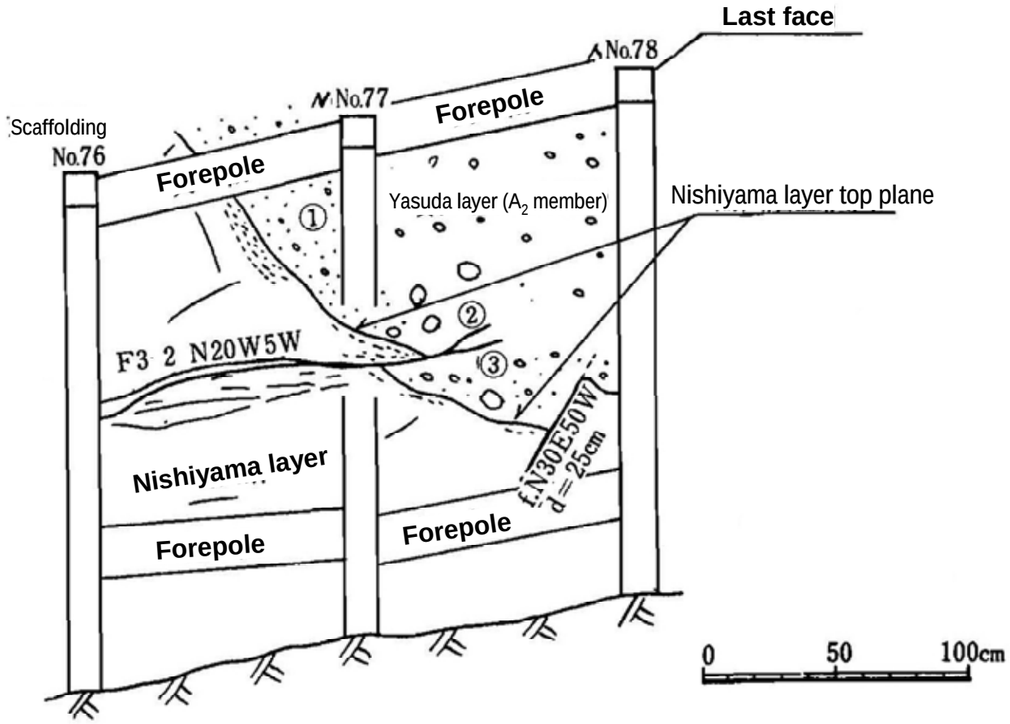


Attachment Drawing 15-3: Result of Vertical Shaft Survey of 3V-5 Fault

Faults etc. in the Site

③ F Faults

Survey Item	Survey Method	Survey Result	Remarks
Bibliographic Survey	—	Fault Description： N/A	
Geomorphological Survey	Aerial Photographic Interpretation	Lineament： N/A	
Ground Surface Geological Survey	Ground Surface Exploration	Fault Outcrop： N/A	
Test Pit Survey	Test Pit Geological Observation	As a result of survey on F_2 Layer where there is relatively large scale and continuity, it is observed that there is a displacement at the upper end of Nishiyama Layer, however, the displacement is disappeared soon in Yasuda Layer, and the F_2 Fault and V_2 Fault are connected with intercepting each other.	Attachment Drawing 16-1 Attachment Drawing 16-2
Vertical Shaft Survey	Vertical Shaft Wall Geological Observation	F_3 Fault has no displacement in Yasuda Layer even when Chuetsu Oki Earthquake.	Attachment Drawing 16-3
Comprehensive Evaluation	○ F_3 Fault has a displacement at the upper end of Nishiyama Layer, however, it is disappeared soon in Yasuda Layer. ○ F_3 Fault and V_2 Fault are connected with interfering each other. F2 Fault was formulated at the almost same time as when V2 Fault was formulated. ○ From the above, we evaluated that at least there is no activity of F Series Faults after the deposition of Yasuda Layer.		

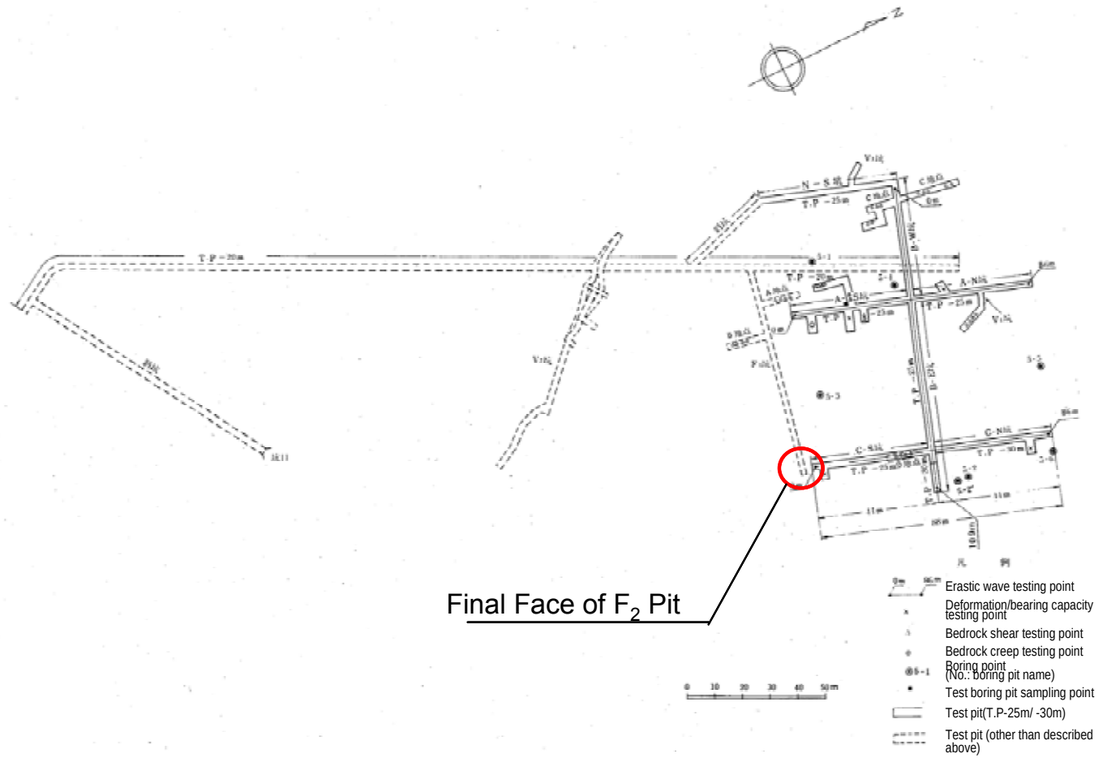


① Mudrock gravel layer (Yasuda layer) includs sand in matrix

② N20W35W Without cray. Disappear after 20cm continuity.

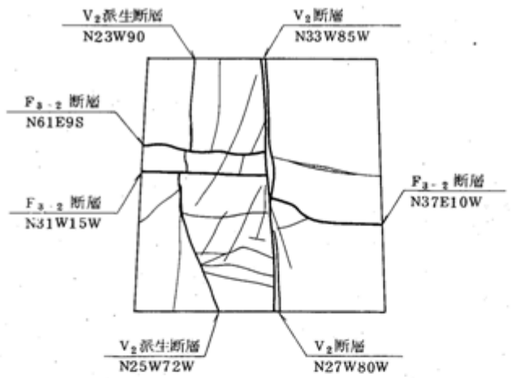
③ N5W30W Without cray. Disappear after 20cm continuity.

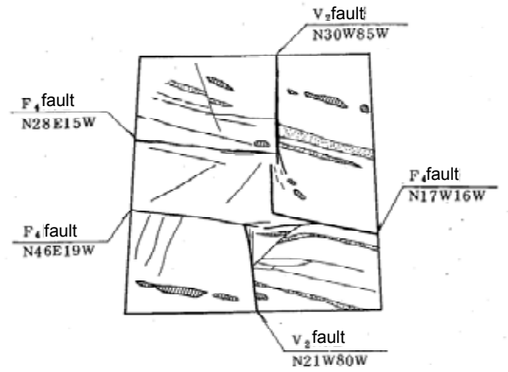
(1) Northern Wall Sketch of Final Face of F_3 Pit

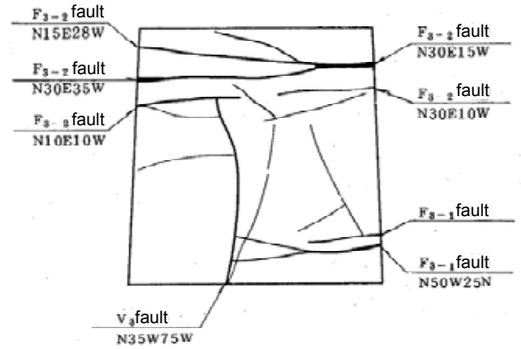


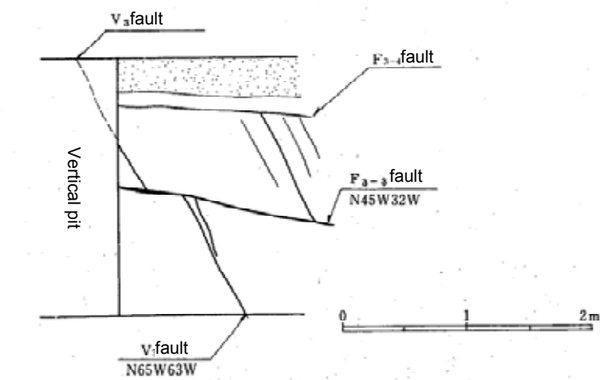
(2) Location Chart of Final Face of F_3 Pit

Attachment Drawing 16-1: Result of Test Pit Survey of F_3 Fault

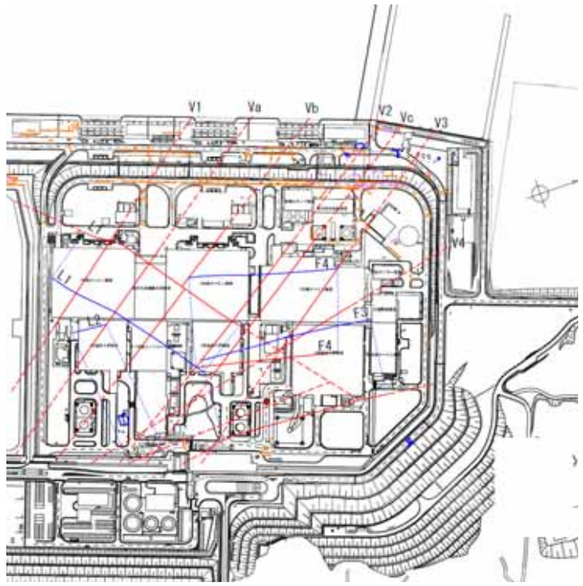


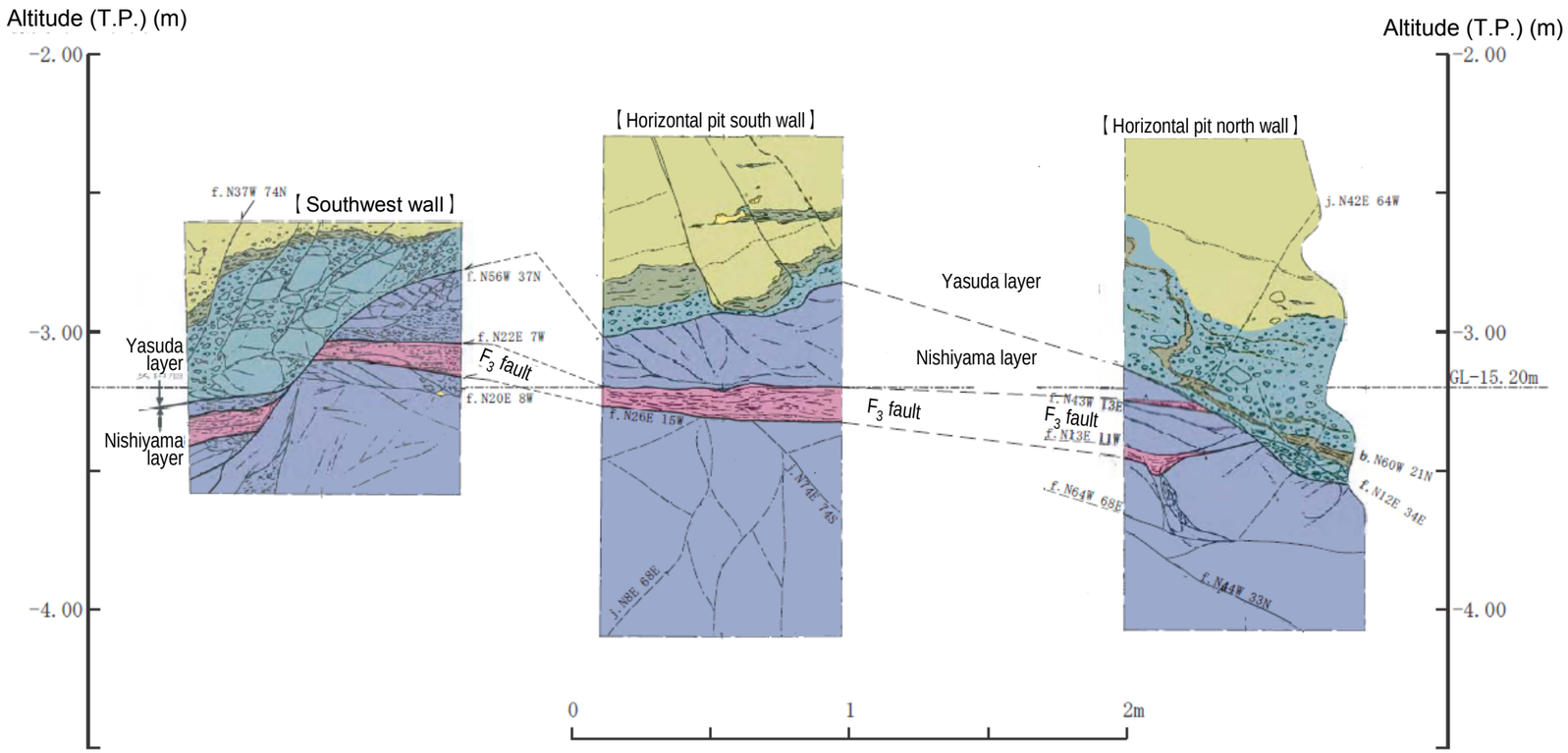






Attachment 16-2: Joining Section of F Fault and V Fault



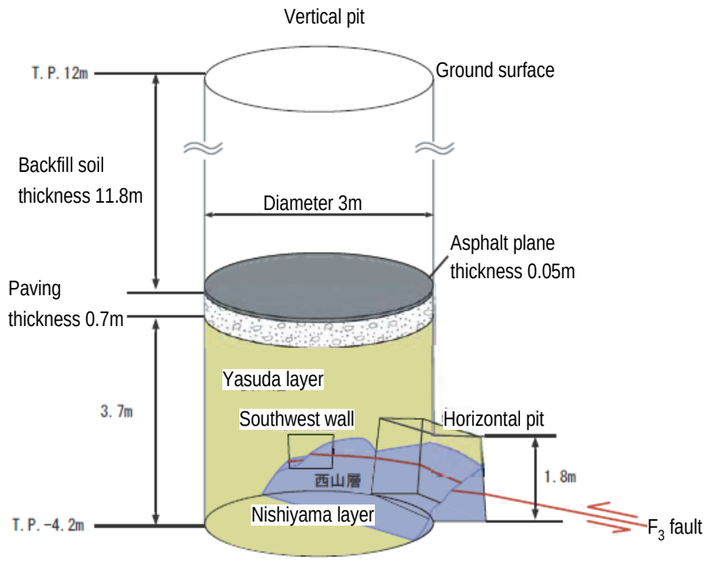


Legend

- Crack
- Falling
- Sand boiling

Fault considered not active at the time of approval

- Downdip projection of the Fault recognized at basement construction on the ground surface
- Downdip projection of the estimated Fault found boring survey on the ground surface
- Vertical projection of the low angle Fault recognized at basement construction
- Vertical shaft survey point
- Trench survey point



Legend

- Shilt layer
- Humic matter
- Mudrock rubble
- Mudrock nodule
- Mudrock
- Fault fragmentation

(Yasuda layer: Shilt layer, Humic matter, Mudrock rubble; Nishiyama layer: Mudrock nodule, Mudrock)

f. N14E 14W: Direction/incline of fault

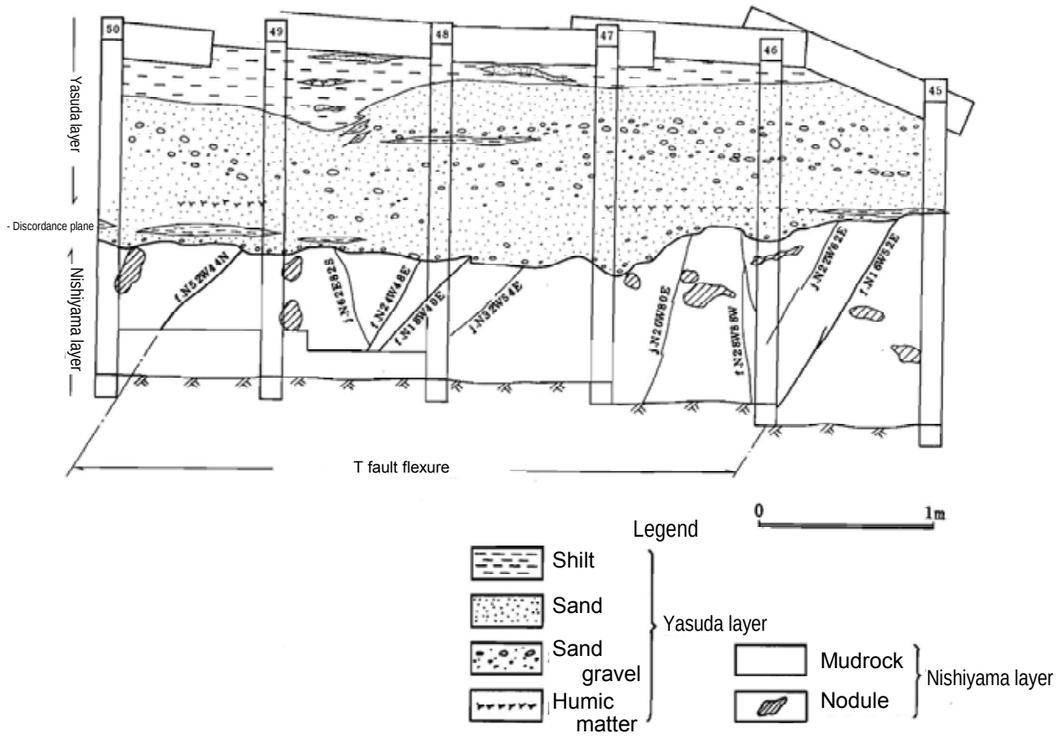
j. N10E 42E: Direction/incline of fault

Attachment Drawing 16-3: Result of Vertical Shaft Survey of F_3 Fault

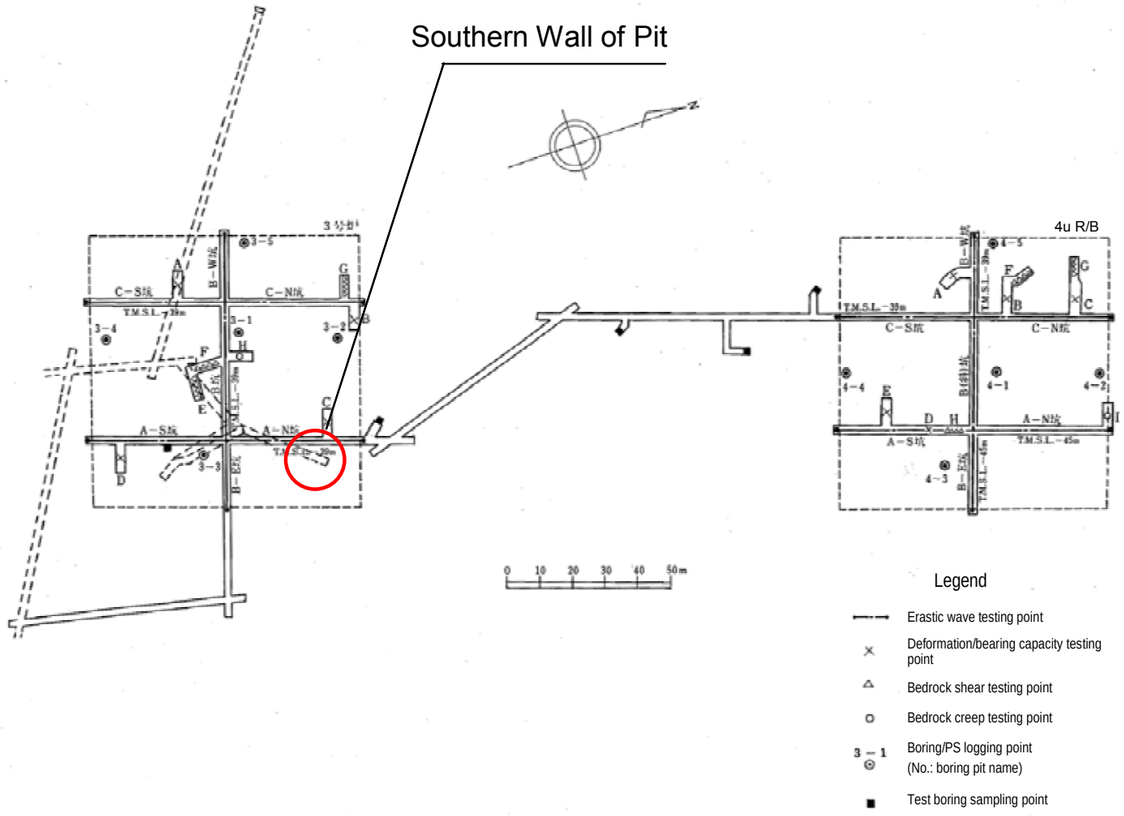
Faults etc. in the Site

④ Faults ① and ②

Survey Item	Survey Method	Survey Result	Remarks
Bibliographic Survey	—	Fault Description：N/A	
Geomorphological Survey	Aerial Photographic Interpretation	Lineament：N/A	
Ground Surface Geological Survey	Ground Surface Exploration	Fault Outcrop：N/A	
Test Pit Survey	Test Pit Geological Observation	As the result of the survey on Fault ①, the Fault has no displacement at the boundary face between Yasuda and Nishiyama Layers, and no continuation in Yasuda Layer.	Attachment Drawing 17
Boring Survey	Boring core observation	Fault① and Fault② are connecting faults where they show annular shape on the same plain.	
Comprehensive Evaluation	○ Fault① and Fault② have characteristics of landslide and are connecting faults where they show annular shape on the same plain. ○ Fault① has no displacement at the boundary face between Yasuda and Nishiyama Layers, and no continuation in Yasuda Layer. ○ From the above, we evaluated that at least there is no activity of Fault① and Fault② after the deposition of Yasuda Layer.		



(1) Sketch of Southern Wall of Pit

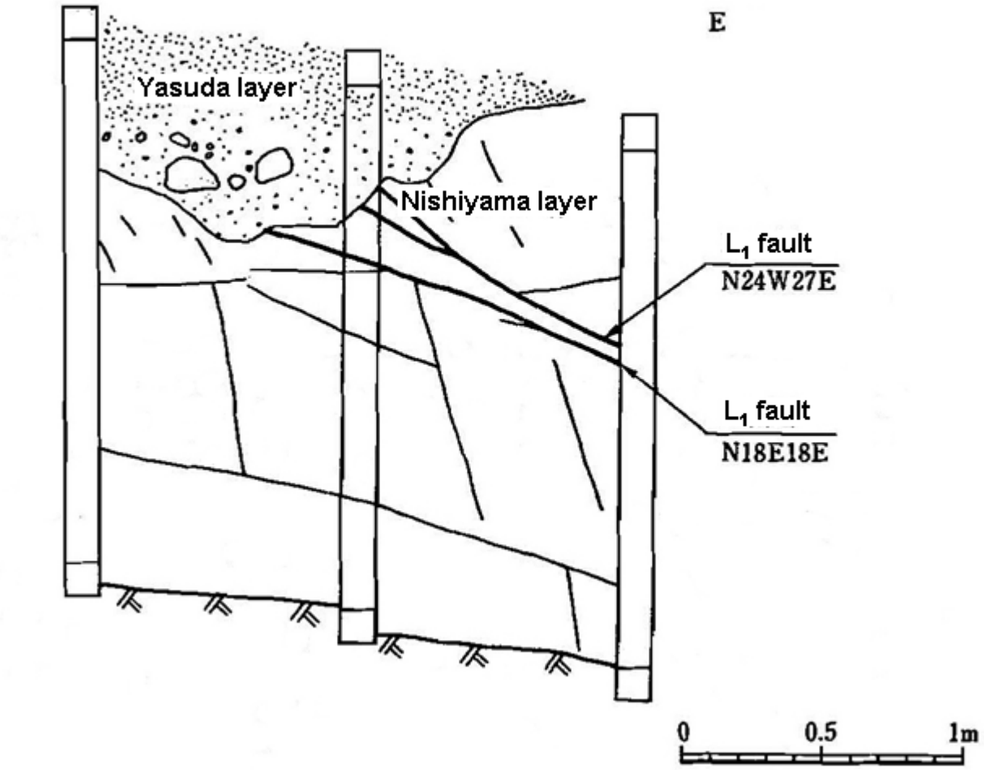


(2) Location Chart of Pit ①

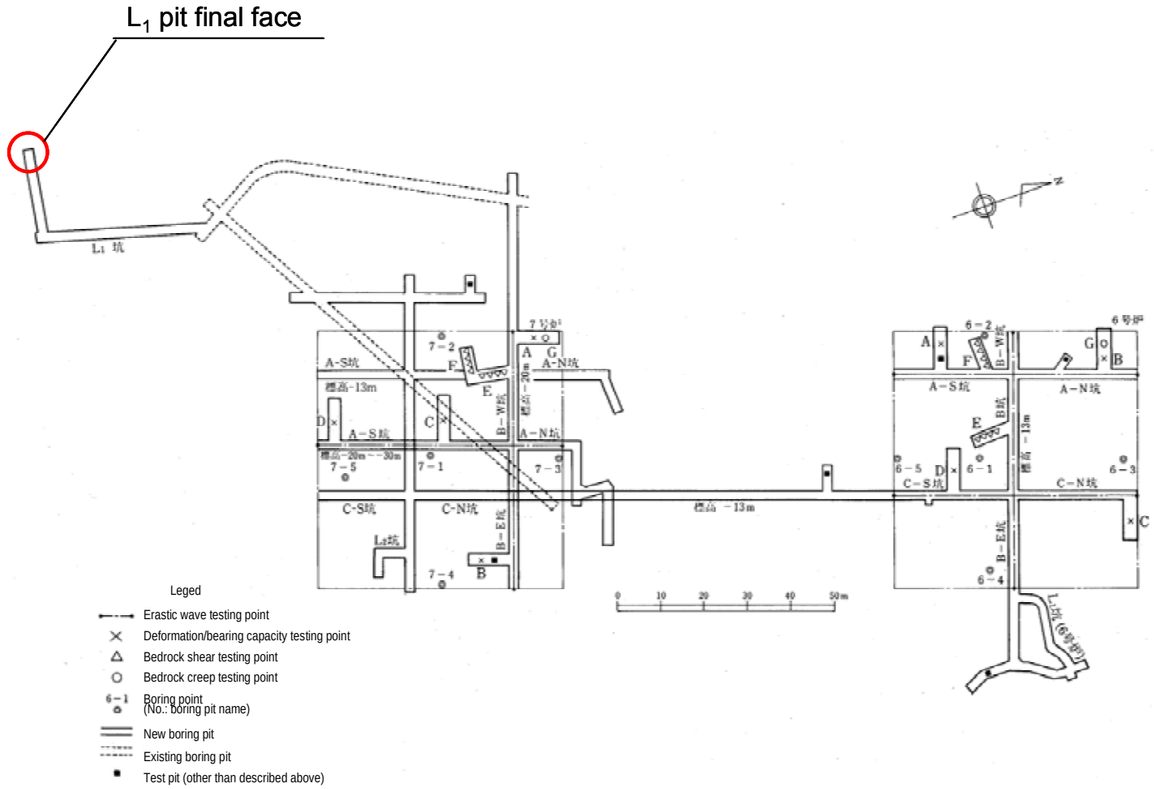
Faults etc. in the Site

⑤ L_1・L_2 Faults

Survey Item	Survey Method	Survey Result	Remarks
Bibliographic Survey	—	Fault Description：N/A	
Geomorphological Survey	Aerial Photographic Interpretation	Lineament：N/A	
Ground Surface Geological Survey	Ground Surface Exploration	Fault Outcrop：N/A	
Test Pit Survey	Test Pit Geological Observation	No Continuation in Yasuda Layer	Attachment Drawing 18－1 Attachment Drawing 18－2
Comprehensive Evaluation	○ L_1 Fault has no continuation in Yasuda Layer ○ L_2 Fault has no continuation in Yasuda Layer ○ From the above, we evaluated that at least there is no activity of L_1 and L_2 Faults after the deposition of Yasuda Layer.		

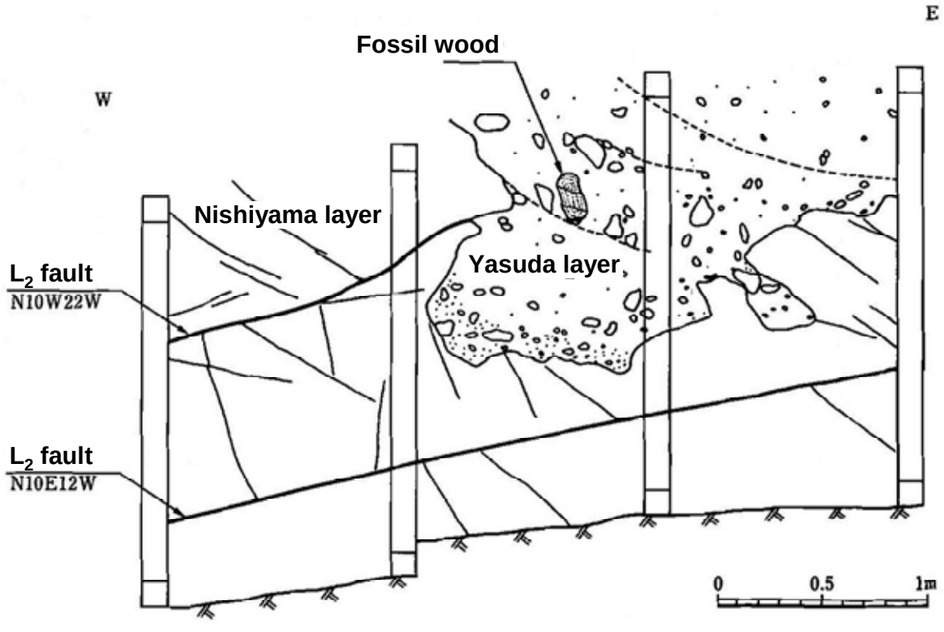


(1) Northern Wall Sketch of Final Face of L_1 Pit

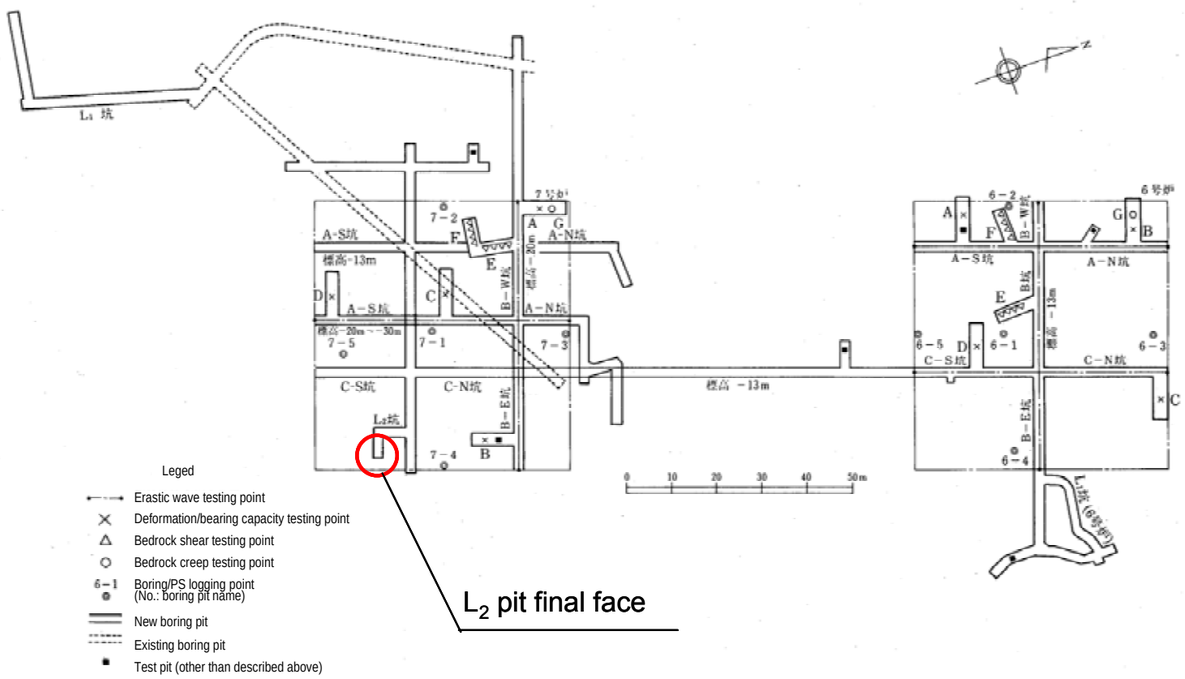


(2) Location Chart of Final Face of L_1 Pit

Attachment Drawing 18－1 Result of Test Pit Survey of L_1 Fault



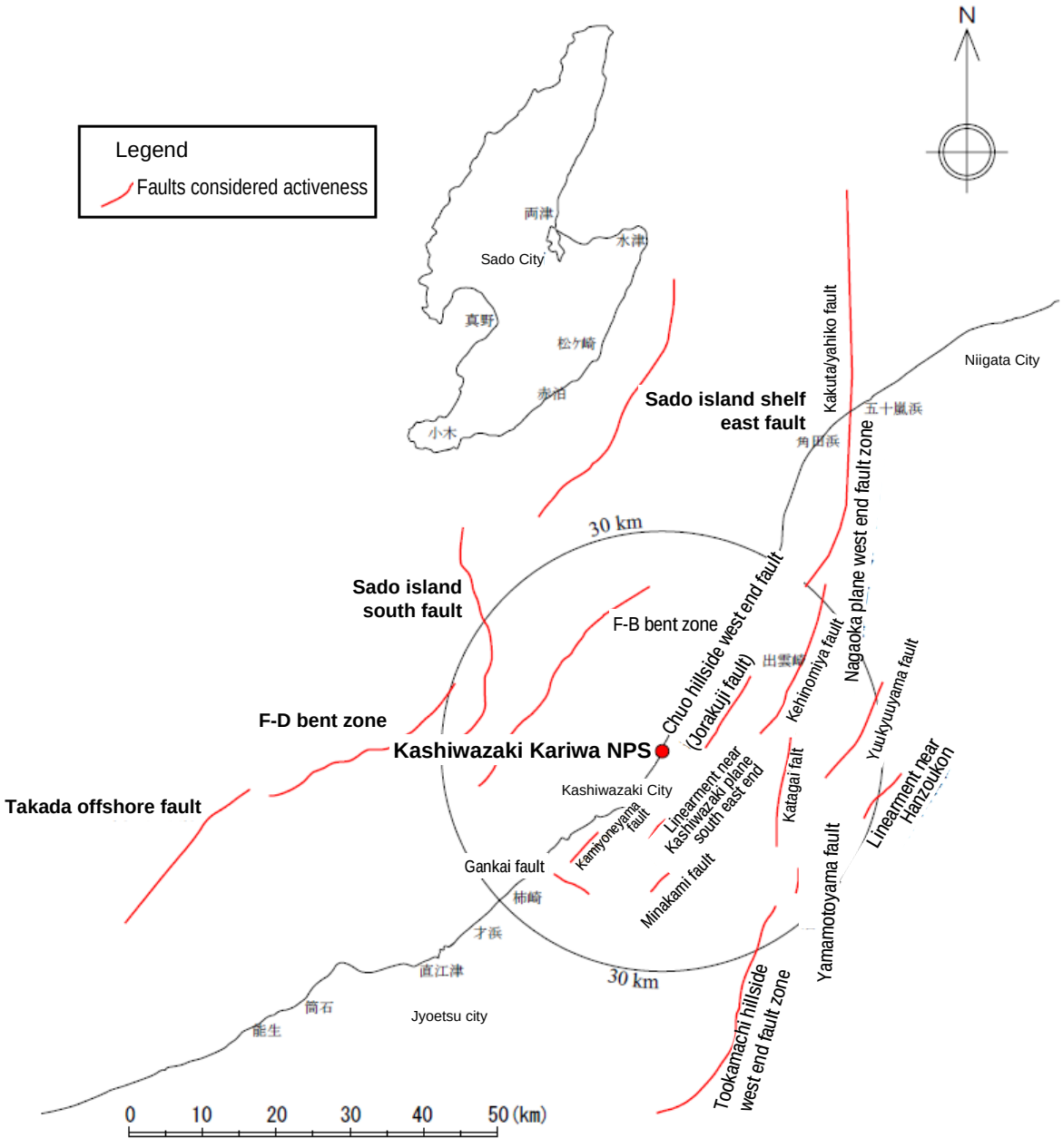
(1) Northern Wall Sketch of Final Face of L_2 Pit



(2) Location Chart of Final Face of L_2 Pit

Attachment Drawing 18－2 Result of Test Pit Survey of L_2 Fault

Reference2



Reference Drawing : Distribution Map of Fault which is considered for seismic design around Kashiwazaki-Kaiwa Nuclear Power Station