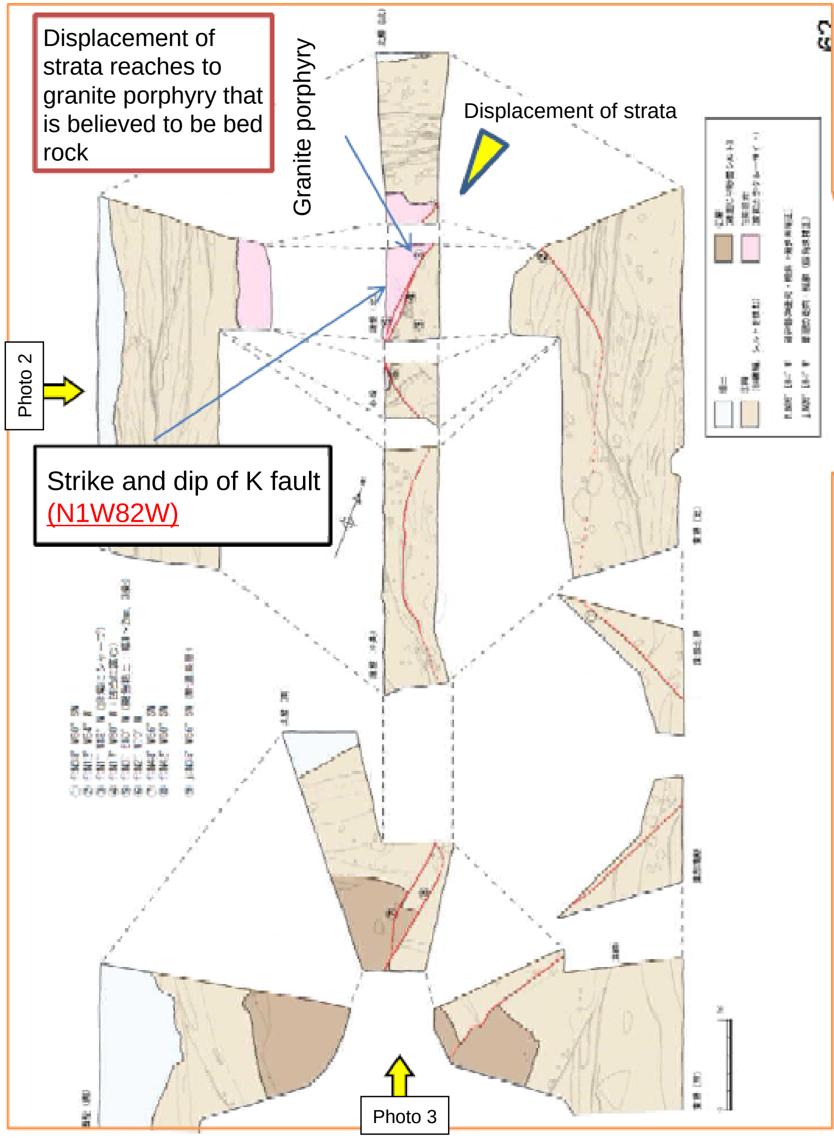
Development drawing (extended) of western pit (K fault)



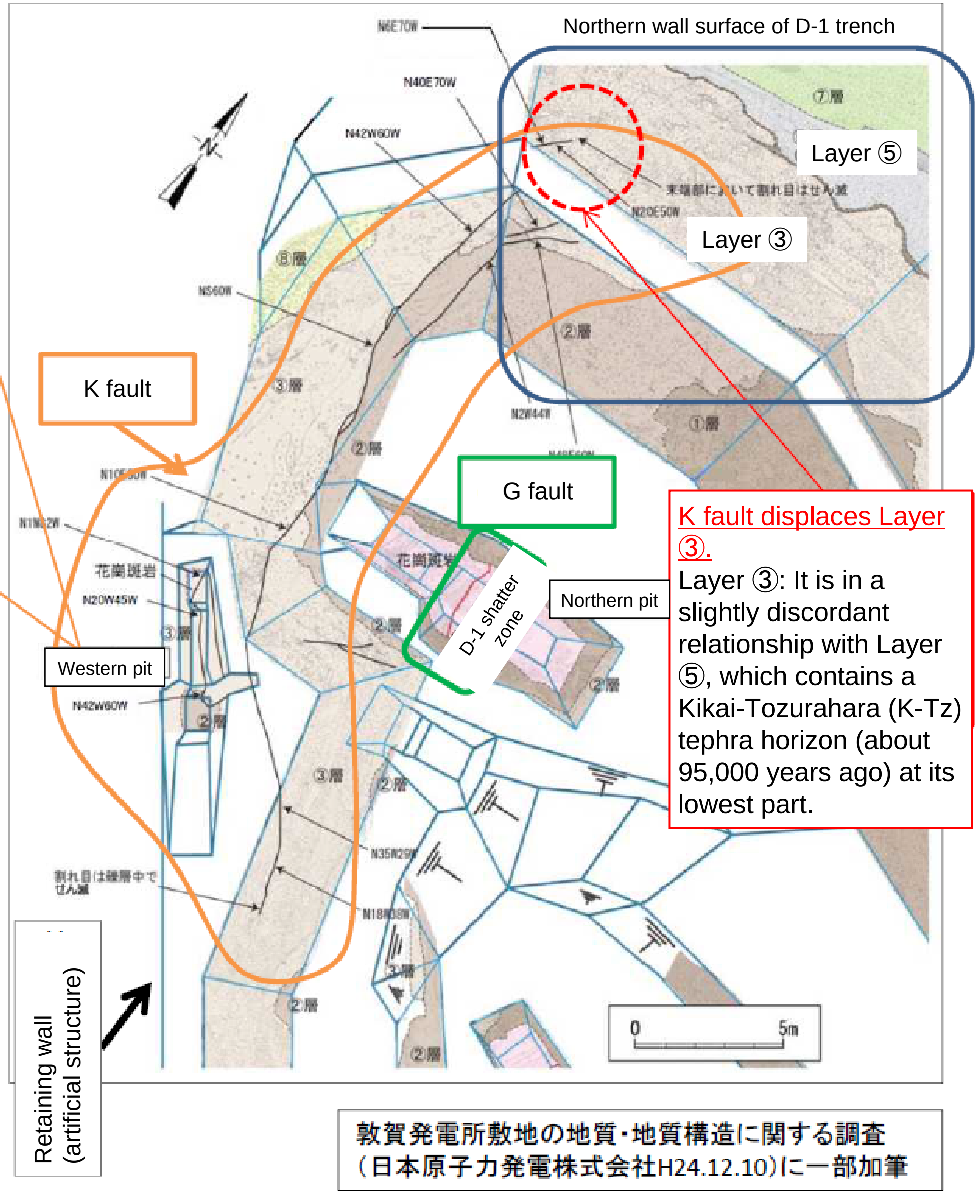


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Fig. 7: K fault near western pit of D-1 trench

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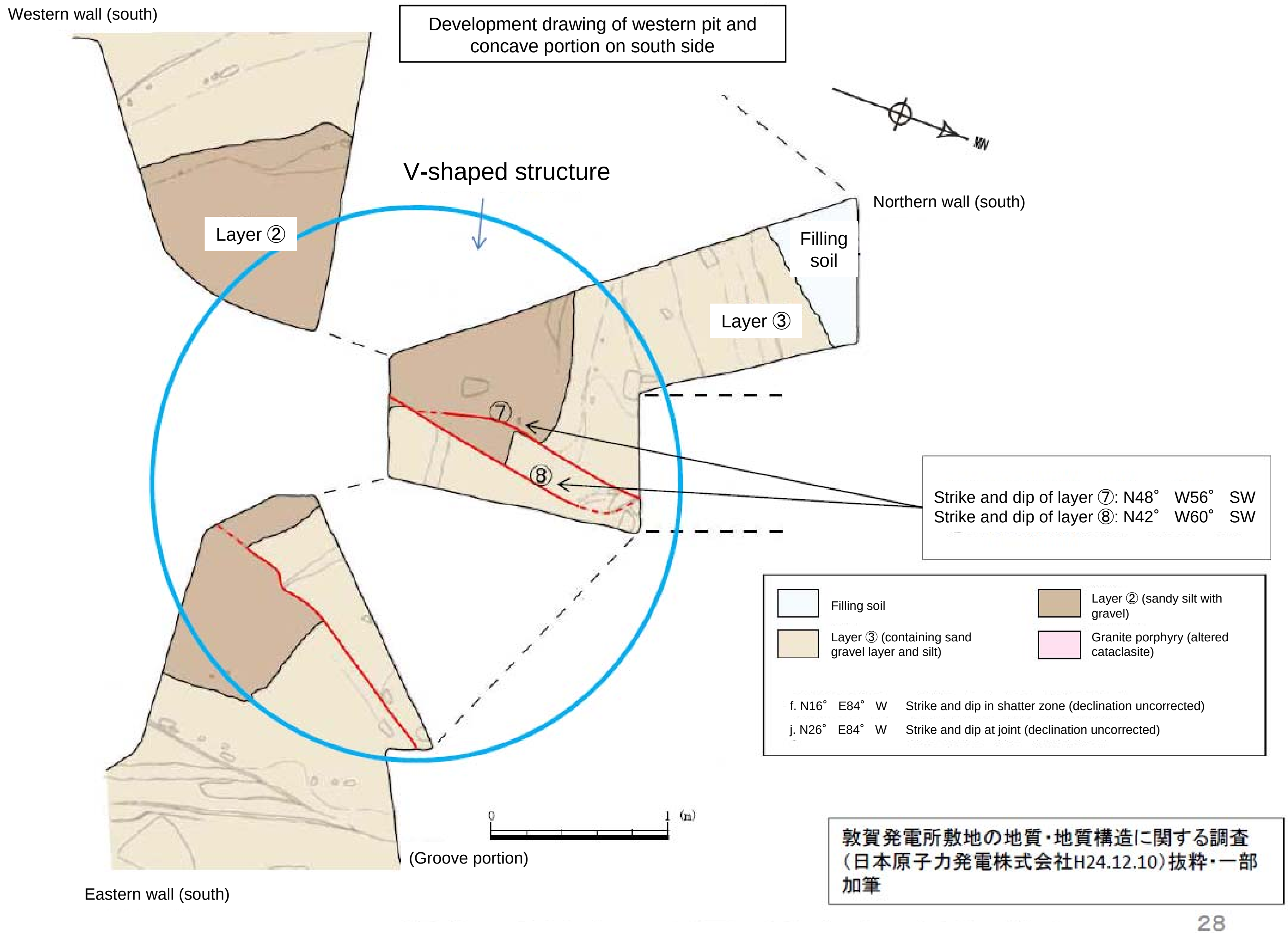

Fig. 9: V-shaped structure seen in K fault near western pit of D-1 trench

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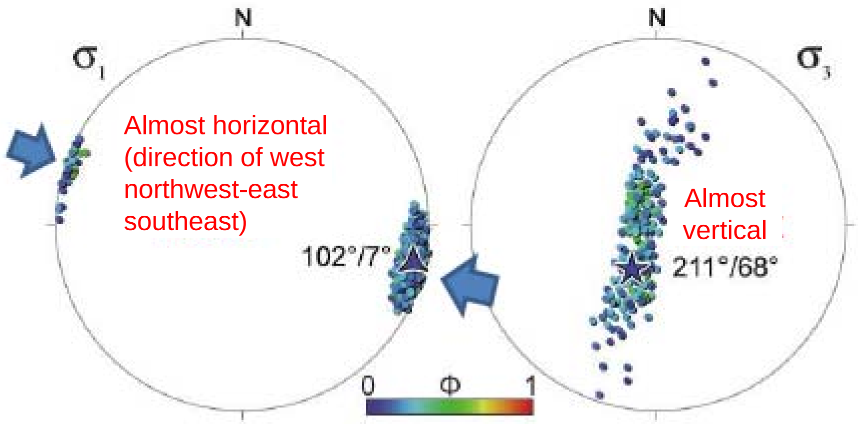
Regional stress fields of Chubu and Kinki regions based on stress inversion analysis

Regional stress fields are calculated for the maximum principal stress, $\sigma 1$ in an almost horizontal direction of west northwest-east southeast and for the minimum principal stress, $\sigma 3$ in an almost vertical direction.



Regional <u>stress fields (compressed stress fields in a direction of west northwest-east southeast)</u> of Chubu and Kinki regions in the <u>Late Quaternary</u>, based on the stress inversion analysis of the data about the active faults existing in Chubu and Kinki regions, <u>are shown</u>.
<u>Reverse fault displacement with strike slip, which is estimated from the structure of K fault, is in harmony with the style of displacement of K fault, if it moves in this stress field.</u>

Tsutsumi et al.
Fig. 4 of "Stability of the regional stress field in central Japan during the Late Quaternary inferred from the stress inversion of the active fault data" is partially retouched.

Source: GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L23303, doi: 10.1029/2012GL054094, 2012

Fig. 11: Regional stress fields in central Japan in the Late Quaternary

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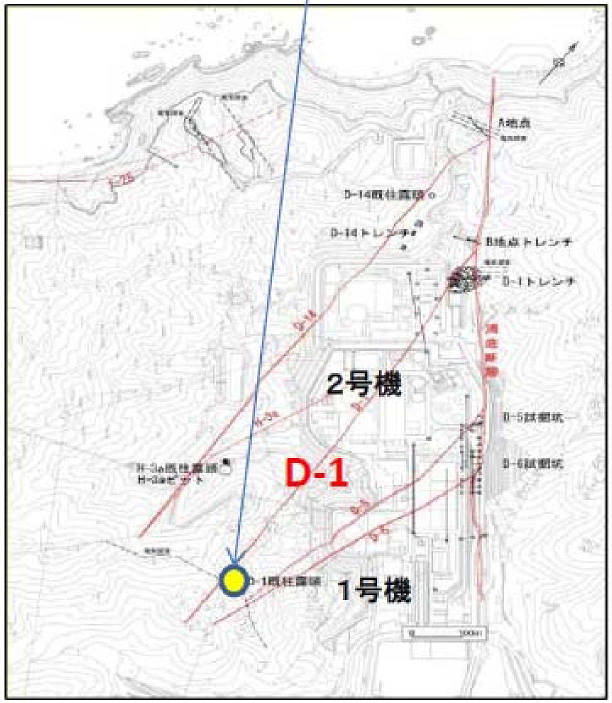
D-1 outcrop (observation of deformed structure)

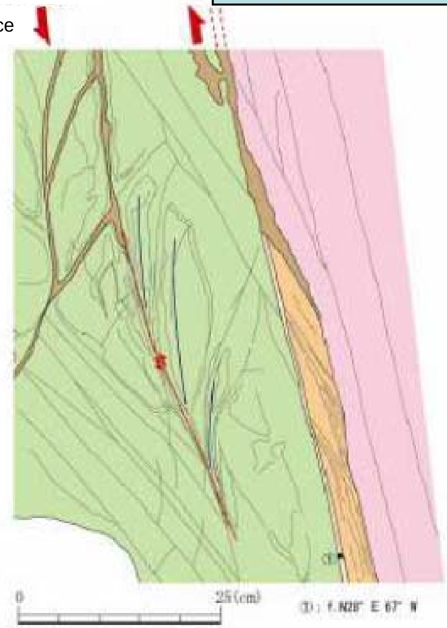
Location of D-1 preexisting outcrop



Result of observation of deformed structure 2

・In the sense of vertical displacement of cataclasite, reverse fault components with going up in the west and going down in the east are recognized.

Sketch of wall surface



(brown)	Clay (brown clay (inflow))	(green)	Fractured portion of sandy breccia (Sandy-brecciated cataclasite)
(light brown)	Fractured portion of clay (light brown gouge)	(pink)	Slightly deformed-nondeformed granite porphyry
(orange)	Fractured portion of sandy breccia (foliated cataclasite)	P Shear	R1 Shear
	f. N16° E84° W	Strike and dip in shatter zone (declination uncorrected)	

Sketch of outcrop

Photo of wall surface

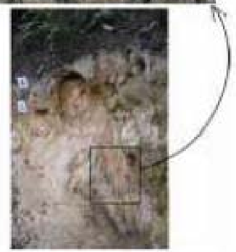


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Fig. 13: Field observation of D-1 outcrop

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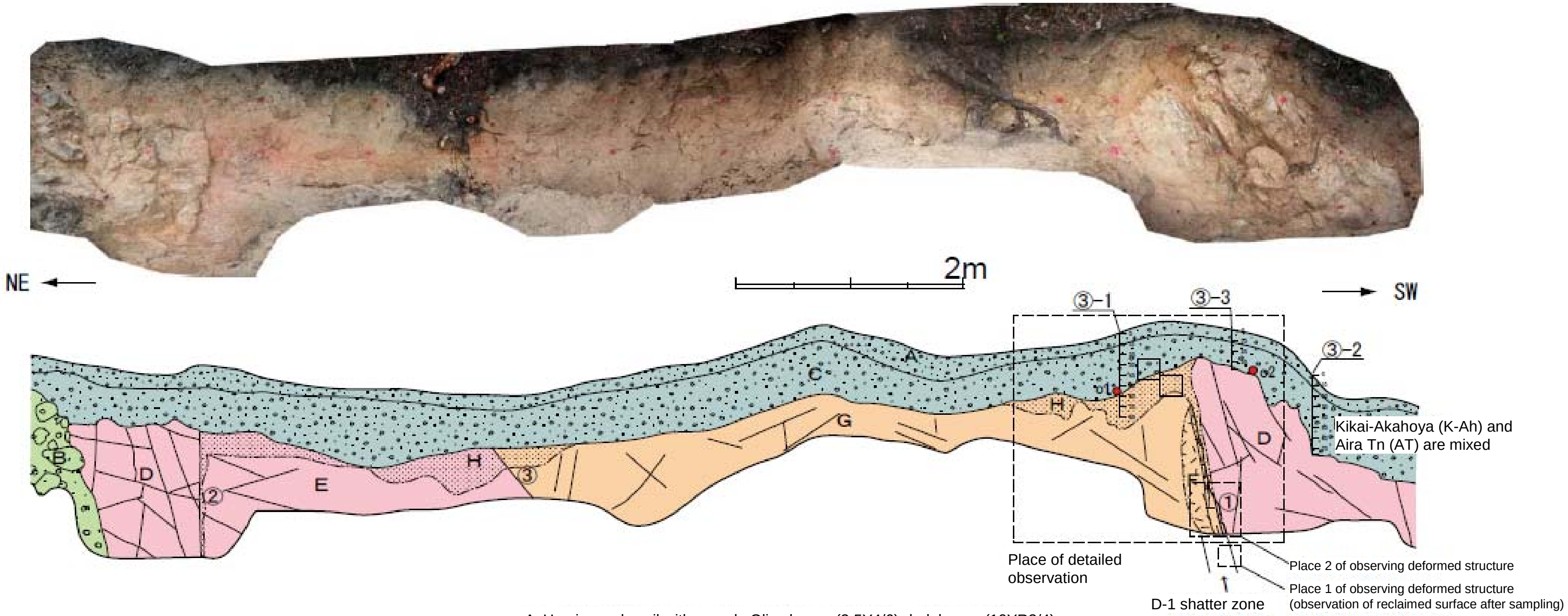
D-1 outcrop



A: Humic sandy soil with gravel. Olive brown (2.5Y4/6)-dark brown (10YR3/4)
B: Gravel (colluvial soil). Ratio of gravel 70%
C: Silty sand with gravel. Bright brownish yellow (10YR6/6)-darkish yellow orange (10YR6/4)
D: Granite porphyry
E: Slightly fractured portion of granite porphyry (subject to alteration)
F: Aplite cataclasite
G: Slightly fractured portion of aplite (subject to alteration)
H: Unclear portion of texture due to strong weathering
① f: N16° E73° W Fault gouge (light brown clay: 2-5 mm wide)
② f: N38° E85° W
③ f: N22° E36° W Boundary between granite porphyry and aplite

Legend
- Talus deposit
- Older fun deposit 2
- Granite porphyry
- Aplite
- Cataclasite
- Unclear portion of structure due to strong weathering
- Sampling place for CT scan
- Place for continual sampling of volcanic ash
- Sampling place for Optically Stimulated Luminescence (OSL) chronology

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- The shatter zone has not displaced or deformed any strata, which was deposited after Kikai-Akahoya (K-Ah) (some 7,300 years ago).

Fig. 6: Result of observation of D-1 outcrop
(result of measuring the age of tephra deposits, sketches, etc.)

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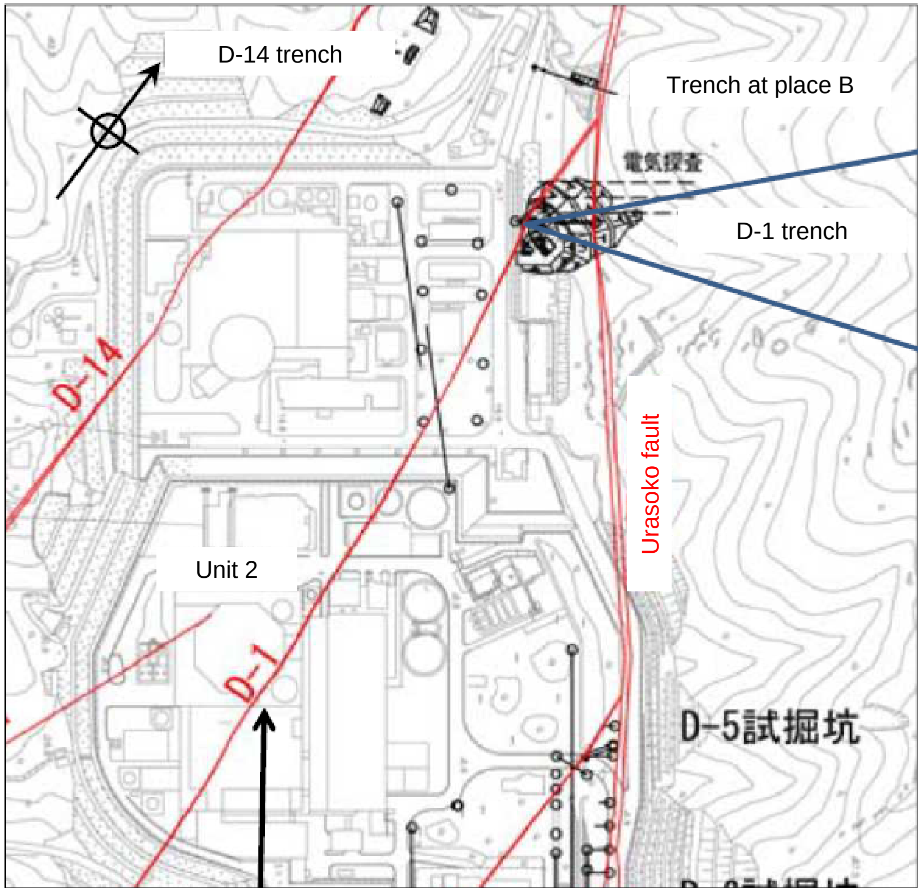
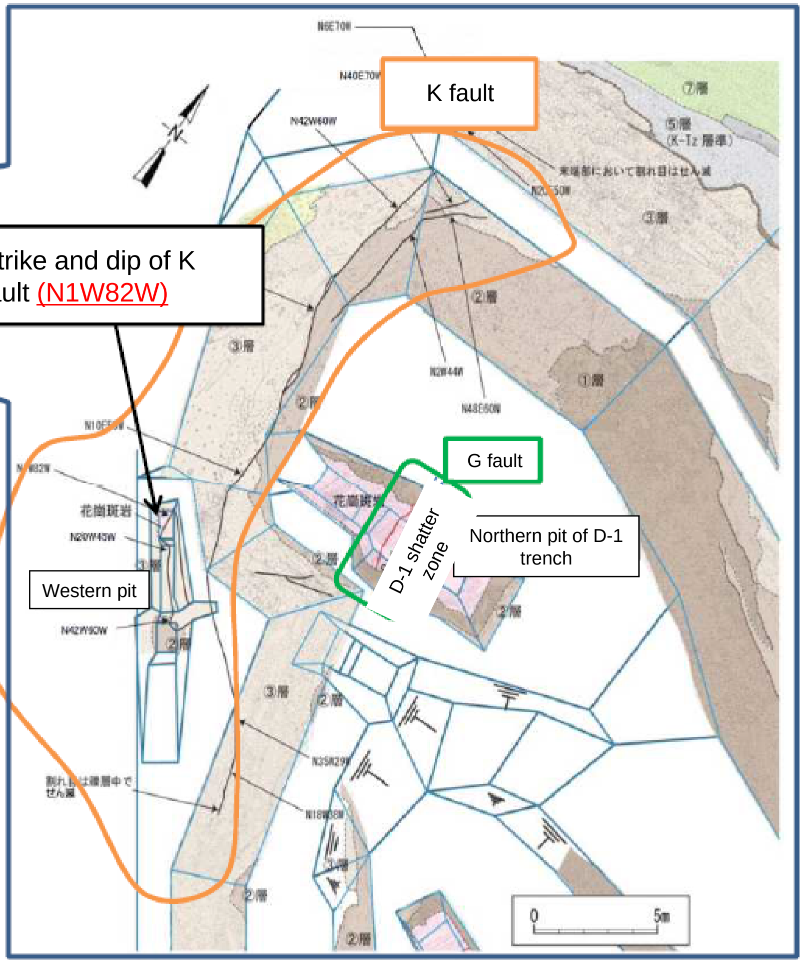


Fault identified as D-1 shatter zone by JAPC (it is called as “H-6a shatter zone” in the application for installation of its Tsuruga Power Station Unit 2 Reactor with strike and dip of N6E78W)

(Urasoko fault, D-14, D-1, D-5, D-6, H-3a and T.P.-15 m slice)

0 100m



Development drawing of D-1 trench

敦賀発電所敷地の地質・地質構造に関する調査
（日本原子力発電株式会社H24.12.10）
に引用・加筆

Fig. 8: Relations between K fault and G fault

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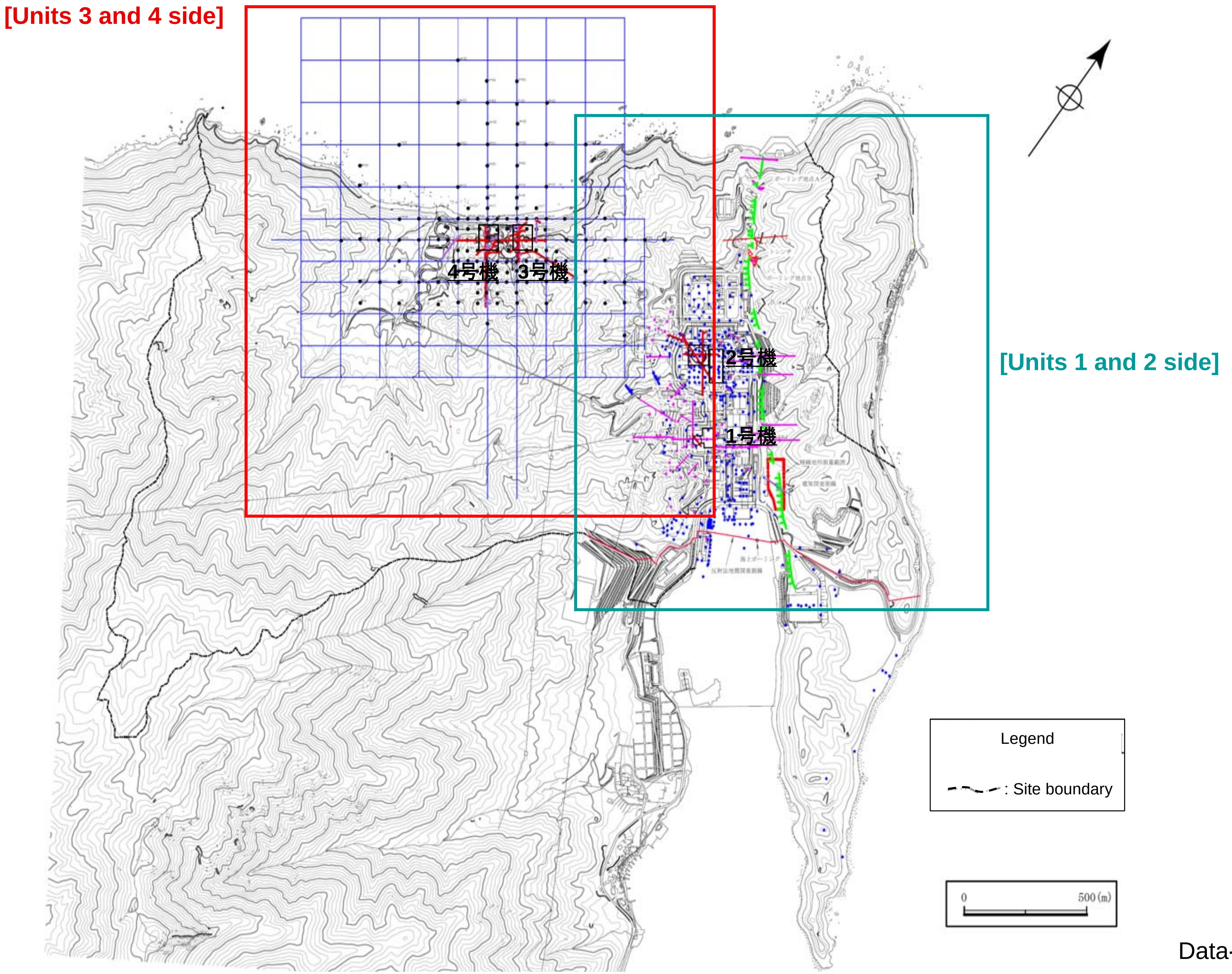
Comparison of “Draft of evaluation meeting report of Tsuruga Experts Meeting” and “JAPC’s opinion”

Item		Draft of evaluation meeting report of Tsuruga Experts Meeting	JAPC’s opinions
Continuity	G fault and D-1 shatter zone	As the grounds used by the operator to define G fault as D-1 shatter zone are unclear, the activity of G fault cannot be used to evaluate the activity of D-1 shatter zone. Grounds: ・The relation between G fault and D-1 shatter zone are unclear.	G fault is D-1 shatter zone. Grounds: ・G fault has same strike and dip as D-1 shatter zone (N-S strikes, high-angle westerly dips) ・It has been confirmed at four points on the north side and south side of the reactor building that the vertical and horizontal displacement senses of the last slips consistently agree with the normal fault and right-lateral slip sense. ＊To increase the density of survey data based on the matters pointed out at the second evaluation meeting, a survey is being conducted by adding survey points.
	K fault and D-1 shatter zone	K fault would be D-1 shatter zone or a part of extension thereof. Grounds: ・K fault is located close to the fault defined as D-1 shatter zone. ・The strike and dip of K fault are similar to those of D-1 shatter zone. Matters pointed out by the second evaluation meeting It was pointed out that “if data that show significant changes in the strike of K fault are obtained in the future, it is necessary to review anew the relations between K fault and D-1 shatter zone.”	K fault is not D-1 shatter zone (including G fault). Grounds: ・K fault extends into the rock mass, the direction of its strikes changes from N-S to NNW-SSW. ・From the observation on thin section, It has been confirmed that K fault and D-1 shatter zone has different displacement senses of the last slips. (K-fault: reverse fault with strike slip, D-1 shatter zone (including G fault): normal fault and right-lateral slip) ・K fault with reverse fault sense dose not extend to southern direction at least beyond B14-2 boring. ＊Genesis of K-fault is under investigation ＊To grasp the shape and strike of K fault in detail based on the matters pointed out at the second evaluation meeting, a survey is being conducted by adding survey points around D-1 trench.
Activity	G fault	Activity before about 95,000 years ago Grounds: ・G fault has not displaced or deformed layer ①. ・Layer① is older than layer⑤, which is evaluated about 95,000 years old by the first evaluating meeting.	No Activity in and after the Late Pleistocene (covered by layer ①) Grounds: ・G fault has not displaced or deformed layer ①. ・Layer① is older than about 120,000 years ago because it is located lower than layer ⑤ (A tephra, which deposited before about 120,000 years ago, has been found in the bottom of layer ⑤)
	K fault	Activity in and after the Late Pleistocene cannot be denied. Grounds: ・Gravel of layer③ is relatively as flesh as that of layer⑤, which is evaluated about 95,000 years old by the first evaluating meeting.	No Activity in and after the Late Pleistocene (covered by layer ⑤) Grounds: ・K fault has not displaced or deformed layer ①. ・Layer ③ is older than about 120,000 years ago because it is located lower than layer ⑤ (A tephra, which deposited before about 120,000 years ago, has been found in the bottom of layer ⑤)

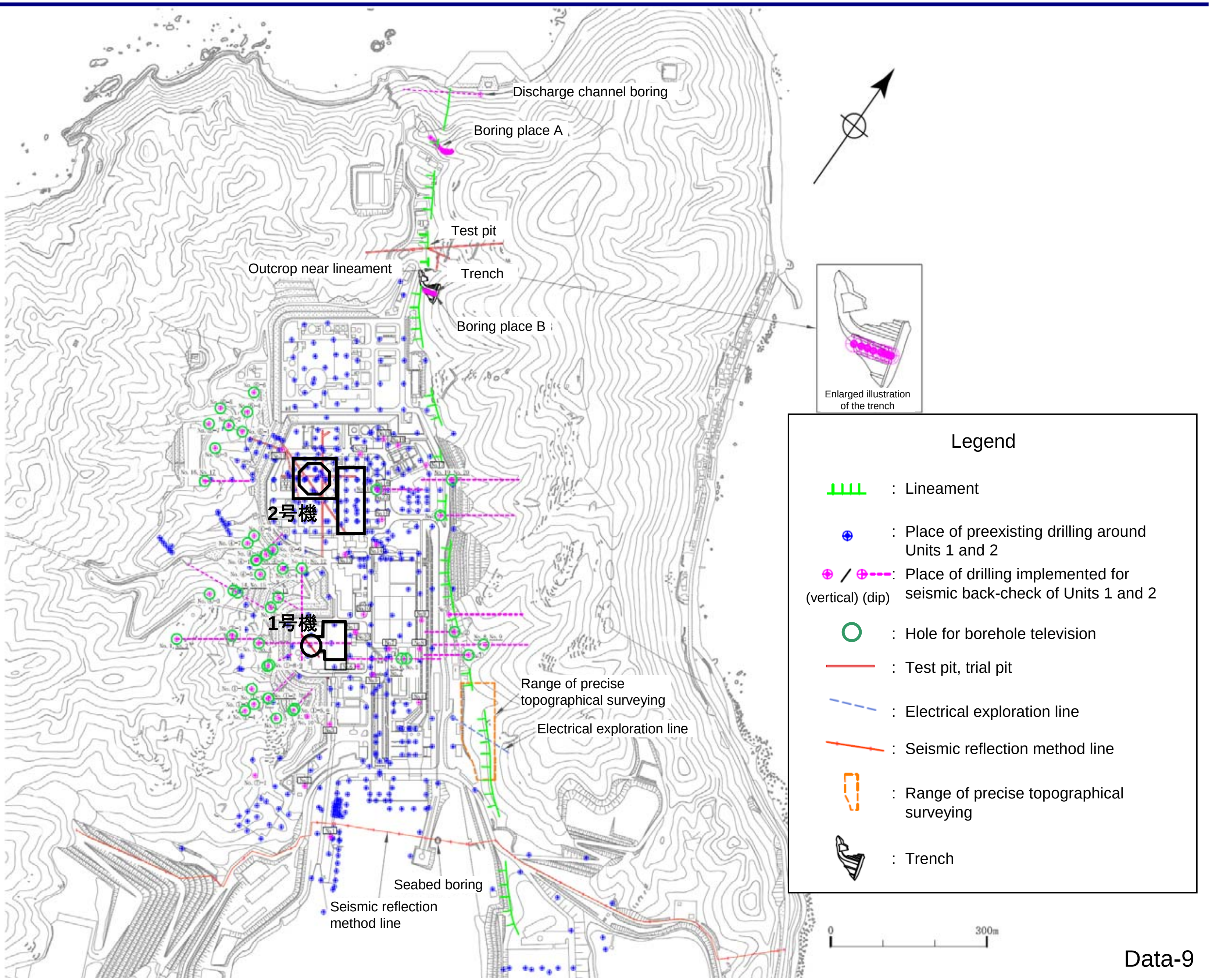
↓

comprehensive evaluation	D-1 shatter zone is likely to be an active fault that should be taken into consideration from the viewpoint of earthquake-resistant design as a conservative judgment.	D-1 shatter zone and K-fault are not active faults that should be taken into consideration for the seismic design.

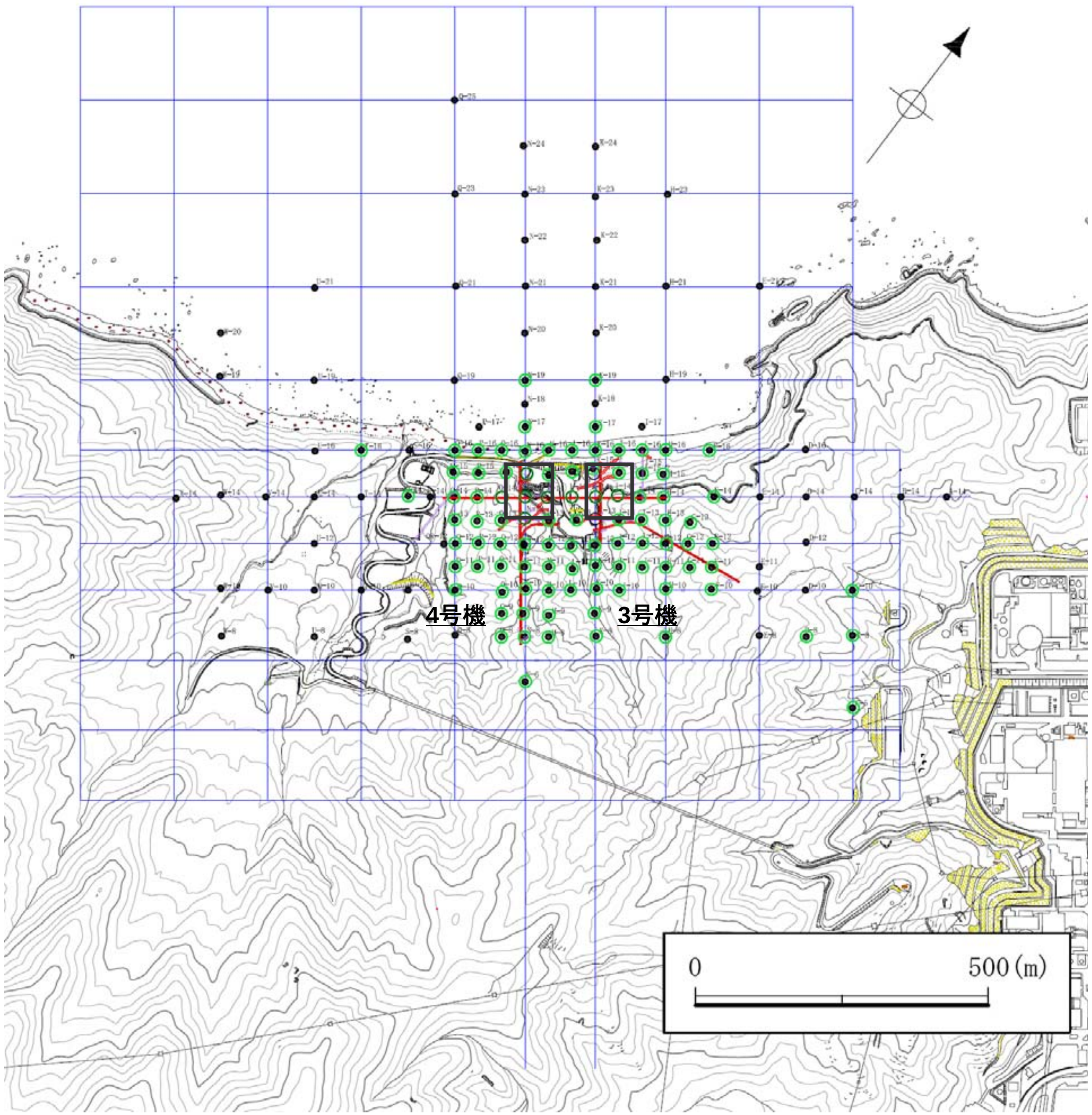
Location map of preexisting survey on the site



Survey on the site (preexisting survey on Units 1 and 2 side)



Survey on the site (preexisting survey on Units 3 and 4 side)



Legend

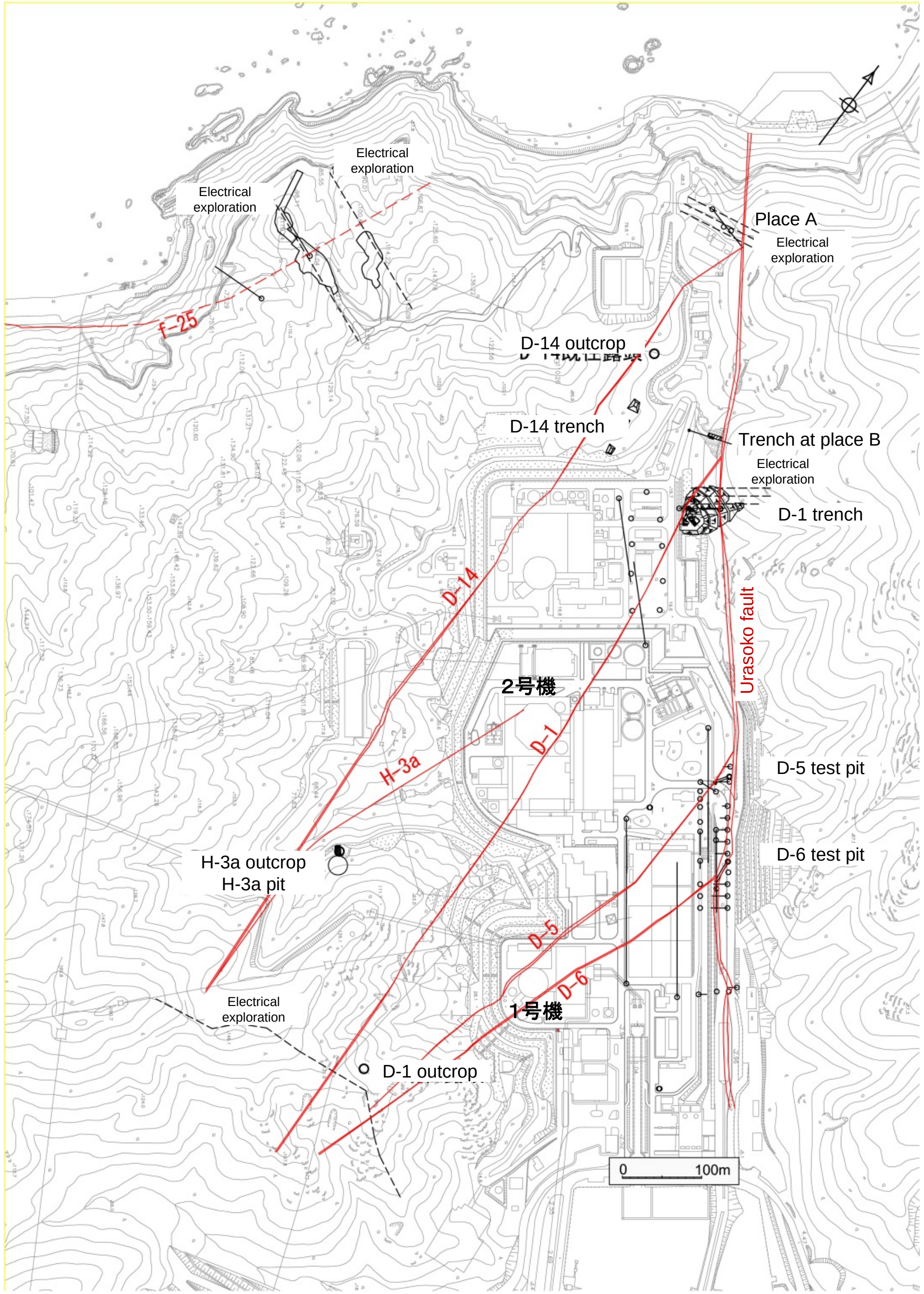
- ● : Place of drilling
- ○ : Place of reactor core drilling
- ◎ : Place of seabed drilling
- ○ : Hole for borehole television
- : Place of elastic waves survey line
- : Location of reactor building
- : Test pit, trial pit
- : Supplemental test pit
- : Trench

Response to comments expressed by the former Nuclear and Industrial Safety Agency during field survey on April 24, 2012

・Evaluation of activities of the shatter zone after the Late Pleistocene should be based on the evaluation by the overlying strata analysis method.
・If evaluation based on the overlying strata analysis method is difficult, evaluation should be carried out in a comprehensive manner, based on the results of various geological analysis and numerical analysis.

	Item			Item of additional survey
1	Reconfirmation whether tectonic landform exists or not			・Reconfirmation whether tectonic landform exists or not by checking again the aerial photography taken before artificial changes were made ・Production of Digital Elevation Model (DEM) based on the aerial photography taken before artificial changes were made ・Production of Digital Elevation Model (DEM) based on airborne laser survey ・Study of whether tectonic landform exists or not by using the above Digital Elevation Model (DEM)
2	Enhanced reliability of evaluation by adoption of overlying strata analysis method	Outcrop		・Evaluation of the ages of the Quaternary deposits overlying the shatter zone by higher density tephra analysis D-14 (outcrop), H-3a (outcrop), H-3a (pit), D-1 (outcrop): Existing 10 cm pitch for analysis is changed to 2 cm pitch * Additionally implemented, as required
				・Clarification of the boundary between the rock mass and the Quaternary deposits through observation of thin section and CT scan. D-14 (outcrop), H-3a (outcrop), H-3a (pit), D-1 (outcrop)
				・Evaluation of the ages of the Quaternary deposits overlying the shatter zone by Optically Stimulated Luminescence (OSL) D-14 (outcrop), H-3a (outcrop), D-1 (outcrop): Field work ended and analyzing work is currently underway.
3		Near Urasoko fault	In north	・Pit survey and trench survey near Urasoko fault D-14 (trench): Excavation ended in the south. Excavation still continues in the north and the midland. Tephra analysis and CT scan start in the south and the north. D-1 (trench): Excavation ended. Tephra analysis and CT scan are underway.
			In south	・Survey through a deep test pit near Urasoko fault Tunneling is still underway.
4	Analysis of the times when the shatter zone was active with looking at the materials in the fault			・Evaluation of the times when the shatter zone was active with putting focus on the materials such as Electron Spin Resonance (ESR) constituting the shatter zone Observation of Electron Spin Resonance (ESR) and the surface structure of quartz particle D-14 (outcrop), H-3a (outcrop), D-1 (outcrop): Field work ended and analysis is now underway. D-14 (trench), D-1 (trench): Based on the result of tephra analysis, to be implemented as required.
5	Enhancement of reliability in evaluation of displacement sense across shatter zones			・Measurement of the direction of slickenline ・Additional observation of strips and slices Currently underway in all places

Map of additional survey locations (since June 2012*)



Locations of shatter zones near Units 1 and 2

T. P.-15 m slice

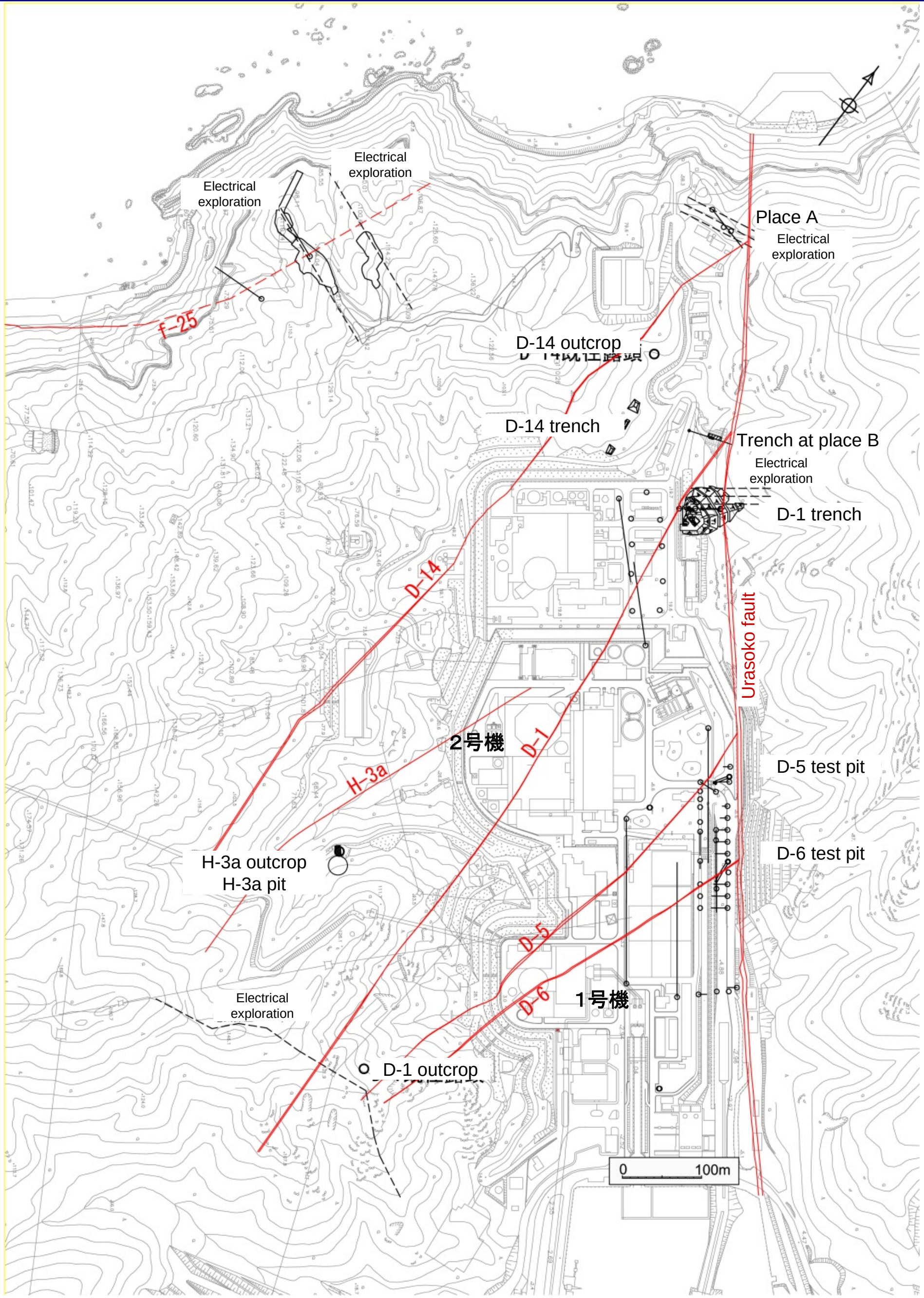
Legend

- ○/-○ (vertical) (dip) Drilling point
- - - - - Electrical exploration line
- ——— shatter zones to be surveyed

Units 1 and 2 side (Urasoko fault, D-14, D-1, D-5, D-6 and H-3a)
T.P.-15 m slice
Units 3 and 4 side (f-25)
T.P.-9 m slice

* Survey work has been conducted after obtaining a survey plan approval from the former Nuclear and Industrial Safety Agency at the occasion of the hearing about the earthquake and tsunami on May 14, 2012.

Map of additional survey locations (since June 2012*)



Locations of shatter zones near Units 1 and 2

T. P.-70 m slice

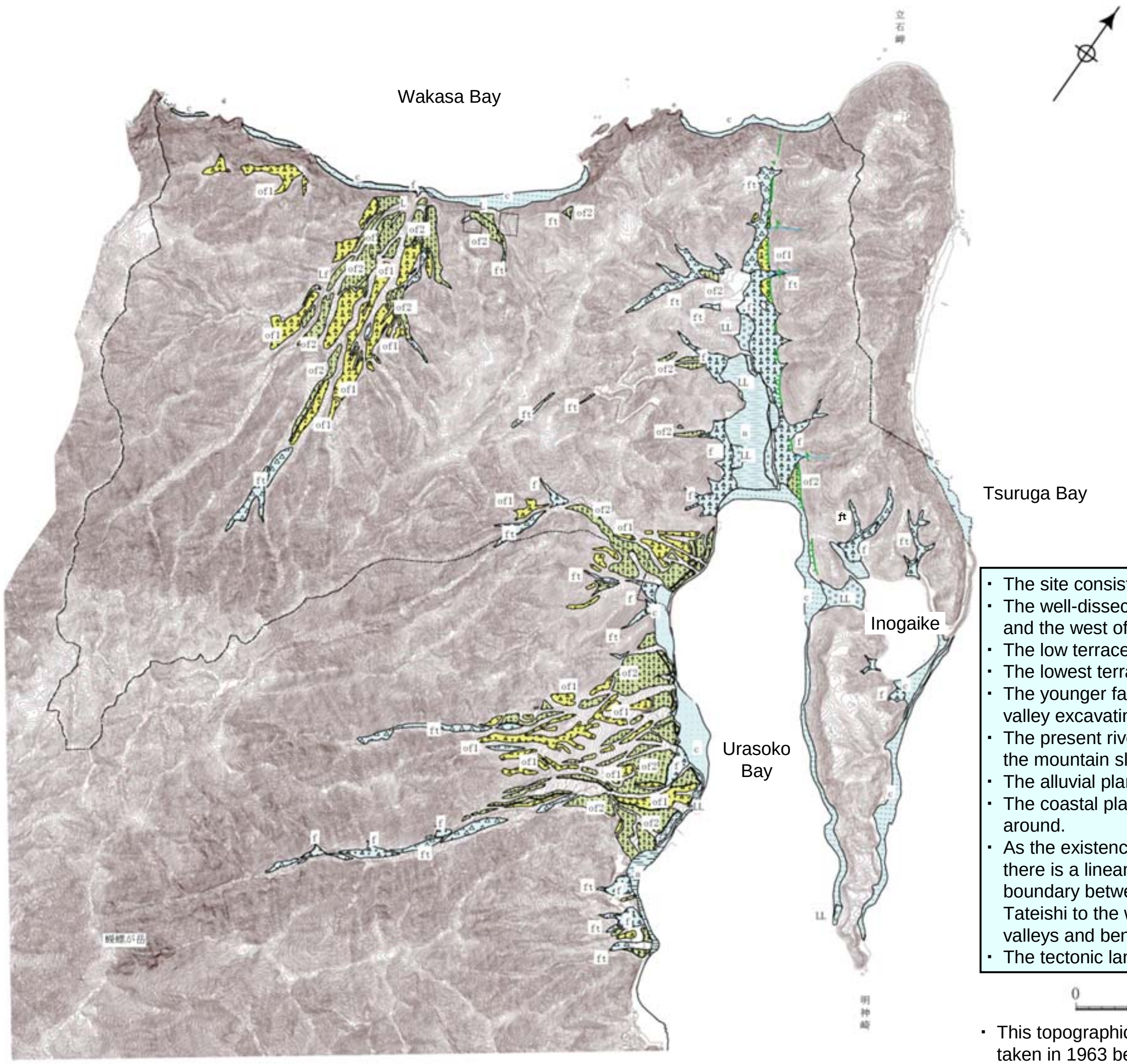
Legend

(vertical) (dip)	Drilling point
- - - -	Electrical exploration line
(red line)	shatter zones to be surveyed

Units 1 and 2 side (Urasoko fault, D-14, D-1, D-5, D-6 and H-3a)
T.P.-70 m slice
Units 3 and 4 side (f-25)
T.P.-9 m slice

* Survey work has been conducted after obtaining a survey plan approval from the former Nuclear and Industrial Safety Agency at the occasion of the hearing about the earthquake and tsunami on May 14, 2012.

Geography of the site (Classification drawing of geographical surface)



Legend

- Coastal plain surface (c)
- Alluvial plain surface (a)
- Present river bed and Talus (ft)
- Younger fan surface (f)
- Lowest terrace surface (LL)
- Low terrace surface (L)
- Older fan surface 2 (of2)
- Older fan surface 1 (of1)
- Lineament
  Short lines indicate geologically low side and arrows indicate directions of curvature in ridges and valleys.
- Bending of river valleys
- : Site boundary

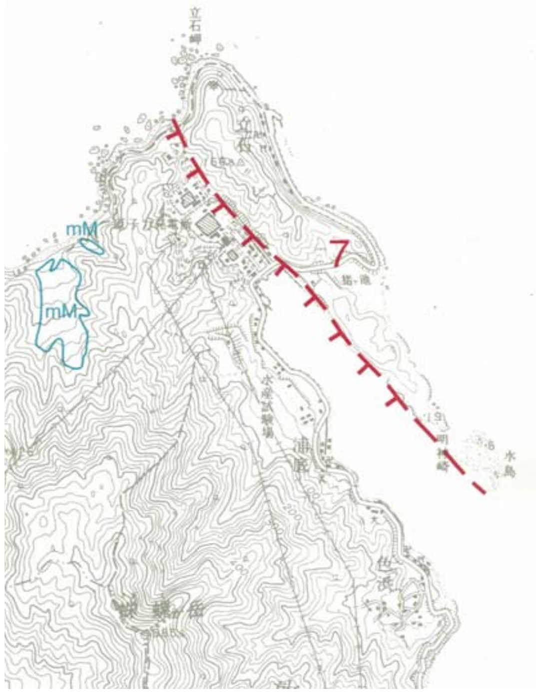
- The site consists mainly of a mountainous area.
- The well-dissected older fan surfaces are found mainly along the Wakasa Bay and the west of Urasoko Bay.
- The low terrace surfaces are found in a very small scale along the Wakasa Bay.
- The lowest terrace surfaces are found in the east coast of Urasoko Bay.
- The younger fan surfaces are found in a small scale in the downstream of a valley excavating mountains.
- The present river bed and talus are found in valleys excavating mountains and the mountain slopes.
- The alluvial plane surfaces extends around the lowland around Urasoko Bay.
- The coastal plane surfaces consisting of beaches and beach ridges extends around.
- As the existence of Urasoko fault is indicated by the documents, it is learned that there is a lineament in a direction of northwest-southeast, which runs through a boundary between the mountains and the lowlands that extend from Cape Tateishi to the west of Inogaike, consisting of steep cliffs, saddles, straight valleys and bending of river valleys.
- The tectonic landform corresponding to shatter zones are not recognized.

0 0.5 1 (km)

- This topographical map was produced, based on the one-20,000th aerial photos taken in 1963 before the topographic change took place, due to construction of the power station, as well as airborne laser survey.
- Airborne laser survey: measurement density of two points/m^2 (without duplication), measurement density of six points/m^2 (with duplication).

Bibliography of active faults near the site

"New Edition: Active Faults in Japan (1991)" by Active Fault Research Group	"Active Faults in Kinki (2000)" by Okada & Togo	"Detailed Digital Maps of Active Faults (2002)" by Nakada & Imaizumi



Fault name	Length	Certainty	Direction of displacement
61 Urasoko	3 km	Ⅰ	Elevation in northeast

Degree of certainty I: Those that are surely active faults
Degree of certainty II: Those that are estimated to be active faults
Degree of certainty III: Those that are suspected to be active faults

Fault name	Length	Certainty	Direction of displacement
7 Urasoko	3.5 km	Ⅱ	Elevation in northeast

Degree of certainty I: Those that are surely active faults
Degree of certainty II: Those that are estimated to be active faults

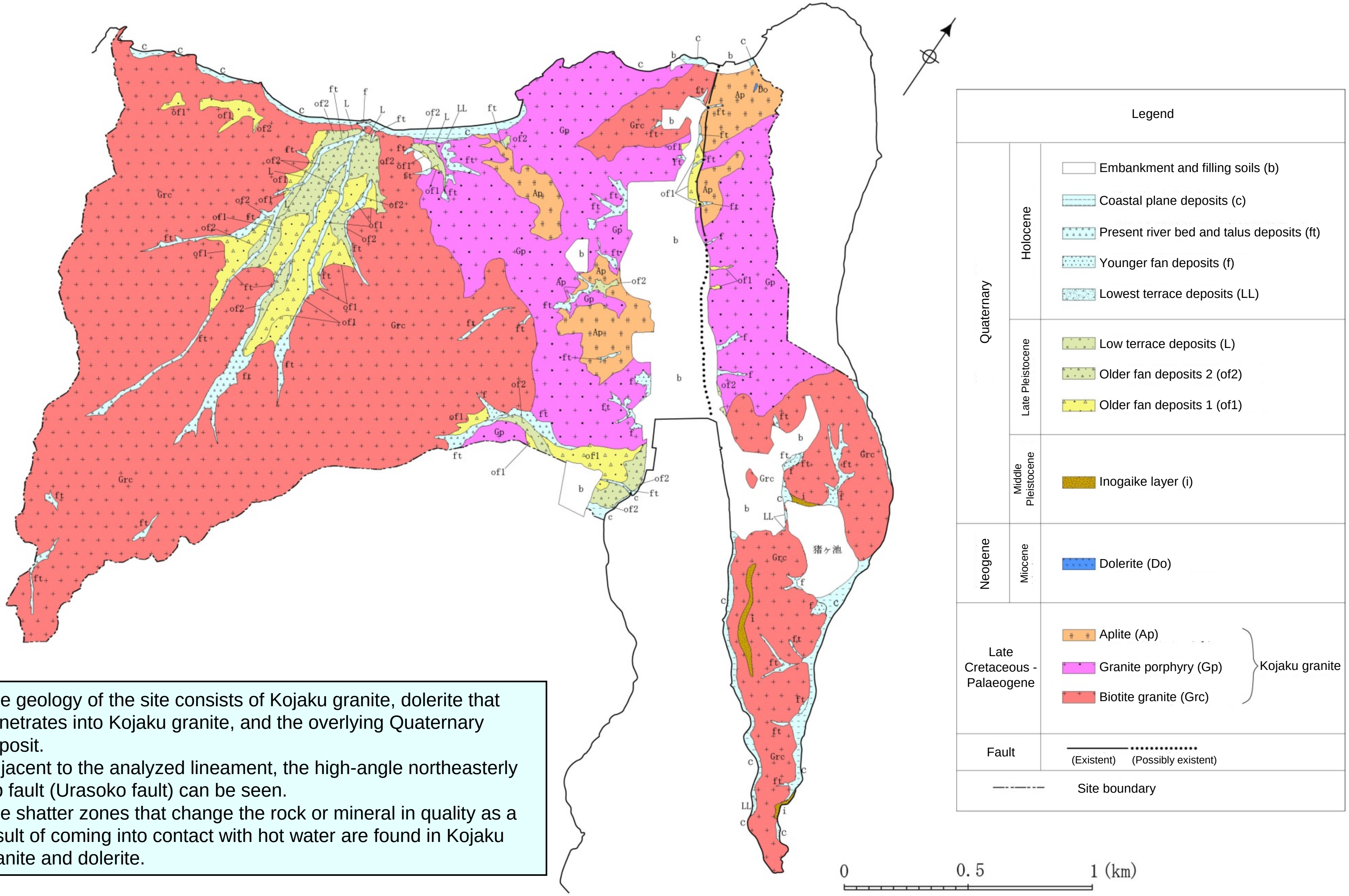
Fault name	Length	Classification	Direction of displacement
① No name	About 3 km (Map reading)	Possible active fault	Elevation in northeast

Active fault: A fault with the signature of repeated movements in the past shown in geography and is expected to repeatedly move in the future

Possible active fault: Though it is possible to exist, based on geographical features, it cannot clearly be identified at present.

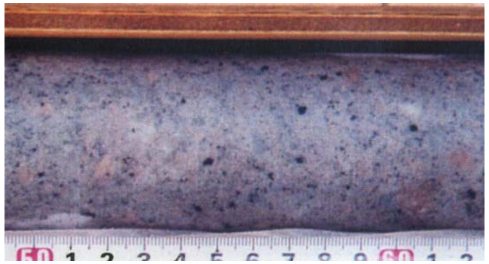
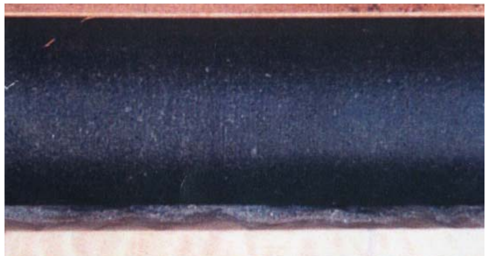
- Existence of Urasoko fault in and around the site is pointed out.
- Tectonic landform other than Urasoko fault (corresponding to the shatter zone) is not pointed out.

Geology of the site



- The geology of the site consists of Kojaku granite, dolerite that penetrates into Kojaku granite, and the overlying Quaternary deposit.
- Adjacent to the analyzed lineament, the high-angle northeasterly dip fault (Urasoko fault) can be seen.
- The shatter zones that change the rock or mineral in quality as a result of coming into contact with hot water are found in Kojaku granite and dolerite.

Types of rocks that are identified

Name of rock type Geology code		Photo (drilling core)	Characteristics
Kojaku granite	Biotite granite Gr		･Holocrystalline-equiangular texture. ･Grain size of minerals is about 5mm. ･Minerals are mainly composed of K-feldspar, plagioclase, quartz and biotite. ･Biotite granite is judged to be formed in the times between the late Crataceous and the Paleogene, since the values stand at around 66.6 Ma measured by K-Ar dating.
	Granite porphyry Gp		･Holocrystalline-porphyritic texture. ･Grain size of phenocryst ranges 2-10 mm. ･Grain size of groundmass is 1 mm or smaller. ･Minerals are mainly composed of K-feldspar, plagioclase, quartz and biotite. ･Granite porphyry is judged to be formed in the times between the the late Cretaceous and the Paleogene, since the values stand at around 66.3 Ma measured by K-Ar dating.
	Aplite Ap		･Holocrystalline-epuiangular texture. ･It contains a small amount of of phenocryst and partly has porphyritic texture. ･Groundmass in porphyritic texture is microcrystalline. ･Minerals are mainly composed of quartz, plagioclase and a very small amount of biotite. ･Aplite is judged to be formed in the times between the the late Cretaceous and the Paleogene, since the values stand at around 64.2 Ma measured by K-Ar dating.
Dolerite Do			･Intersertal texture. ･Grain size is 2 mm or smaller. ･Minerals are mainly composed of K-feldspar, pyroxene and a very small amount of opaque minerals. ･Dolerite is judged to be formed during the Neogene (Miocene), since the values stand at around 21.1 Ma measured by K-Ar dating.

Characteristics of fault gouge (X-ray diffraction analysis)

Units 1 and 2 side (fault gouge)

Category	shatter zone to be surveyed	Sampling place	Chlorite	Muscovites	Kaolinite	Minerals in muscovites/smectite mixed-layer	Smectite	Laumontite	Quartz	Plagioclase	Potassium	Calcite	Pyrite	Siderite
In Kojaku granite	[illegible]	No. ① hole			·*		○		◎	△	△			
	[illegible]	No. ② hole		·	·		·		◎	◎	◎			
	[illegible]	No. ③ hole		·*	·		·		◎	◎	○			
	[illegible]	No. ②-1 hole		·*	·		·		◎	△	◎			
	[illegible]	No. ③-1 hole		·	·		·*		◎	△	△			
	[illegible]	No. 3 hole					△		◎	·	△			
	[illegible]	①-10 hole			△		·		◎	·	△			
	[illegible]	No. ①-9 hole		·	·		△		◎	△	◎			
	[illegible]	No. ①-4 hole		·	·		·		◎	△	△			
	[illegible]	No. 4 hole		·	·		·		◎	◎	◎			
	[illegible]	No. 17 hole		·	·		△		◎	·	△			
	[illegible]	No. 17 hole		·	·		△		◎		·			
	[illegible]	No. 16 hole			·*		△		◎	·	△			
	[illegible]	No. 17 hole			·*		·*		◎	○	○			
		D-14 preexisting outcrop			△	·	△		◎	·	○			
	[illegible]	No. 17 hole		·	·		△		◎	◎	◎			
	[illegible]	No. 17 hole		·	·		·		◎	○	△			
	[illegible]	No. 17 hole		·	·				◎	◎	◎			
	[illegible]	No. 17 hole		·	·				◎	◎	○			
	[illegible]	No. ①-4 hole		·	·		·		◎	△	◎			
	[illegible]	No. ④-5 hole			△				◎		△			
	[illegible]	No. ④-5 hole			△		·		◎		○			
	[illegible]	No. ⑥-1 hole			·				◎	·	△			
	[illegible]	No. ⑥-2 hole		·	·*		·		◎	○	○			
	[illegible]	No. 7 hole			·		·		◎	△	△			
	[illegible]	No. 8 hole					·		◎	○	○			
	[illegible]	No. 8 hole		·	△		△		◎	◎	△			
	[illegible]	No. 19 hole			·		·		◎	△	○			
	[illegible]	No. ④-7 hole			·				◎		△			
	[illegible]	No. ④ hole			·		·		◎	◎	◎			
	[illegible]	No. ④ hole			·		·		◎	○	○			
	[illegible]	H-3a preexisting outcrop		·	·		○		◎	·	○			

* It can be identified only during water elutriation.

Units 3 and 4 side (fault gouge)

Category	shatter zone to be studied	Sampling place	Chlorite	Muscovites	Kaolinite	Smectite	Laumontite	Quartz	Plagioclase	Potassium	Calcite	Pyrite	Siderite
In Kojaku granite	[illegible]	F-10 hole	·	·	·	○		◎	△	◎	○		
	[illegible]	H-10 hole			·	△		◎	○	◎			
	[illegible]	Test pit B2			·	△		◎	·	○			
	[illegible]	H-11 hole		△	·	·		◎	·	○	·		
	[illegible]	Test pit B1			·	◎		◎		○			
	[illegible]	Test pit B1		·	·	○		◎	△	○			
	[illegible]	O-9 hole		·	·			◎	○	◎			
	[illegible]	Test pit C2		·	△	△		△	◎				
	[illegible]	Test pit B1		·	·	△		◎	△	○			
	[illegible]	Test pit C2		·	△	○		△	△	△			
	[illegible]	Test pit B1			·	△		◎	○	△			
	[illegible]	Test pit A1			·	◎		◎	△	△			
	[illegible]	Supplemental test pit A4		·	△	△		◎	◎	△			
	[illegible]	Test pit C1		·	·	△		◎	○	○			
	[illegible]	Test pit C1		·	·	·		◎	○	○			
	[illegible]	Test pit A3 Mountain side		·		△		◎		·	△	·	
	[illegible]	Test pit A3 Mountain side			·	△		◎	△	△	△		
	[illegible]	Trial pit i		·	△	○		◎	△	△			
	[illegible]	Supplemental test pit f		·	·	△		◎		△	·		
	[illegible]	O-13 hole		△	△			◎	○	△			
	[illegible]	Test pit A1		·	△	△		◎		△			△
	[illegible]	Supplemental test pit A5		·	△	·		◎		△			
	[illegible]	S-14 hole		·	·	·		◎	◎	◎			
	[illegible]	K-19 hole		·	△	△		◎		△	·		
In dolerite	[illegible]	Trial pit m		△		◎	·	△			○		

Relative content:
◎: Large volume
○: Medium volume
△: Small volume
·: Very small volume

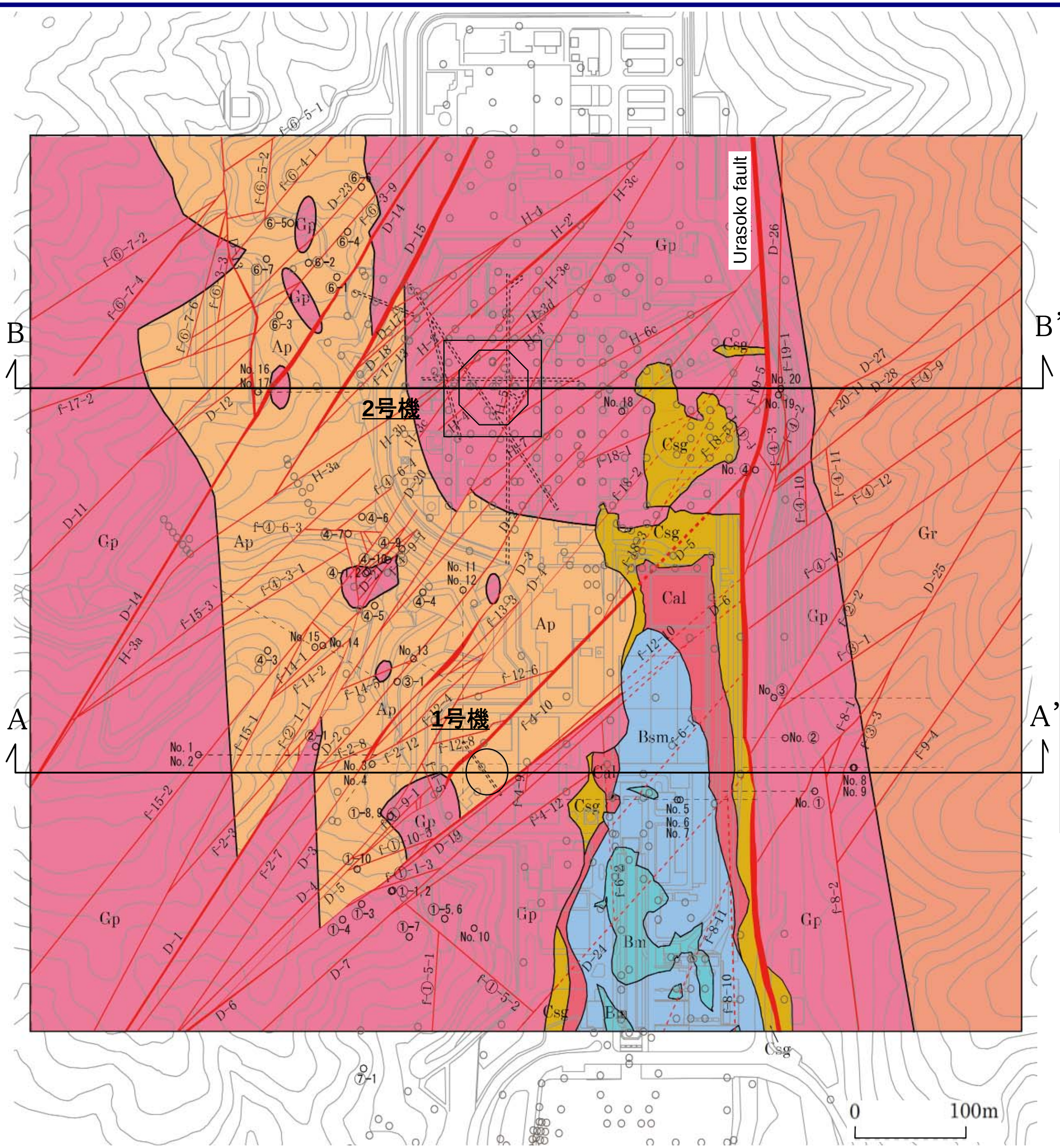
Urasoko fault

Sampling place	Sample name	Chlorite	Mica clay mineral	Kaolinite	Minerals in muscovites/smectite mixed-layer	Smectite	Laumontite	Quartz	Plagioclase	Potassium	Calcite	Pyrite	Siderite
B trench	[illegible]			△				◎		△			
	[illegible]			·				◎	△	○			
	[illegible]		·*	·		△		◎		△			
	[illegible]			·		△		◎		△			
	[illegible]		·*	·		△		◎		·			
M outcrop	[illegible]		·*	·		·*		◎		△			
Northern saddle of Urasoko fault	[illegible]			△				◎	·	△			
Arrayed boring at B trench	[illegible]		·	·		△		◎	△	△			
	[illegible]			·		·		◎	△	△			
	[illegible]		·*	·		△		◎		△			
	[illegible]			·		·		◎	△	△			
	[illegible]			·		·		◎		△			
	[illegible]			·		·		◎	△	△			
	[illegible]			·		·		◎	△	△			
	[illegible]			·		·		◎	△	○			

* It can be identified in a fixed direction.

- The fault gouges in granite on the Units 1 and 2 side as well as on the Units 3 and 4 side contain quartz, K-feldspar, plagioclase, muscovite, kaolinite and smectite. Measured values of clay mineral by K-Ar dating (the time of rock or mineral changing in quality as a result of coming into contact with hot water) resulted in some 54.6-61.4 Ma.
- The fault gouge in the Urasoko fault contains quartz, K-feldspar, plagioclase, muscovite, kaolinite and smectite. Measured value of clay mineral by K-Ar dating (the time of rock or mineral changing in quality as a result of coming into contact with hot water) resulted in some 50.3 Ma.
- The fault gouge in dolerite contains high volume of smectite, medium volume of calcite and laumontite. Measured value of clay mineral by K-Ar dating (the time of rock or mineral changing in quality as a result of coming into contact with hot water) resulted in some 18.9 Ma.

Geological plan (Units 1 and 2 side)



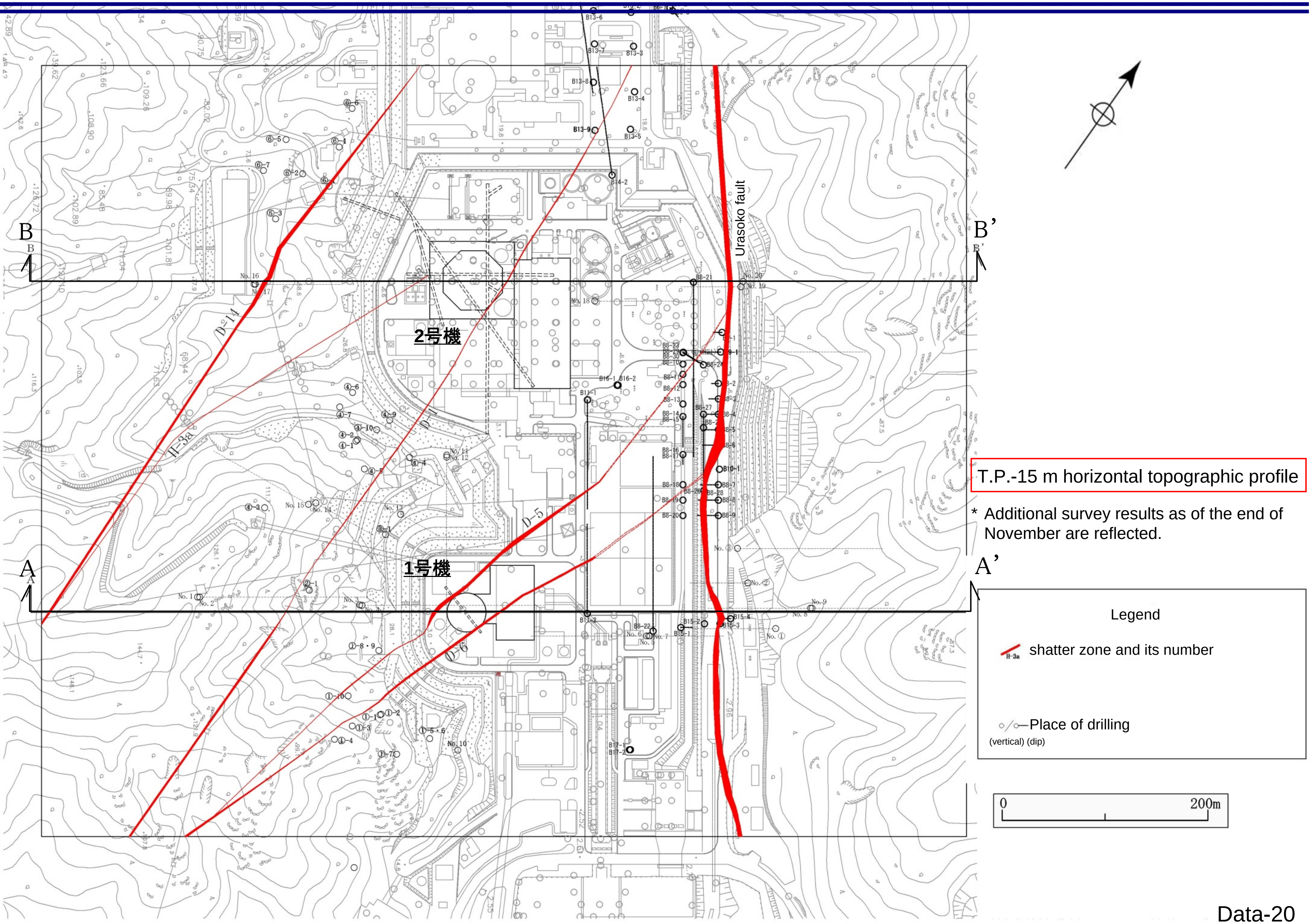
Geological classification legend

Bm	Bm layer:	Enclosed bay deposits (that contains silt, fine sand and shell)	Holocene	Quaternary system
Bsm	Bsm layer:	Enclosed bay deposits (that contains medium sand, coarse sand, granule, silt and shell)	Holocene	
Cal	Cal layer:	Lowland deposits (that contains a large volume of fine sand, medium sand and humus)	Holocene Pleistocene	
Csg	Csg layer:	Fan deposits (that mainly contain gravel, coarse sand, medium sand and humus)	Holocene Pleistocene	
Ap	Aplite	Kojaku granite		
Gp	Granite porphyry			
Gr	Biotite granite			
H-3a	shatter zone and its number			

T.P.-15 m horizontal topographic profile

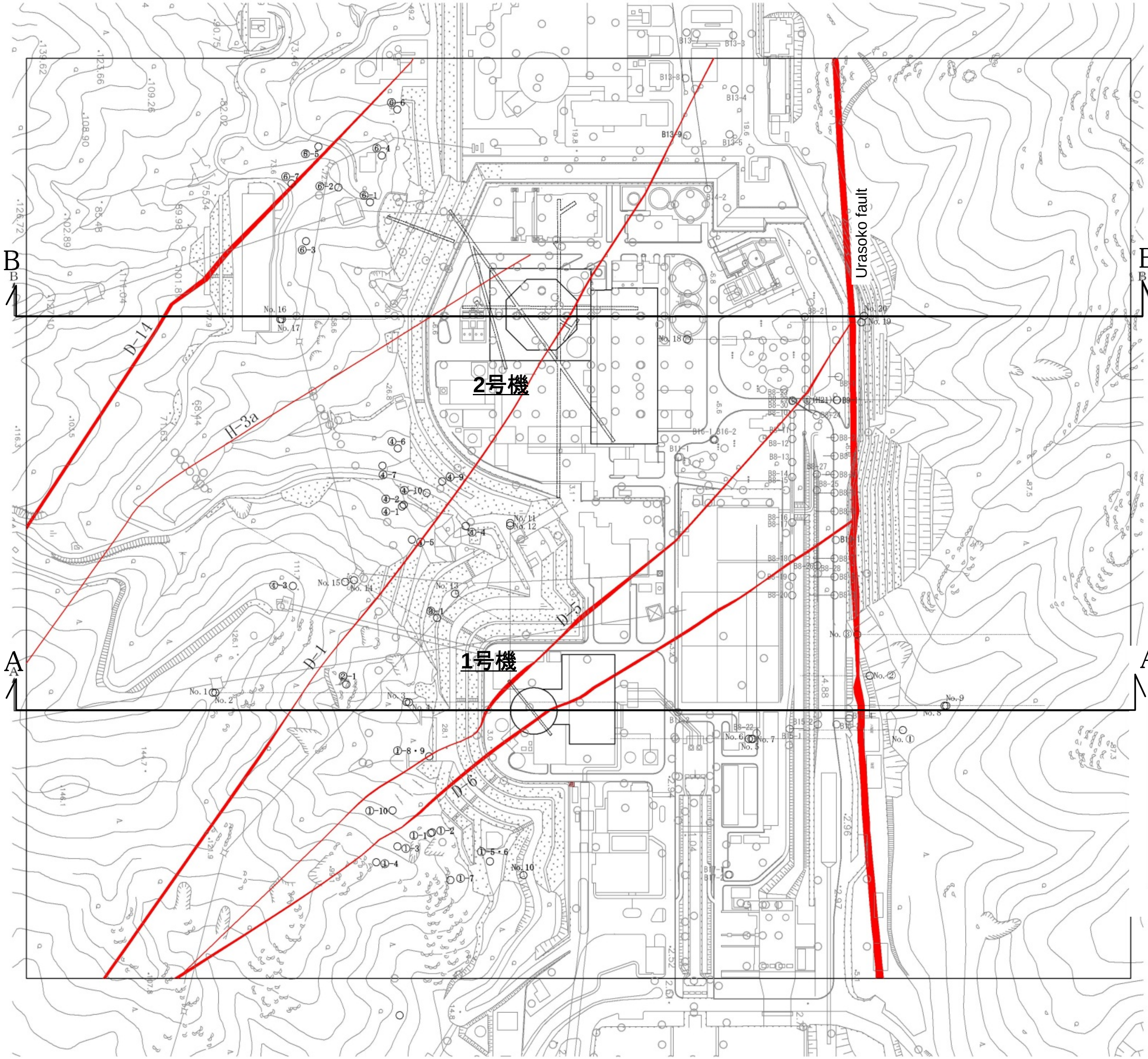
* Before reflection of additional survey results

Distribution of major shatter zones based on additional survey result (Units 1 and 2 side)



* Additional survey results as of the end of November are reflected.

Distribution of major shatter zones based on additional survey result (Units 1 and 2 side)



T.P.-70 m horizontal topographic profile

* Additional survey results as of the end of November are reflected.

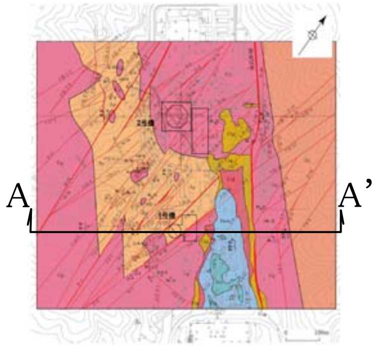
Legend

shatter zone and its number

Place of drilling
(vertical) (dip)

0 200m

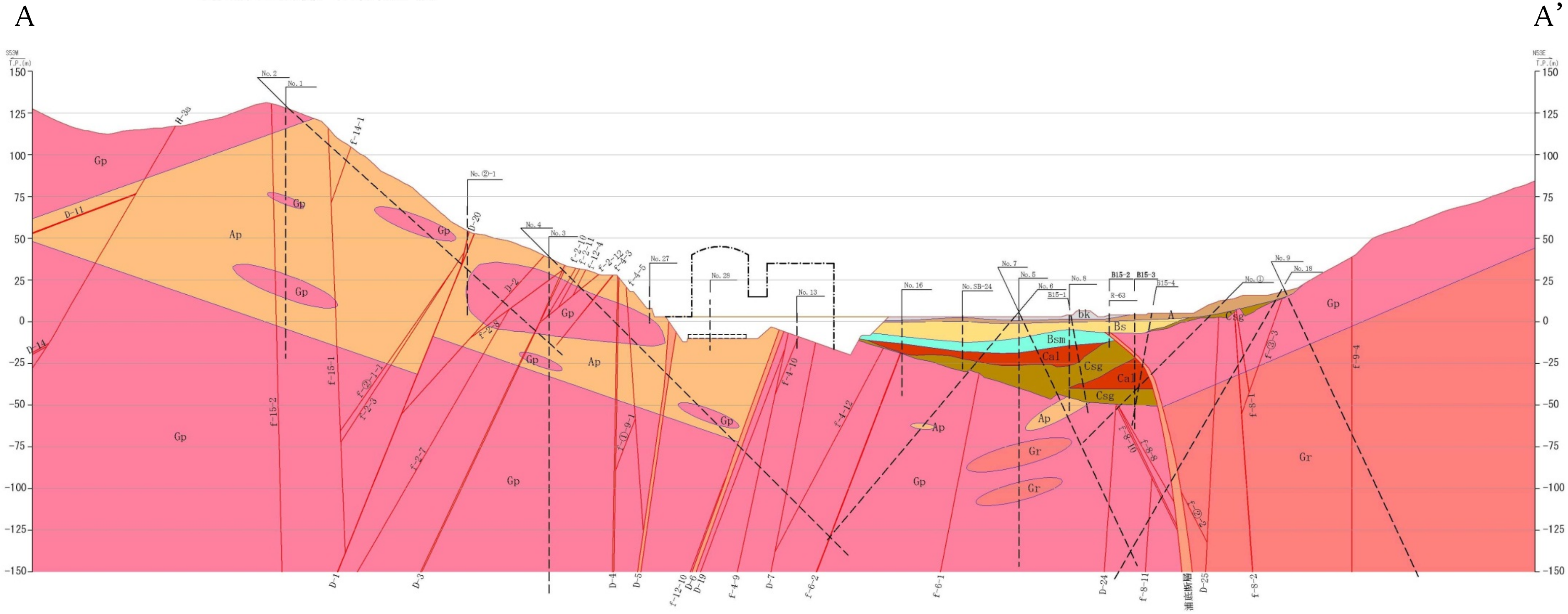
Geological profile (Unit 1 side)



Geological classification legend

Symbol	Layer	Description	Epoch	
bk	Surface soil and fillig soil			Quaternary system
A	A layer:	Alluvial plain deposits, fan deposits and talus deposits (that may contain sand, gravel, silt, humus and humic matters)	Holocene	
Bs	Bs layer:	Deltaic deposits (that contains coarse sand, medium sand and shell)	Holocene	
Bsm	Bsm layer:	Enclosed bay deposits (that contains medium sand, coarse sand, granule, silt and shell)	Holocene	
Cal	Cal layer:	Lowland deposits (that contains a large volume of fine sand, medium sand and humus)	Holocene Pleistocene	
Csg	Csg layer:	Fan deposits (that may contain gravel, coarse sand, medium sand and humus)	Holocene Pleistocene	

Symbol	Rock type	
Ap	Aplite	Kojaku granite
Gp	Granite porphyry	
Gr	Biotite granite	
H-3a	shatter zone and its number	
	Geological boundary	



- Many of the shatter zones are high-angle westerly dip.
- The shatter zones have displaced the boundary between rock types (Gp/Ap boundary) into one like a normal fault.

Geological profile around Unit 1 A-A’ profile

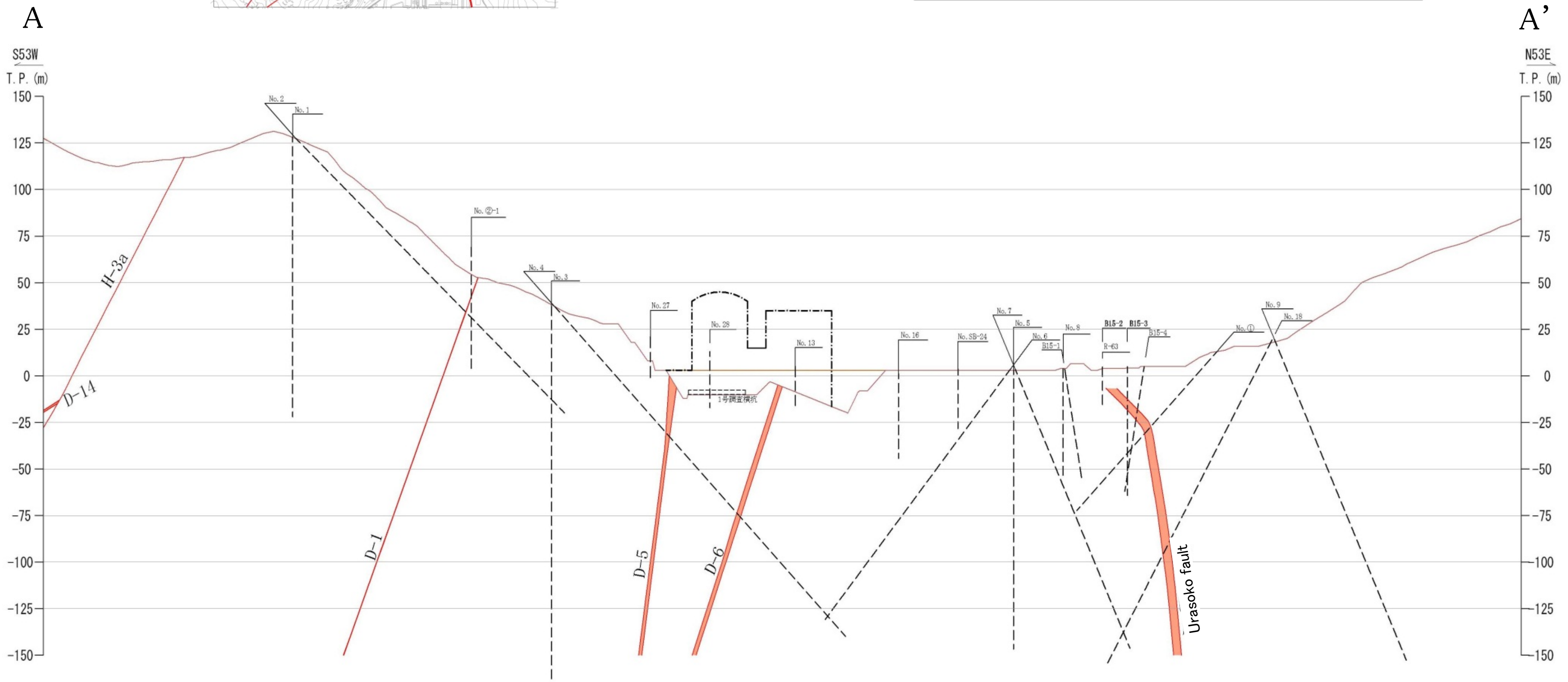
＊ Before reflection of additional survey results

Profile of distribution of major shatter zones based on additional survey result (Unit 1 side)

Geological classification legend

shatter zone and its number

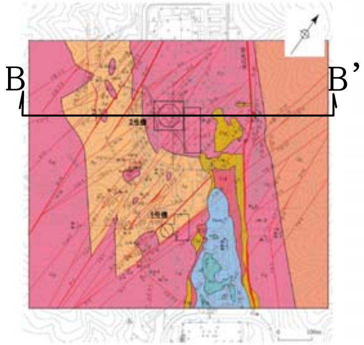
D-6



Geological profile around Unit 1 A-A' profile

* Additional survey results as of the end of November are reflected.

Geological profile (Unit 2 side)

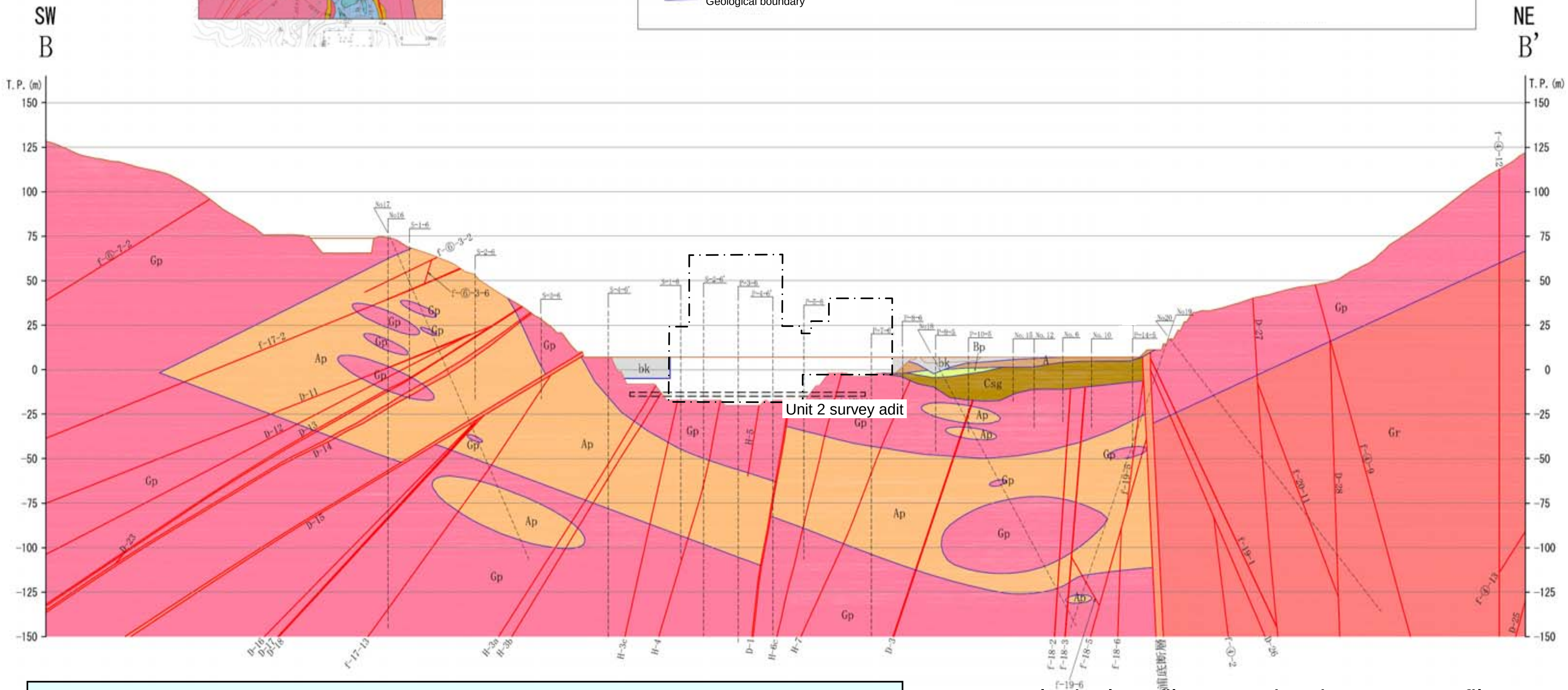


Geological classification legend

bk	Surface soil and filling soil		Quaternary system
A	A layer: Alluvial plain deposits, fan deposits and talus deposits (that may contain sand, gravel, silt, humus and humic matters)	Holocene	
Bp	Bp layer: Marsh deposits (that contains humic soil and fine sand, and partly coarse sand and granule)	Holocene	
Csg	Csg layer: Fan deposits (that may contain gravel, coarse sand, medium sand and humus)	Holocene Pleistocene	

Ap	Aplite	Kojaku granite
Gp	Granite porphyry	
Gr	Biotite granite	
H-3a	shatter zone and its number	

Geological boundary



- Many of the shatter zones are high-angle westerly dip.
- The shatter zones have displaced the boundary between rock types (Gp/Ap boundary) into one like a normal fault.

Geological profile around Unit 2 B-B' profile

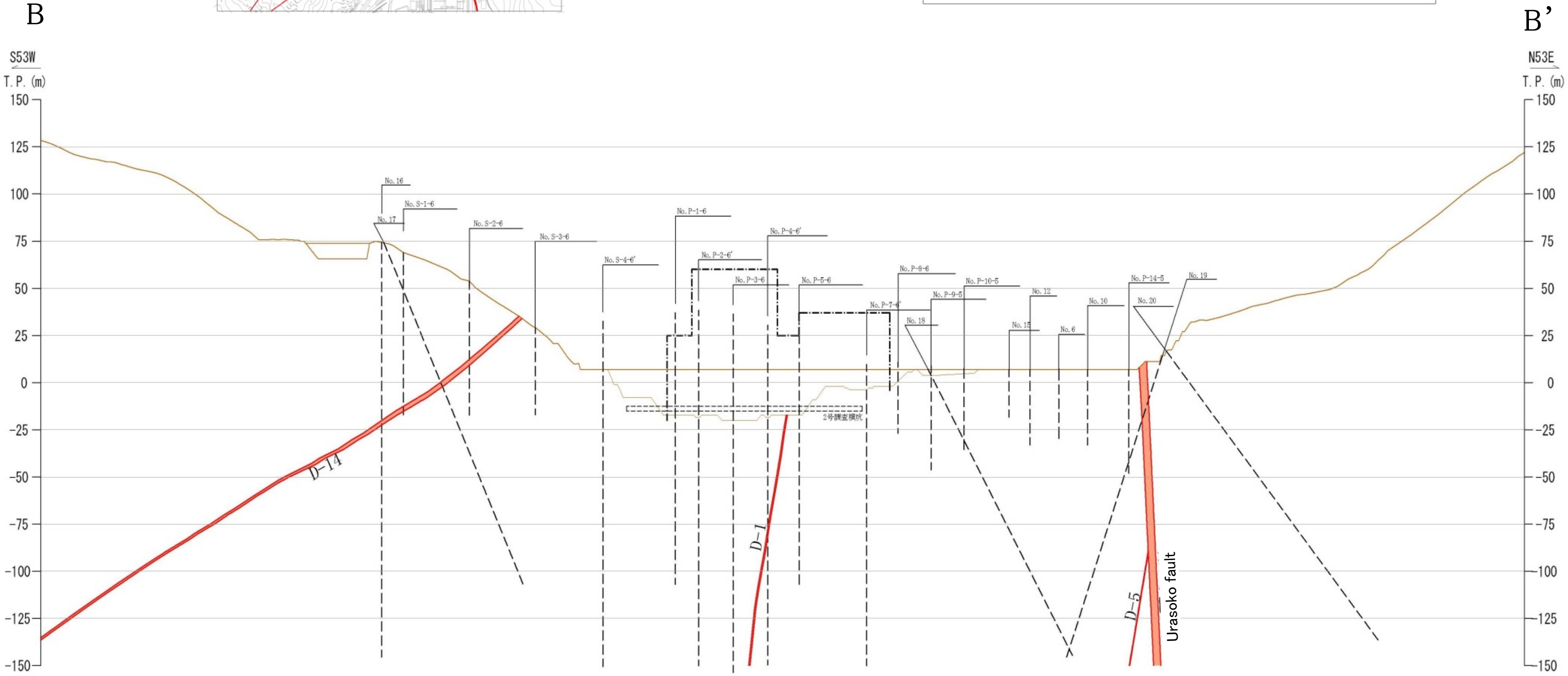
* Before reflection of additional survey results

Profile of distribution of major shatter zones based on additional survey result (Unit 2 side)

Geological classification legend

shatter zone and its number

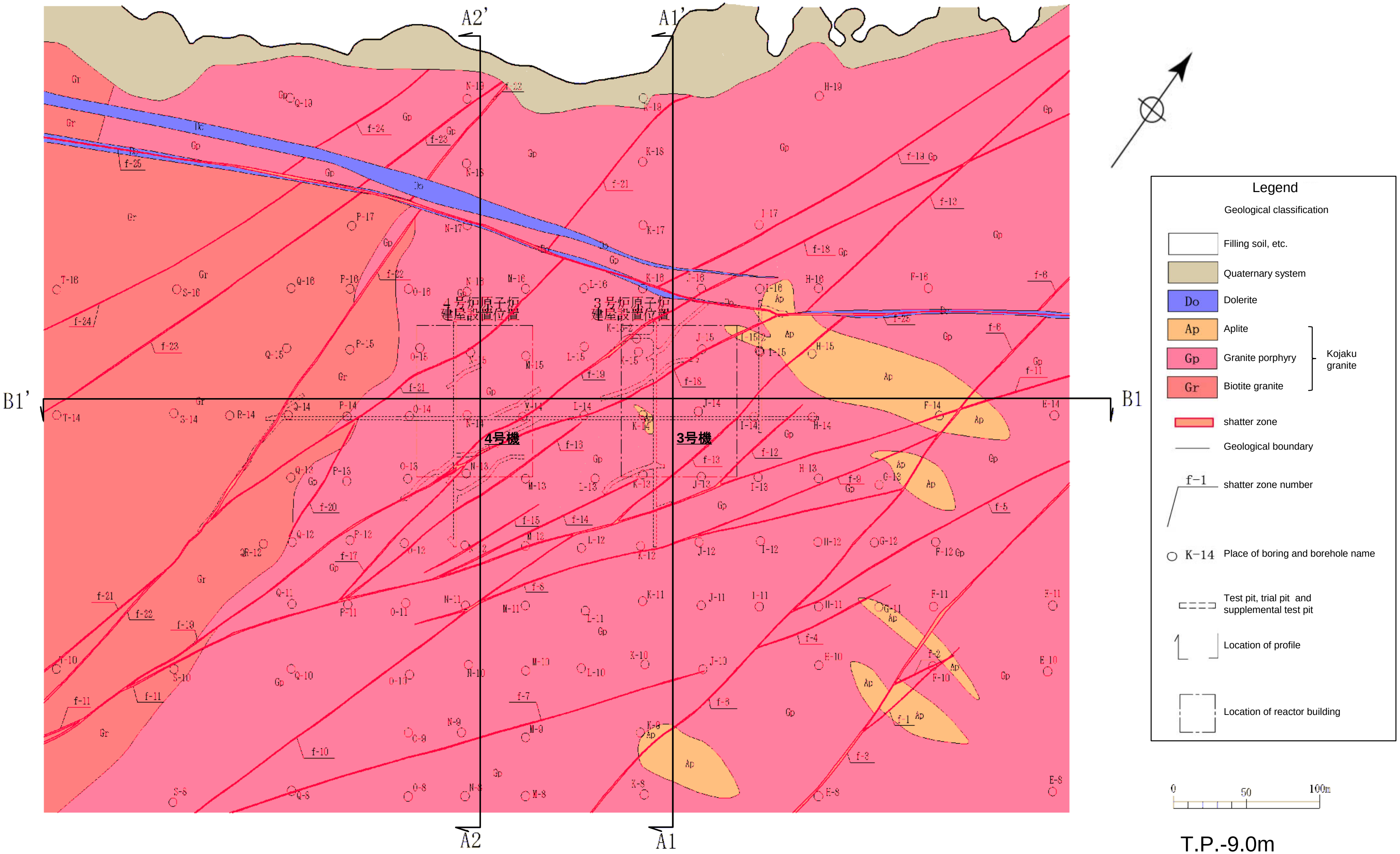
D-6



Geological profile around Unit 2 B-B’ profile

* Additional survey results as of the end of November are reflected.

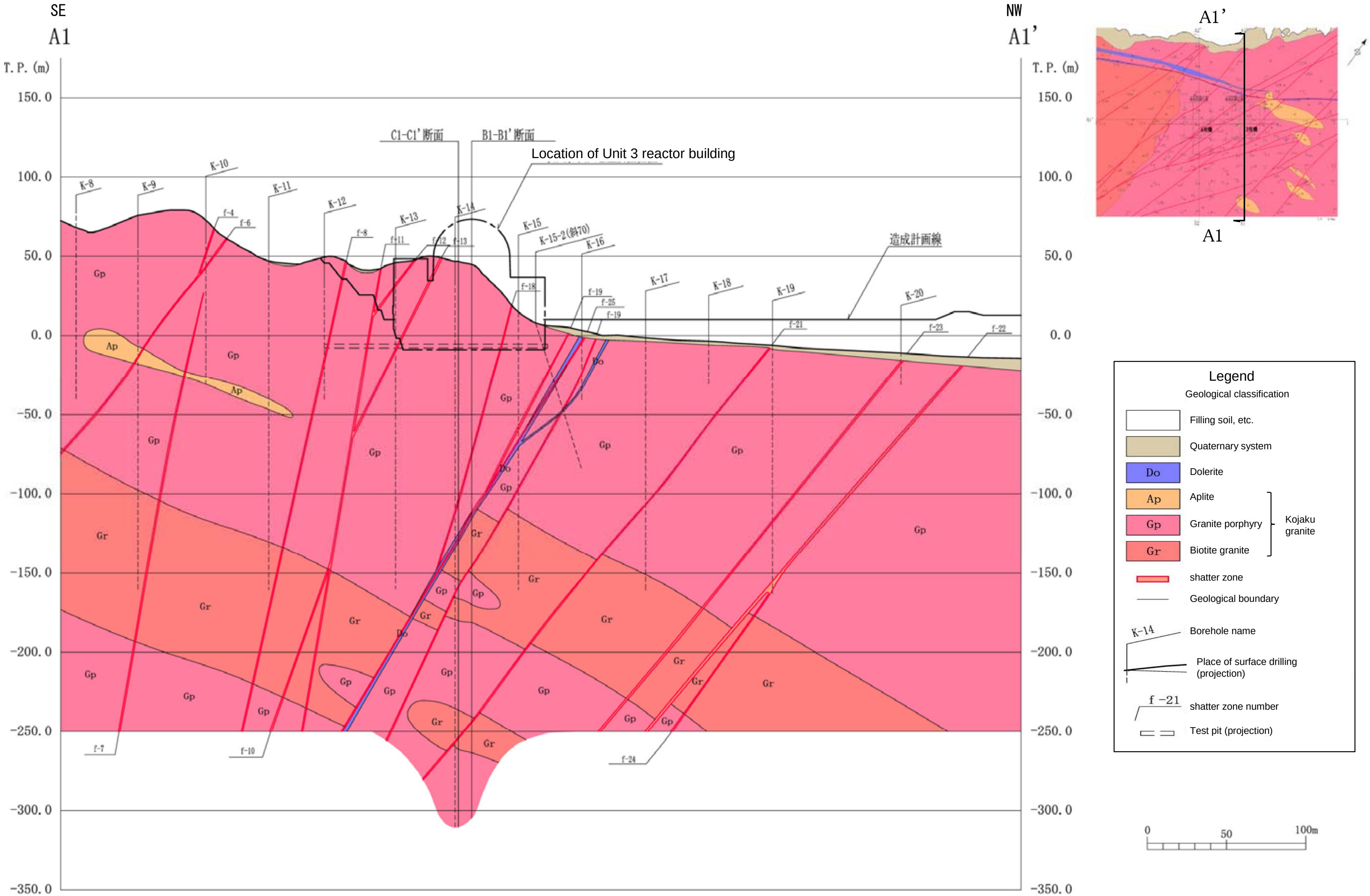
Geological plan (Units 3 and 4 side)



T.P.-9.0m

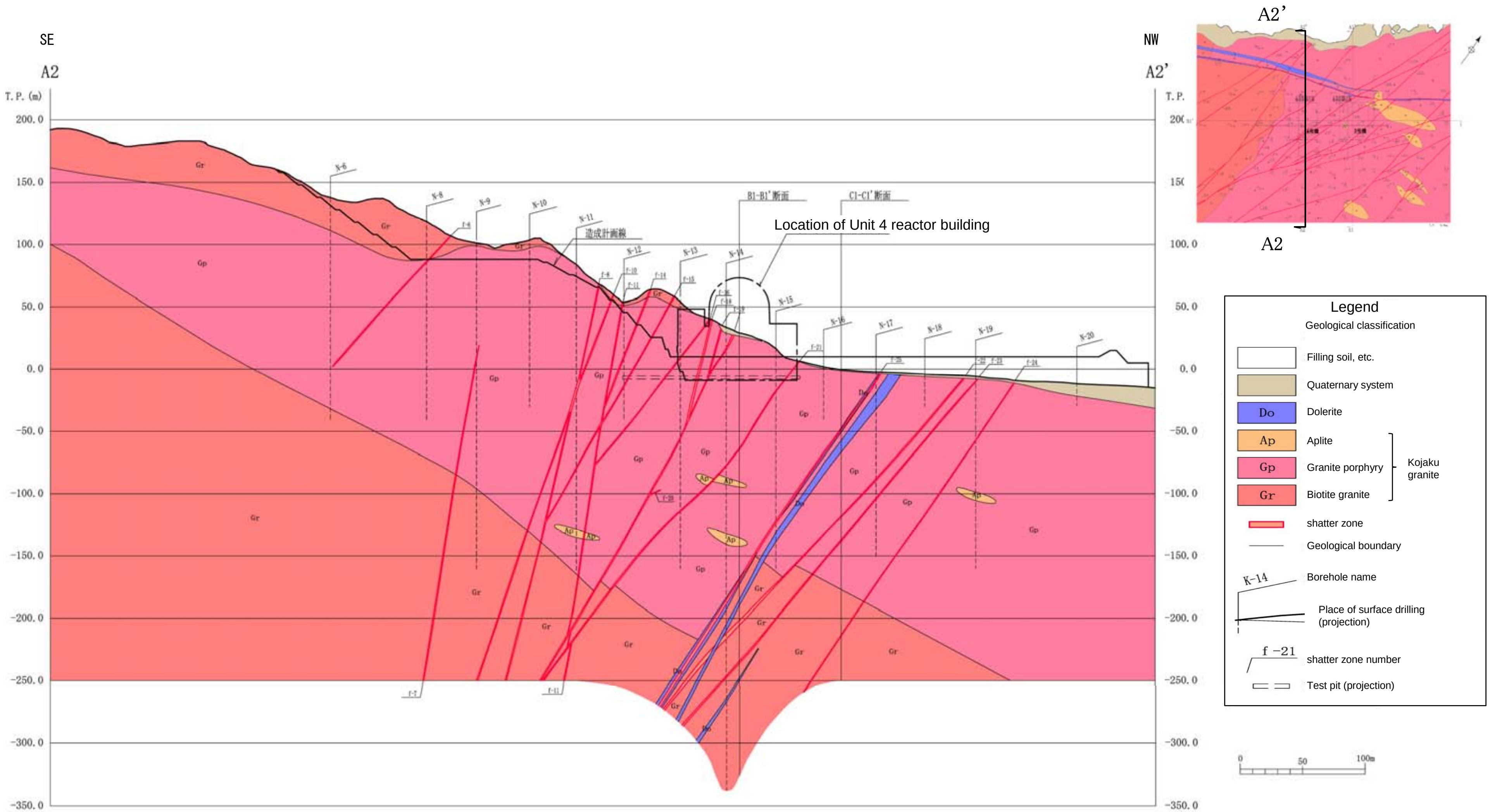
- The shatter zones running in the directions between N-S and NE-SW are predominant.
- In dolerite, the shatter zones running in the direction of ENE-WSW are found, which have displaced the shatter zones running in the direction between N-S and NE-SW.

Geological profile (Unit 3 side: A1-A1’)



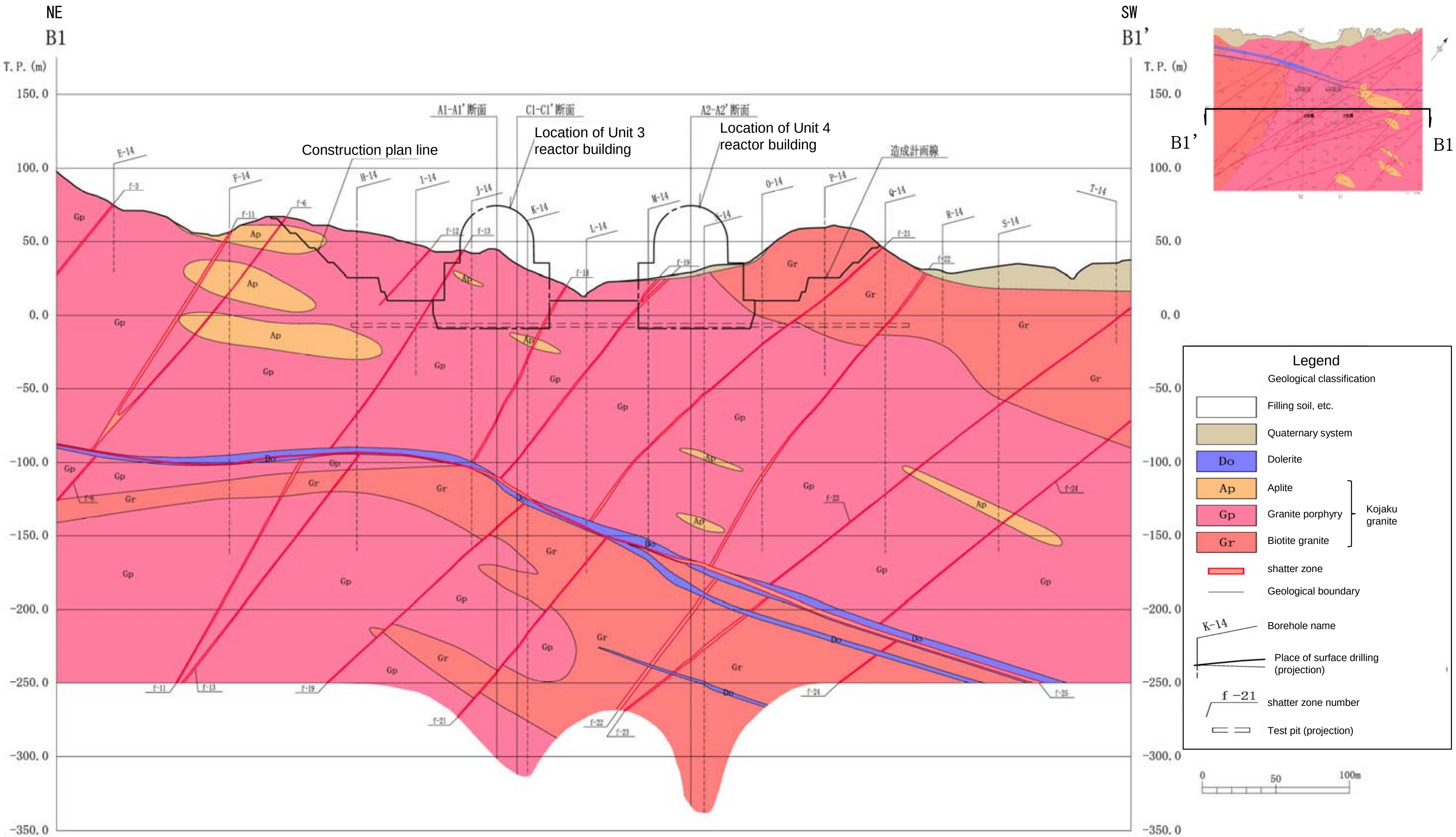
- The shatter zones are high-angle easterly dip.
- The shatter zones have displaced the boundary between rock types (Gr/Gp boundary) into one like a normal fault.

Geological profile (Unit 4 side: A2-A2')



・The shatter zones are high-angle easterly dip.
・The shatter zones have displaced the boundary between rock types (Gr/Gp boundary) into one like a normal fault.

Geological profile (Units 3 and 4 side: B1-B1’)



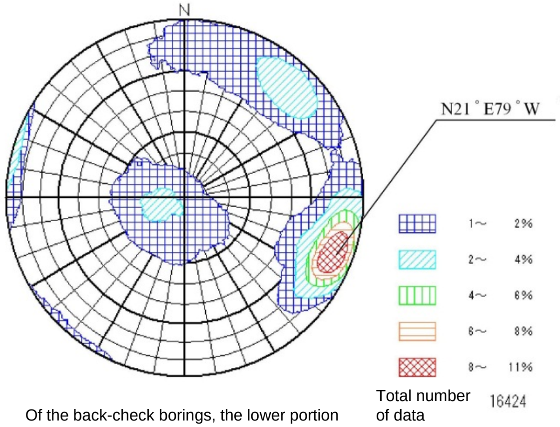
・The shatter zones show easterly dip.

・The shatter zones show easterly dip.
・The shatter zones have displaced the boundary between rock types (Gr/Gp boundary) into one like a normal fault.

Strikes and dips of joints and shatter zones (Schmidt net, lower hemisphere projection)

Joint

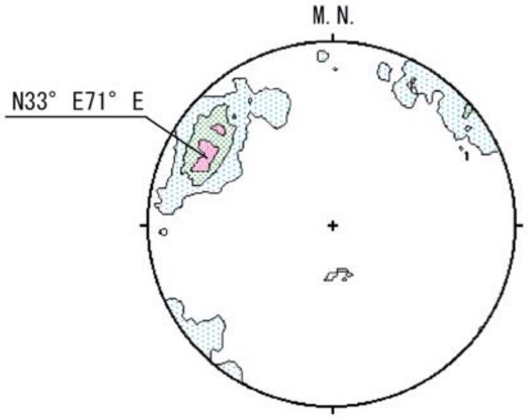
Joint on Units 1 and 2 side



Total number of data

Of the back-check borings, the lower portion of Urasoko fault

Joint on Units 3 and 4 side

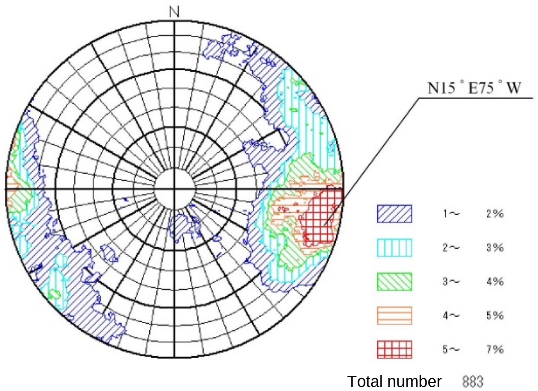


Surface joints N = 427

- The joints run in the directions between N-S and NE-SW, NNW-SSE and E-W. Among them, those running in the directions between N-S and NE-SW are predominant.
- As for dip, many of those adjacent to the Units 1 and 2 are high-angle westerly dips, while those adjacent to the Unit 3 and 4, which are high-angle easterly dips, are predominant.

shatter zone

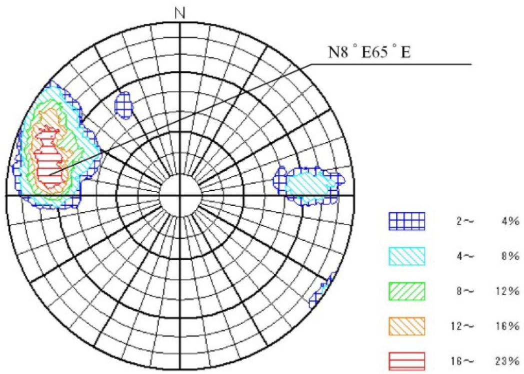
shatter zone on Units 1 and 2 side



Total number of data

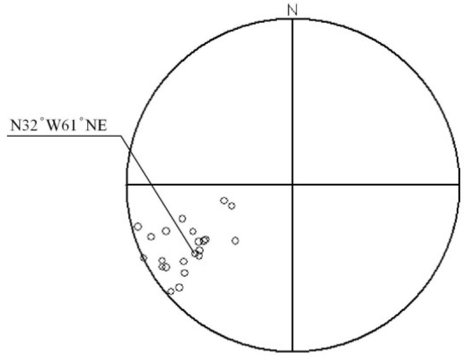
Of the back-check borings, the lower portion of Urasoko fault

shatter zone on Units 3 and 4 side



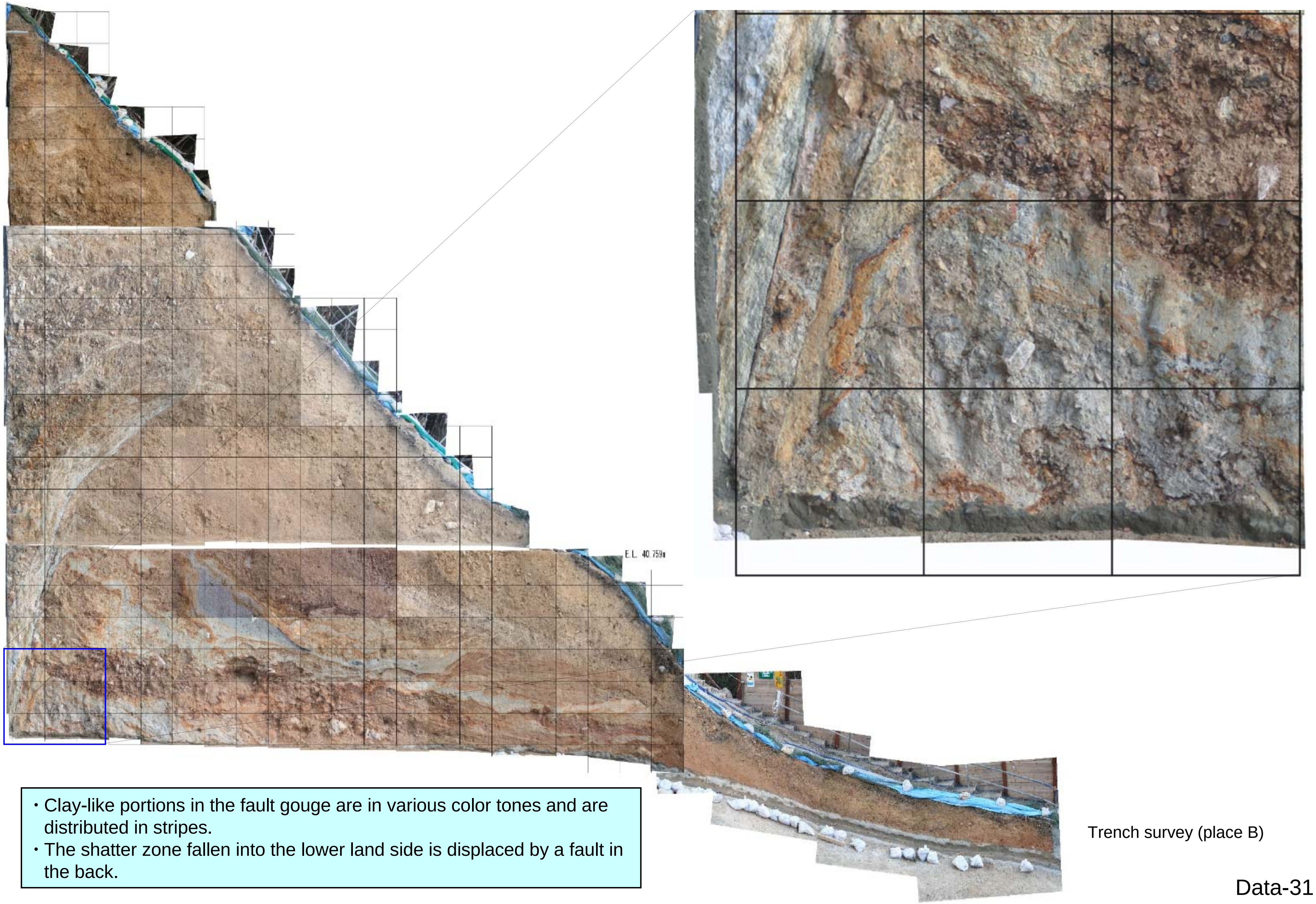
Surface shatter zones around Units 3 and 4 N = 16
shatter zones just beneath the locations of Units 3 and 4 N = 142

Urasoko fault



- The shatter zones other than Urasoko fault run mainly in the directions between N-S and NE-SW, in harmony with the direction that joints are predominant.
- Urasoko fault generally runs in a direction of NW-SE and is vertical to high-angle easterly dip.

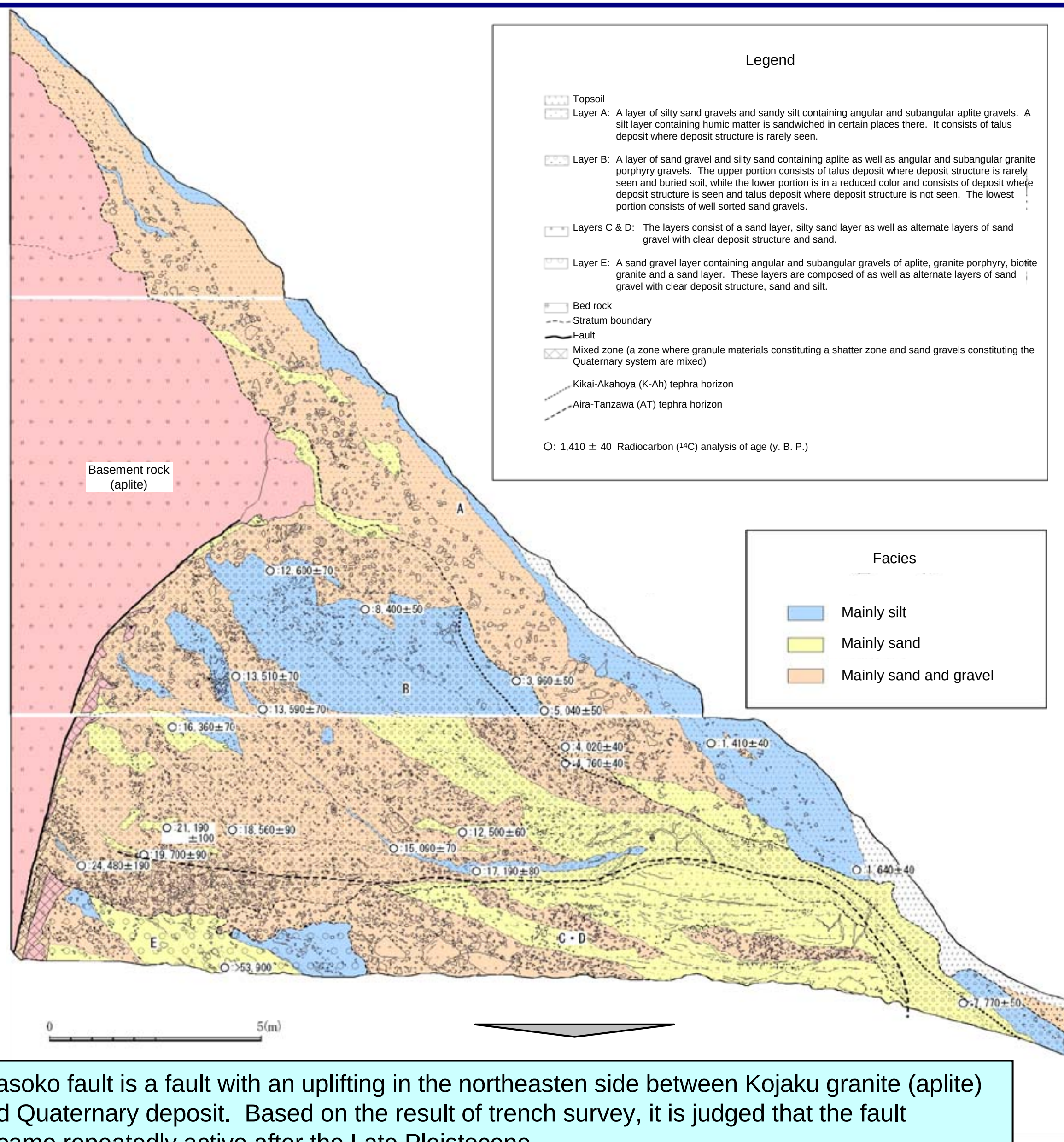
Urasoko fault (trench at place B)

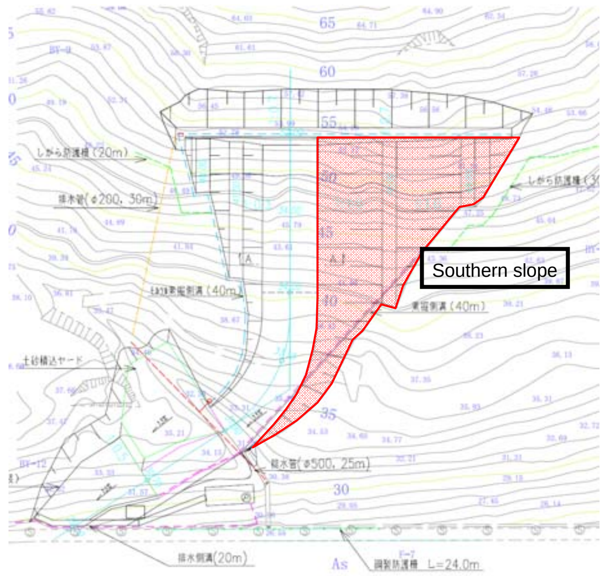


・Clay-like portions in the fault gouge are in various color tones and are distributed in stripes.
・The shatter zone fallen into the lower land side is displaced by a fault in the back.

Trench survey (place B)

Urasoko fault (trench at place B)





- Basement rock consisting of aplite as well as Quaternary talus deposit that overlays disconformably are found. On the boundary between aplite as well as Quaternary talus deposit (layers B & E), a shatter zone (brown and ash gray clay of about 10 cm wide) with a northeasterly dip of about 40° in the upper zone and about 70° in the lower zone is recognized.
- The layer B (radiocarbon (^{14}C) analysis of age: 24,480 ± 190 y. B.P. to 3,960 ± 50 y. B.P.) that contains Kikai-Akahoya tephra (about 7,300 years ago) and Aira Tn tephra (about 29,000 - 26,000 years ago) contacts the basement rock in terms of a fault.
- Displacement and deformation by a fault is not recognized in the layer A (radiocarbon (^{14}C) analysis of age: 1,640 ± 40 y. B.P. to 1,410 ± 40 y. B.P.)
- We can see from the above that the latest active period was after the layer B was deposited and before the layer A was deposited.
- In the boundary between the shatter zone and the layer E, a mixed zone is continuously seen and the gravels inside the layer E show strong preferred orientation. In the boundary between the shatter zone and the layer B, a mixed zone is intermittently seen and the gravels inside the layer B show poor preferred orientation.

Sketch of B1 trench southern slope

- Urasoko fault is a fault with an uplifting in the northeasten side between Kojaku granite (aplite) and Quaternary deposit. Based on the result of trench survey, it is judged that the fault became repeatedly active after the Late Pleistocene.

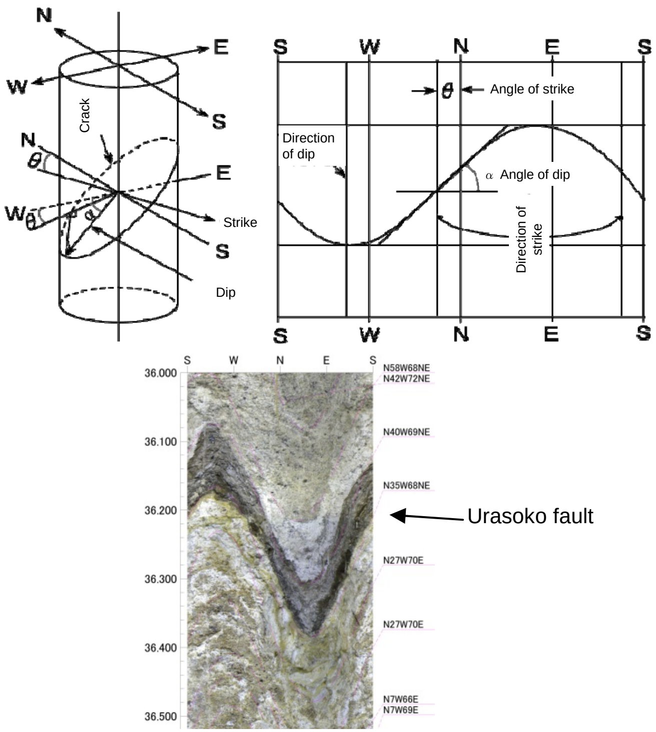
Concept of evaluating continuity of shatter zones

① The identified shatter zones should be extended, following their strikes and dips.
― For strike and dip, values measured by a borehole television (BHTV), surficial geology survey and test pit survey should be used.
― If there is no rational reason to bend it, it should be extended linearly in principle.

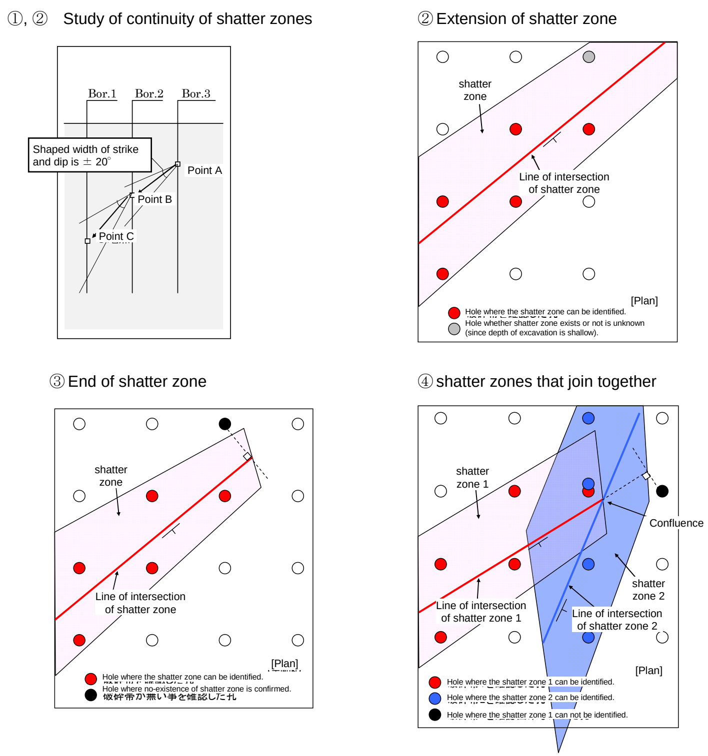
② If “a shatter zone that has similar strike and dip exists” in the extended location, and “a shatter zone whose strike and dip are unknown exists,” it should be evaluated as being continuous.
― It should be deemed as being continuous on the assumption that a strike and dip change locally (changes in strike and dip are estimated within a range of ± 20°).
― In the case of the characteristics (whether a fault gouge exists or not, linearity, etc.) of shatter zones being different, if strike and dip are similar, it should be deemed as an extension and being continuous.
― If in the extended location “the existence of a shatter zone is unknown,” it should be extended directly.

③ In cases that in the extended location “the shatter zone is not identified,” and “a shatter zone with a different strike and dip exists,” it should not be extended further.

④ In case that in the extended location “the corresponding shatter zone is not identified and a different shatter zone is judged to cross,” it should be deemed that the shatter zones are consolidated.



Example of measuring strike and dip of shatter zone
by BHTV



Frame format of concept of evaluating continuity