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65. Feasibility Study on the Integrated Development of the Arror River Basin, KVDA, 1990
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68. Kirandich River Dam Project for Kambanet Water Supply, NWCPC
69. Greater Nakuru Water Supply Project Phase 1, Chemosusu Dam, MOWD, 1989

TABLES

Table J3.1 List of Topographical Maps and Aerial Photographs

	Map: 1:50,000 Sheet No.	Aerial Photo No.	Scale of Photo	Date of Photo	Remarks
1. Hemsted's Bridge	89/1	038-043,062-065	1:12,500	1971	by SOK
2. Rambula	101/4	140/144	1:12,500	1970	by SOK
3. Gongo	102/3 101/4	186-090,390-392	1:9,000	1970	by SOK
4. Mushangumbo	102/3	198-202	1:12,500	1969	by SOK
5. Nandi Forest	103/3	054-055,067-070,108-111	1:12,500	1972	by SOK
6. Nyando/Koru	117/3	074-082,392-395,442-445	1:10,000		by SOK
7. Magwagwa	117/3	C1.4587-4595, C2.4649-4663 C3.4623-4637, C4.4601-4611 C5.4668-4673	1:20,000	1988	by JICA
8. Namba Kodero	129/4	1307-1310	1:12,500	1967	by SOK
9. Katieno	129/4	445-449	1:12,500	1970	by SOK
10. Kerio-A	90/1	0733-0735	1:10,000	1987	by SOK
11. Sererwa	90/1	001-007	1:12,500	1981	by SOK
12. Molo	118/2	1038-1040	1:10,000	1990	by Photomap
13. Malewa	119/4				
14. Oldorko	160/1 147/3	094-098,131-135	1:50,000		by SOK
15. Leshota	147/3	041-042	1:50,000	1969	by SOK
16. Marun	62/4	9977-9981	1:12,500	1978	by SOK
17. Munyu	149/1				
18. Kiteta	163/1				
19. Thwake	163/1				
20. Yatta Kiboko	174/2	0431-0435, 2804-2807	1:20,000	1989	by SOK
21. Tsavo	89/2	CW1A 15-17	1:60,000	1988	by JICA
22. Baricho	192/2	6091-6093	1:10,000	1990	by SOK
23. Rare	192/3				
24. Pemba	200/2	CE9A 31-33	1:60,000	1988	by JICA
25. Mwachi	198/3 201/1	CE9A 27-29	1:60,000	1988	by JICA
26. Thiba	135/2				
27. Karura	136/2	0528-0530, 0561-0566	1:20,000	1980	by SOK
28. Mutonga	122/4	0547-0551	1:20,000	1980	by SOK
29. Grand Falls	123/3	9799-9804,9885-9889	1:10,000	1987	by SOK
30. Usueni	123/1	0051-0055,1460-1465	1:20,000	1980	by SOK
31. Adamson's Falls	123/2	0005-0007	1:50,000		by SOK
32. Kora	124/1	0072-0074	1:50,000		by SOK
33. Runuruti	105/4	209-212,1019-1021	1:10,000	1990	by SOK
34. Kirimun	92/2,4				
35. Crocodile Jaw	92/4	0048-0050,0100-0102	1:50,000	1966/67	by SOK
36. Archer's Post	94/3, 93/4	064-066,091-093 0063-0064,0086-0090	1:50,000	1961/67 1972	by SOK

Table J3.2 Summary of Preliminary Geological Assessment

Name of damsite	Topo-graphy	Geo-logy	Construction material			Conceiv-able Dam type	Max dam height
			Core	Filter	Rock		
Hemsted's Bridge	C	B	A	A	A	R	30
Rambula	B	B	A	B	C	R	50
Gongo	B	B	A	C	C	E(R)	80
Mushangumbo	B	A	A	B	A	R	40-50
Nandi Forest	B	B	A	C	B	R	40
Nyando/Koru	A	A	A	B	A	G/R	70
Magwagwa	A	A	A		A	G/R	120
Namba Kodero	B	A	A	C	A	R	60
Katieno	C	A	B	A	A	R	20
Kerio-A	C	C		B	A	D	–
Sererwa	B	B	A	B	A	R	100
Molo	B	B	A	C	B	R	60
Malewa	A	B	A	B	A	R	70
Oldoroko	C	B/C	A	C	A	R	50-60
Leshota	C	B/C	A	C	A	R	110
Marun	A	C	C	B	A	D	–
Munyu	B	B	B	A	B	R	50
Kiteta	B	B	A	B	A	R(E)	30-50
Thwake	B	B	A	A	A	R	80
Yatta Kiboko	B	B	A	A	A	R	50
Tsavo	A	A	A	A	A	G/R	40
Baricho	B	B	A	A	A	R	50
Rare	B	B	A	C	A	R	50
Pemba	A	A	C	C	A	G	80
Mwachi	A	B	C	C	A	G/R	70
Thiba	B	B	A	B	A	R/E	40
Karura	C	B	A	C	B	R	20
Mutonga	B	A/B	A	B	A	R	50
Grand Falls	C	A/B	A	B	A	R	120
Usueni	C	B	A	A	A	R	40
Adamson`s Falls	C	A/B	A	A	A	R	50
Kora	C	A/B	A	A	A	R	60
Rumuruti	C	B	A	C	A	R/E	60
Kirium	A	A	A	C	A	G(R)	150
Crocodile Jaw	A	A	C	C	A	G/R	70
Archer`s Post	C	B	A	A	A	R	40

Notes:

Topography	A: Good, B: Fair , C: Open Valley
Geology	A: Good, B: Fair , C: Poor
Construction Materials	A: Available, B: Available but some constraints, C: Further investigation required.
Dam type	R: Rockfill, E: Earthfill , G: Concrete gravity, D: Difficult to construct

Table J3.3 Geological Assessment of Hemsted's Bridge Damsite

River Basin: Nzoia, Sub-basin: 1BD, River: Nzoia

Item	Description
1. Topography and geology	The damsite is located near the Hemsted's Bridge and is about 25km south of Kitale. The terrain around the damsite is composed of a peneplain Kitale plain with an elevation of 1,800-1,900m above the sea level. The plain at the damsite has been disected about 100m by Nzoia River and formed very gentle slopes along the river. For instance, the width of the valley at about height of 30m from the riverbed is about 1km long, but the width of river is only 30m on the same section at the Hemsted's Bridge. The geology at the damsite consists of Precambrian Basement gneissose granites and banded gneisses. Gneissose granites are very hard rocks and have few joints. The rocks have formed many rock hills about several kilometers away from the damsite. Banded gneisses are rather soft and have more developed cracks, than gneissose granites. Banded gneisses tend to weather fairly easily. Outcrops can be seen only around the river bed and the weathered layers are probably thick. Overburden is composed of residual reddish brown soils which are widespreading around the damsite and presumably thick. Alluvial sands deposits are about 2 to 3m thick along the entire riverbed. An alternative Hemsted's Bridge damsite has been considered. However, there is not much difference between the two sites topographically and geologically.
2. Possibility of dam construction	Construction of a high dam, say up to 80m, may be possible from the geological viewpoint. However, such a high dam will not economical in view of large embankment required mainly due mainly to the wide valley.
3. Maximum dam height	Preferably 30m

4.	Construction materials	
	Core	Residual soils around the damsite are considered to be suitable for use as impervious material.
	Filter	Alluvial sands along the riverbed can be used for filter material.
	Rock	A rock hill located about 2km to the east is considered to be a potential quarry site (3.5 Km in case of an alternative downstream site)
5.	Dam type	Suitable for a rockfill dam.
6.	Foundation treatment	Excavation depth at the core embankment zone is presumed to be relatively large. No intensive grouting work will be required.

Table J3.4 Geological Assessment of Rambula Damsite

River Basin: Nzoia, Sub-basin: 1EE, River: Nzoia

Item	Description
1. Topography and geology	The dam is proposed between gentle sloping ridge abutments on a wide valley. Foundation rocks are alternations of pelitic schists and some Psamitic schists with well developed schistosity trending in the same direction as the river flow and dipping at 70-80 degrees to the north. A small alluvial deposit is present at the damsite. Red soils overlying the schists around the dam site area are presumed to be thick.
2. Possibility of dam construction	No specific difficulty is foreseen
3. Maximum dam height	50m
4. Construction materials	
Rock	Foliated schists are not good for rock materials. There is a possibility of using the psamitic schists as rock material, provided a thick layer is located nearby. Further investigation covering a wider area is required.
Filter	Sandy material is available about 4km upstream from the damsite. If the quantity of sand is not sufficient, an alternative source of filter material may become necessary.
Core	Red brown soils around the dam site may be utilized. However, laboratory and insite tests are required to ascertain the suitability of the soils.
5. Dam type	The most likely type of dam would be a rockfill type. In case of lack of sufficient rock material, an earthfill type of dam would be the second choice. The red brown soils are to be used for core embarkment and the schists for outer shell material.
6. Foundation treatment	Careful curtain grouting and blanket grouting treatment will be required.

Table J3.5 Geological Assessment of Gongo Damsite

River basin: Yala, Sub-basin: IFG, River: Yala

Item		Description
1.	Topography and geology	Foundation rocks consist mainly of pelitic schists with well developed schistosity generally trending in the same direction as the river flow with dips ranging from 70 to 80 degrees northwards. A thin red soil layer covers the slightly to fairly weathered rocks. The fluviatile deposits along the right river bank are a few meters thick. There is a remarkable fault scarp on the right bank side which is about 2 km away from the river. There are also other faults striking approximately E-W; the same direction as the schists.
2.	Possibility of dam construction	Possible but the site not so good.
3.	Maximum dam height	80m
4.	Construction materials	
	Rock	Pelitic schist around the dam site are not considered to be suitable for use as rock materials. There is no good rock material around the damsite.
	Filter	Not available around the damsite .
	Core	The red soils around the dam site and the deposits occuring at the upstream gentle slopes are possible sources of impermeable soil material.
5.	Dam type	An earthfill dam is conceivable in view of the topography and the abundance of suitable soils as compared to rock materials.
6.	Foundation treatment	Some minor faults may exist across the dam site. The strike of schistosity is more or less parallel to the river flow. Curtain grouting and blanket grouting would be required to seal off potential water leakage.

Table J3.6 Geological Assessment of Mushagumbo Damsite

River basin: Yala, Sub-basin: 1FE, River: Yala

Item		Description
1.	Topography and geology	Foundation rocks consists of greywackes. The rock is firm(hard), slightly weathered with rather well developed joints dipping about 15 degrees towards the downstream side. The thickness of the red soils overlying the rocks ranges from a few meters at the lower part to about ten metres at the top of the ridges. Some faults with strikes parallel to the river are assumed to exist on both abutment ridges about 400m to 500m away from the river. A small amount of alluvial sands are present in the river bed. The site is located in a wide river valley between extensive ridges with gentle slopes on both sides.
2.	Possibility of construction	Possible to construct a dam. No specific difficulty is foreseen.
3.	Maximum dam height	40 to 50m.
4.	Construction materials	
	Concrete	Greywackes around the damsite can be used for concrete aggregate.
	Rock	Greywackes around the damsite can be used as rock materials since they are hard and slightly weathered.
	Filter	It may not be possible to obtain enough sand materials around the damsite. Additional sources should be investigated.
	Core	Red soils occuring around the damsite are available for use as impervious material.
5.	Dam type	Topographically a rockfill dam is preferred. A concrete gravity dam is also possible, though presumably more costly.
6.	Foundation treatment	Moderate requirements of foundation treatment, since the bed rock at the site is firm.

Table J.3.7 Geological Assessment of the Nandi Forest Damsite

River basin: Yala, Sub-basin: IFD. River: Yala

Item		Description
1.	Topography and geology	This site is located just downstream of confluence of the Kimondi River and the Sirua river south of the Uasin-Gishu plateau. Both flanks at the damsite are very gentle and form low ridges which have been eroded by small ravines. The geology around the damsite consists of Precambrian granites. Granites outcrops are very hard. Joints are rather few but most of them are open. The thickness of the residual sandy silts and that of weathered granite is probably thick. The inferred NNW-SSE Nandi Fault cuts across the river. This fault is located about 2km downstream from the damsite. Tere are no major faults at the damsite.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	40m
4.	Construction material	
	Core	The residual soils and the highly weathered rock around the damsite can be used as impervious fill material.
	Filter	No sandy material is available around the damsite. Further investigation over a wider area are required.
	Rock	The granites around the damsite can be used as rock materials, however the weathered zone appears to be thick. Further investigations will hence be required to determine the cost-effect of mass granite production. The weathered parts may be used for core and transition embankments.
5.	Dam type	Rockfill dam appears to be suitable

6.	Foundation treatment	Excavation at the impervious fill area is expected to be deep. Joints of foundation rocks are slightly open at the outcrops. It is uncertain weather the open joints develop only at the rock surfaces or to the deeper parts. If the latter is the case, a lot of curtain grouting will be required.

Source:

1. Huddleston. A (1954)-"Geology of the Kakamega District" Rept. No 28 GSK.
2. D.J Jennings (1964)-"Geology of the Kapsabet-plateau area," Rept. No.63, GSK.

Table J3.8 Geological Assessment of the Nyando Damsite

River basin: Nyando, Sub-basin: IGC, River: Nyando

Item		Description
1.	Topography and geology	The damsite is located at a steep narrow gorge near the border between the hills and the Nyando Plain. Nyando river valley becomes wider and more gentle in the reach downstream from the damsite resulting to the formation of the vast Nyando Plain. The geology of the damsite consists of Tertiary phonolite lavas. The lavas are fresh and seem to be a monolith. The lava flow was almost horizontally. The lava does not include tuffs and agglomerates. Alluvium deposits consist of sands and some gravels. The deposits are mainly concentrated at the riverbed downstream from the damsite, while small deposits occur in the upstream area.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	About 70m
4.	Construction materials	
	Core	Residual red-brown soils on the gentle slopes around the downstream area can be used as for impervious fill materials.
	Filter	Alluvial sands are available along the downstream reaches of the Nyando. Removal of oversize particles will be necessary.
	Rock	Phonolites occuring in the upstream area can be used as rock materials and concrete aggregates.
5.	Dam type	The geological conditions are suitable for either a concrete gravity dam or a rockfill dam. The latter appears to be much more economical.
6.	Foundation treatment	No major problem is foreseen.

Table J3.9 Geological Assessment of Magwagwa Damsite

River basin: Sondu, Sub-basin: 1JG, River: Sondu

Item	Description
1. Topography and geology	The geology of the region consists of metamorphic rocks of sedimentary rocks origin, Precambrian igneous rocks, Post-Cambrian granitic intrusious. Tertiary volcanics, and Pleistocene to Holocene river deposits. The geology at the damsite consists largely of andesites of Bukoban system. Dolerite of the Bukoban system occurs at the upper half of the right bank. Andesite is homogeneously and widely distributed in the foundation area. Cracks in andesites could be sealed with grouting in the absence of clay seams intercalations The top soil and residual soil at the top of the right bank is estimated to be 5m to 8m in thickness. The geology of the saddle damsite is composed of lateritic soil, fractured andesite and sandstone of the Bukoban system.
2. Possibility of dam construction	Possible.
3. Maximum dam	120m in height with a saddle dam at Magwagwa village.
4. Construction materials	
Core	Possible borrow areas are located in the upstream areas of both banks and also near the saddle dam site.
Rock	The rock materials quarry site is located on the left bank about 1km downstream from the damsite. Porphyritic andesite is suitable for both concrete aggregates and rock materials.
5. Dam type	A rockfill dam is suitable.
6. Foundation treatment	No specific difficulty is foreseen.

Table J3.10 Geological Assessment of Namba Kodero Damsite

River Basin: Kuja, Sub-basin: 1KC, River: Migori

Item	Description
1. Topography and geology	This site is located at a narrow river valley which is flanked by ridges extending in a northwest southeast direction. Migori River is wider at both downstream and upstream portions except at the damsite. The geology around the damsite is composed of shales, slate, slaty tuffs, greywacks, epidiorites, diorites, granite porphyrites and banded ironstones of the Precambrian Nyanzian system. The bedrock at the site comprises the Nyanzian low grade metamorphic slate with well developed schistosity. This rock is hard and strong enough for dam foundations. Foliation in the bedrock trends generally east-west and dips steeply south but partially varied northwest-southeast in strike. Overburden in the area generally consist of red to reddish brown residual soil containing some angular fragments of various degrees of weathering. A variable thickness of the soil covers the proposed damsite and the surrounding areas. A Pre-Tertiary Masaba Fault which runs approximately NW-SE in direction is located across the river about 2 Km downstream from the proposed damsite. Although no major and minor fault have been found at damsite, a lineament which runs in the same direction as Masaba Fault is recognized about 250m upstream from the damsite. This lineament is possibly a fault.
2. Possibility of dam construction	Fairly possible from the geological aspect.
3. Maximum dam height	60 m
4. Construction materials	

	Core	Residual red soil is suitable for core materials. About 1 Km upstream the soils are considered to be thick and extensive.
	Filter	No sandy materials are available around the damsite. Further investigation covering a wider area required.
	Rock	The greywackes and the diorites located about 1.5 and 3 Km, respectively upstream from the damsite are possible source of rock materials.
5.	Dam type	This site is suitable for a rockfill dam.
6.	Foundation treatment	Sufficient grouting will be required to seal off schistosity planes.

Table J3.11 Geological Assessment of Katieno Damsite

River basin: Kuja, Sub-basin: 1KB, River: Kuja

Item	Description
1. Topography and geology	This site is located just downstream of the confluence of the Kuja river and the Oyani river, where the tail water of the existing Gogo dam reaches. The terrain around the damsite is part of the broad Nyanza low plateau physiographic unit which exists as an erosion plain around the Lake Victoria. The plain is incised very gently by the Kuja river, while there are many projections as the rock ridges or isolated hills in the plain. The right abutment is one of these rock ridges. On the other hand the left abutment is on the erosion plain so that the slope is almost flat. The geology around the damsite consists of Precambrian Nyanzian porphyritic andesites. Kavirondian conglomerates occurs in the area about 2km downstream of the damsite just downstream of the existing Gogo dam and extends further. Porphiritic andesites at the damsite are very hard and are resistance to weathering. For this reason, there are extensive outcrops of fresh rocks. The rocks have less developed joints, form massive bedrocks. The firm bedrock is overlain by a thin weathered layer which is presumed to be several meters thick. Residual soils are light- brown to light - grey colored silty sand to sandy silts and partially show a reddish brown color. This overburden seems to be thin. The alluvium deposits along the Kuja River consist mainly of sands, 2 to 3 which are about meters thick. They are wide spread around the confluence of Kuja river and Oyani river. The reservoir of Gogo dam is filled with alluvial deposits.
2. Possibility of dam construction	A high dam is possible from the geological point of view. Owing to the flat topography on the left bank, however, there would be a limit in dam height from the cost-effectiveness viewpoint.

3.	Maximum dam height	Preferably less than 20m, subject to further optimization study.
4.	Construction Materials.	
	Core	Residual soils seem to be generally thin and sandy. Recuperation work would require a large borrow area. In case the soils are found not to be fit for core material through tests, further investigation for alternative sources will be required.
	Filter	The alluvial sands in the Gogo dam and around the confluence of the Kuja river and Oyani river can be used.
	Rock	The rocky ridges near the damsite are possible quarry areas.
5.	Dam type	Rockfill dam
6.	Foundation treatment	Foundation condition is expected to be good and would not require complicated treatment.

Table J3.12 Geological Assessment of Kerio-A Damsite

River basin: Kerio, Sub-basin: 2CD, River:Kerio

Item	Description
1. Topography and geology	The left bank of the site has a gentle slope comprised of colluvium deposits. These unconsolidated deposits are probably thick and consist of gravel, sand and soil. The right bank has a steep escarpment which is probably a fault.
2. Possibility of dam construction	Difficult to construct or impossible due to the presence of a major faults at the dam axis.
3. Other Items	No comment is given in view of Item 2 above.

Table J3.13 Geological Assessment of Sererwa Damsite

River Basin : Kerio Sub-basin : 2CC, River: Arror

Item	Description
1. Topography and geology	The right side flank shows a regular profile and acclivity of 23 degrees on the average, while the left side flank is at a low acclivity of about 11-12 degrees. Rocks at the damsite are composed of alterations of two varieties of gneisses. The rock locally outcrops in the river bed and occasionally in small spots scattered on the flanks. The foliation strike stretching sub-parallel to valley axis is landslide resting with the mean angle steeper than the slope angle on the right bank and is bank-holder on the left side. Silty to sandy residual soil is at an average thickness of about 20m from the ground level in the river bed. The thickness of the weathered rock layer which acts at the transition between the residual soils and the bedrocks is more or less constant around 15-20m. The general bedrock trend is characterised by uniform slope from the bed to shoulder that lies at variable depths ranging between 21 and 50m.
2. Construction materials	
Rock	All the rock types found throughout the study area can be considered as having the required mechanical and durability characteristics to be used for the dam shells construction and as concrete aggregates. The granitoid types should be preferred in general, owing to their better resistance to weathering processes.
Filter	The advanced weathering product of rocks belonging to the group of metagranites and to the close alternation of granites amphibolite gneiss is assumed for the transition zones. But no sandy materials which are more fine grain than weathering product of rocks are present.
Core	They are represented by SM-MH type of soils which are available in large quantite around the damsite area.
3. Foundation treatment	The foundation of the impervious fill area is to be excavated on compact rock while the shell zones would have to rest on residual soil and/or weathered rock layers.

Source: Feasibility study on the Integrated Development of the Arro River Basin (1990), KVDA.

Table J3.14 Geological Assessment of Molo Damsite

River basin: Molo, Sub-basin: 2EG, River: Molo

Item		Description
1.	Topography and geology	The site is located in a relatively steep valley which widens gradually towards the top. The foundation rocks are Tertiary trachytic pyroclastics mainly composed of tuffs, quartz trachytes, welded tuffs, agglomerates and sediments. The tuffs display well developed joints which are generally slightly open. Red brown soils are fairly thick and overly the foundation rock at higher part of the valley.
2.	Possibility of dam construction	Not difficult to construct.
3.	Maximum dam height	60m
4.	Construction materials	
	Rock	Tuffs are available but they are considered to be light and not mechanically strong enough.
	Filter	No sandy materials are available around the damsite.
	Core	Red brown soils around the damsite can be used as core material.
5.	Dam type	Rockfill
6.	Foundation treatment	Grouting will be required to seal off cracks and/or joints. Considerable excavation is to be carried out at higher parts.

Table J3.15 Geological Assessment of Malewa Damsite

River basin: Malewa, Sub-basin: 2GB, River: Malewa

Item		Description
1.	Topography and geology	The site is located in a steep V-shaped river valley. The geology of the site is composed of Pliocene welded tuffs, massive tuffs and lacustrine deposits. The Pliocene series of the pyroclastic rocks with the lake sediments generally show subhorizontal bedding. Overburden in this area is generally Quaternary colluvial deposits which are several meters thick.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	70m
4.	Construction materials	
	Rock and Concrete aggregates	Not available at the damsite. However, a suitable quarry is located about 5km away along the Kipipiri road. Rocks of the site consist of welded tuff and high degree welded tuff. The latter is suitable for concrete aggregates.
	Filter	The nearest sand source is located near Nakuru town about 65km away from the damsite. However, the sands are not of good quality. Rock quarrying is the only way to obtain filter materials.
	Core	Suitable soils are located about 17 km southwest from the damsite. The tuffaceous residual soils and lateritic soils are the predominant types of soil for core embarkment which are not thick.
5.	Dam type	Concrete gravity dam is difficult because of weakness of lake sediments in the river bed. A rockfill dam is the most suitable type of dam.
6.	Foundation treatment	Excavation at the river bed down to 8 meters for foundation of impervious fill in the riverbed section. It is necessary to extend the grout curtain deep into both abutments possibly with rim grouting.

Source: Study for Construction of Dam in Malewa River System, Greater Nakuru Water supply project Eastern Division (1990), MOWD and NWCPC

Table J3.16 Geological Assessment of Oldorko Damsite

River basin:	Sub-basin:	River:
Ewaso Ngiro south,	2KB,	Ewaso Ngiro south,

Item		Description
1.	Topography and geology	The dam will abut up against the escarpment on its right side. For the most part, residual volcanic soils should predominate with minor deposits of alluvium along and adjacent to the river. An accumulation of talus material is expected to exist at the base of the escarpment. The bedrock at the damsite consists of Pleistocene and Pliocene basaltic and trachytic lavas. Volcanic ash deposits also exist in the area. In the bedrock the presence of many major and minor faults is to be considered. Overburden in the area comprises a thin residual soil derived from the volcanic rocks.
2.	Possibility of dam construction	There should be many major and minor faults in the bedrock of the proposed site. If the faults are found to be active, it would be difficult to construct a dam. The final decision on the possibility of dam construction depends on further detailed investigations.
3.	Maximum dam height	50 to 60m
4.	Construction materials	
	Core	The volcanic soils at the damsite area are suitable.
	Filter	Sand deposits are not available near the damsite.
	Rock	Most of the rocks from the underground and opencut excavations will be used as rock fill in the dam. Additional rockfill material can be quarried from the volcanic lava rocks around the damsite.
5.	Dam type	This site appears to be suitable for a rockfill dam from the topographical and geological point of view.
6.	Foundation treatment	Since the weakening of the bedrocks under the influence of faults are expected, complicated treatment will be required.

Source of information: Kenya National Power Development Plan 1986- 2006 (1987), MOE/KPC

Table J3.17 Geological Assessment of Leshota Damsite

River Basin:	Sub-basin:	River:
Ewaso Ngiro south,	2KB,	Ewaso Ngiro south,

Item	Description
1. Topography and geology	The Ewaso Ngiro South River originates on the Western flanks of the Mau escarpment and flows in a generally southernly direction over the Nguruman escarpment on its way to emptying into Lake Natron in Northern Tanzania. The Ewaso Ngiro River runs in a deep gorge. The river alignment down the face of the scrap may be fault controlled. The rift valley floor at the base of the escarpment is broken by numerous small fault escarpments which from step-like strips descending to the east trending north-northeast. It is considered that this part of the rift valley is still seismically active. The rocks exposed at the proposed sites are volcanic in origin consisting mainly of Pleistocene and Pliocene basaltic and trachytic lavas. Volcanic ash deposits also exist in the area. The quality of the lava rocks should be suitable for underground excavation as well as an embankment dam foundation however, the presence of major and minor faulting, weak and/or weathered subsurface ash deposits and subsurface weathered lava horizons cannot be discounted and should be studied during future investigation. Overburden on the plateau at the proposed Leshota damsite is generally a thin residual soil derived from the volcanic rocks. Some granular alluvium material in generally small quantities is anticipated in the vicinity of the existing rivers.
2. Possibility of dam construction	There are several major and minor faults in the bedrock of the proposed site. The extent to which the bedrocks have been weakened under the influence of faults has not been estimated. Therefore, the possibility of dam construction is to be decided at a later stage.
3. Maximum dam height	110m

4.	Construction materials	
	Core	The volcanic soils existing at the damsite areas should be suitable for impervious fill.
	Filter	No suitable fine granular material has been noted near the damsite.
	Rock	The basalts and trachytes occuring in the area are suitable.
5.	Dam type	The foundation condition is not suitable for a concrete gravity dam. A rockfill dam would be economically viable.
6.	Foundation treatment	It is expected that considerable treatment works will be required for the improvement of the foundation conditions.

Source of information: Kenya National Power Development Plan (1986-2006), MOE/KPC

Table J.3.18 Geological Assessment of Marun Damsite

River basin: Turkwel, Sub-basin: 2BA , River: Iang

Item	Description
1. Topography and geology	The site is located along the Iang seasonal river and is about 2km upstream from the confluence with Marun river. The terrain around the damsite is characterised by a narrow deep gauge forming a V-shaped valley while in the upstream side of the damsite, the valley is wide and has rather gentle slopes. Hence the landform of this damsite and the reservoir is favourable. The geology around the damsite consists of Precambrian Basement schists, ultrabasic rocks and crystalline limestones while the dam foundation rock comprises crystalline limestones. The crystalline limestones at the damsite have well developed laminations and joints. Laminations and bedding strike in the N-S direction across the river and dips about 50 degrees eastward (downstream). Most joints of the crystalline limestones vary from slightly to rather widely open and water leakage through the joints can be seen in some places. Overburden is interspersed in most places. Limestone outcrops are seen elsewhere on the slopes from the river bed to the hill tops. The weathered layer of limestone is probably thin. Alluvial deposits of variable thicknesses consist of sands, gravels, cobbles, and boulders accumulated in the river bed.
2. Possibility of dam	The existence of water passages through the limestone indicates that the joints are variable in sizes and their continuity. It seems difficult to seal off water leakage. The worn would require a considerable amount costs. Hence it is considered difficult to construct a dam at this site.

Table J3.19 Geological Assessment of Munyu Damsite

River basin: Athi, Sub-basin: 3DA, River: Athi

Item		Description
1.	Topography and geology	The valley bottom is flat and wide resulting to a topographically U-shaped valley. The left river bank rises gradually to form a steep tuff escarpment. The geology of the site is composed of Tertiary volcanic rocks which overlie the hard fine grained Kapiti phonolite. The higher parts of both river banks are composed of the Tertiary deposits.
2.	Possibility of dam construction	Possible to construct a dam
3.	Maximum dam height	50m
4.	Construction materials	
	Concrete aggregates	It appears difficult to obtain concrete aggregates around the damsite, other than recuperation from a quarry.
	Rock	Stratigraphically, the area has two rock types which differ may much on hardness Hard rocks (phonolite and welded tuffs) can be used for the outer shell embankment and soft rocks can be used in the transition zone. The rocks can be quarried separately for outer shells and transitions.
	Filter	The alluvium on the valley floor tends to contain a high sand content.
	Core	Suitable soils are not available in large quantities at the dam site.
5.	Dam type	Rockfill is favoured
6.	Foundation treatment	Sufficient grouting is required to seal off water leakage.

Table J3.20 Geological Assessment of Kiteta Damsite

River Basin: Athi, Sub-basin: 3EB, River: Kiteta

Item		Description
1.	Topography and geology	The rocks are biotite gneiss at the damsite. Granitoid gneiss, banded gneiss and migmatite of the Kenya basement system cover the surrounding areas.The rocks outcrop in the river bed at many locations. Depth to fresh rock varies from 0-2m in the river channel to 6-13m on the upper slopes of the valley sides. Alluvial sand is present in thicknesses of up to 2 m. The river banks were for the most part formed by sandy silty clay with gravel layer visible in places in the lower parts of the banks. The clay gravel layer is 1 m thick on average.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	30-35m
4.	Construction materials	
	Rock	Weathered rock zones are suitable for rock embankment
	Filter	Sufficient sand quantities are available along the river bed and the nearby seasonal streams.
	Core	Residual soil is suitable for core materials
5.	Dam type	Rockfill with a central clay core with upstream and downstream weathered rock transitions and rockfill shoulders.
6.	Foundation treatment	Excavation will be required for a few meters depth.

Sources of information: Kiteta Water Supply Project- Kiteta Dam (1983) MOWD

Table J3.21 Geological Assessment of Thwake Damsite

River Basin: Athi, Sub-basin: 3FA, River: Athi

Item		Description
1.	Topography and geology	The site is located just downstream of the confluence of the Athi river and the Thwake River. Athi river flows down in the Yatta plateau in a NNW-SSE direction and the Thwake river enters the Athi River from the west bank immediately upstream of the damsite. The geology around the damsite is composed of Precambrian Basement gneisses in which granitoid gneisses are distributed mainly on right bank and biotite gneisses on left bank, interbeding a little amphibolites. Miocene Kikipili phonolites cover the Yatta plateau. Though the structure of the Basement system is shown to be NW-SE in strike and 40-50 degrees SW in dip on 1:125,000 scale geological map (Dodson R.G.1953- Geology of the South-east Machakos Area). Foliation at the river bed of the damsite is E-W in direction and dips 20-30 degrees northwards. Overburden is composed of residual red brown soils which overly the weathered rocks. Weathered rock layer is probably thick at the damsite except at the flank of Yatta Plateau. Thick alluvium sands have accumulated widely along the Thwake river and Athi river downstream from confluence of Thwake river.
2.	Possibility of dam construction	This site has a possibility of dam construction, but the sedimentation rate is estimated to be quite high.
3.	Maximum dam height	Some 80m
4.	Construction materials	
	Rock	Rocks at the flank of Yatta Plateau which are exposed on the left bank of the damsite can be quarried for use as rockfill.

	Filter	Alluvial sandy materials along the Twake River and Athi River can be used.
	Core	Residual reddish-brown soils and heavily weathered rock around the damsite can be used as the sources of core material.
4.	Dam type	Rockfill dam is suitable.
5.	Foundation treatment	No complicated foundation treatment will be required.

Table J3.22 Geological Assessment of Yatta Kiboko Damsite

River basin: Athi, Sub-basin: 3FD, River: Athi

Item		Description
1.	Topography and geology	The site is located between two small ridges occuring on both sides of the river. The right bank is very gentle. The foundation rocks are gneisses of the Pre-cambrian Basement system. Remarkable folding was observed. Schistosity is developed and corresponds to the river flow direction. The rocks are hard and slightly weathered in the river bed and heavily weathered towards the ridge top on the right flank.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	50m
4.	Construction materials	
	Concrete aggregates	It is difficult to obtain suitable granular concrete aggregates around the damsite.
	Rock	Fresh and slightly weathered gneisses around the damsite can be used
	Filter	Sandy alluvial deposits in the river bed can be used but quantity will not be sufficient. There would be enough sandy materials available along the Kiboko River which flows into upstream side of the damsite.
	Core	Red brown loamy soils occuring in higher part around damsite can be used.
5.	Dam type	Rockfill
6.	Foundation treatment	Sufficient rim grouting will be required to stop water leakage.

Table J3.23 Geological Assessment of Tsavo Damsite

River Basin: Athi, Sub-basin: 3G, River: Tsavo

Item		Description
1.	Topography and geology	This site is located between steep ridge abutments of quartz and hornblende gneisses, but the major ridges are in close proximity to each other, separated only by narrow zones of less resistant hornblende gneiss. Joints are generally tight.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	40m
4.	Construction materials	
	Rock	Rockfill is abundant in the area and easily obtained near the damsite.
	Core	No suitable deposits of fine materials for the impervious core were found in the immediate locality. There is however a suitable deposit of fine materials 9 km away.
5.	Dam type	Foundation and abutment conditions would be suitable for either a concrete gravity or a rock-fill dam.
6.	Foundation treatment	There is a slight possibility that water leaks from the bottom of the reservoir. Further investigation is recommended.

Source of information: Athi River Basin Pre-investment Study (1981), TRDA

Table J3.24 Geological Assessment of Baricho Damsite

River Basin: Athi, Sub-basin: 3HB, River: Sabaki

Item		Description
1.	Topography geology	The site is located in a wide river valley with gentle slopes on both sides. Foundation rocks on the abutments consist of Jurassic sandstone. The rocks are hard and contain a few joints. The depth of the weathered layer is estimated to be thin. An inferred Lango Mbaya fault is located across the river about 300m upstream from the proposed dam axis. Alluvial sands of considerable thickness occur along the river bed.
2.	Possibility of dam construction	No specific difficulty in constructing a dam. However, sedimentation rate seems to be high.
3.	Maximum dam height	50m
4.	Construction material	
	Concrete aggregates	There is a sandstone quarry located about 1.5km downstream which was used for the construction of the Baricho water treatment works.
	Rock	Sandstones around the damsite can be used.
	Filter	There are large quantities of sand deposits in the riverbed.
	Core	Red brown soils overlying the sandstones are estimated to be 3-5m thick and can be used as core materials.
5.	Dam type	Rockfill dam is favoured

Table J3.25 Geological Assessment of Rare Damsite

River basin: Rare, Sub-basin: 3L, River: Rare

Item		Description
1.	Topography and geology	Foundation rocks are Jurassic sandstone and siltstone. Sandstone is hard and strong while siltstone is relatively weak and broke easily. The strike of the siltstone strata is approximately N-S and dips about 30 degrees eastwards. The left river bank is weakened by the siltstone layers dipping into the river bed and the reservoir. There are two other alternative sites. One is located about 3km downstream and the other is located about 20km downstream at Kajora.
2.	Possibility of dam construction	Possible to construct a dam but the site is not so good because of the weak nature of the siltstone. River discharge is also small.
3.	Maximum dam height	50m
4.	Construction materials	
	Concrete aggregates	Sandstones can be used provided that thick sandstone layer is identified.
	Rock	Sandstones or a sandstone and siltstone combination is a possible source of rock materials where sandstone portion should be predominant in the latter.
	Filter	No sand materials are available at the damsite. Further investigation covering a wider area is required.
	Core	The red brown soils in the vicinity of the damsite can be used. The thickness of the soils and its quantity should be investigated.
5.	Dam type	This site is suitable for a rockfill dam.
6.	Foundation treatment	Preventions of slaking in the shales will be necessary after excavation. There is a possibility of sliding on the right river bank. Hence careful planning and excavation work will be required.

Table J3.26 Geological Assessment of Pemba Damsite

River basin: Pemba, Sub-basin: 3MC, River: Pemba

Item		Description
1.	Topography and geology	The site is located in a V-shaped valley. Foundation rocks are Triassic sandstones which are hard and strong. Rock outcrops are visible in all areas from the riverbed to the top of hills. The thickness of the weathered zone around the damsite is presumed to be small.
2.	Possibility of dam construction	No major difficulties are foreseen in construction.
3.	Maximum dam height	80m
4.	Construction materials	
	Concrete agg. and Rock	Sandstones around the dam site can be used.
	Filter	No sands are available around the damsite. Further investigation covering a much wider area is required.
	Core	There are no suitable soils around the dam site. However, there should be suitable soils near Kwale town or Kibaoni.
5.	Dam type	Concrete gravity type appears to be favourable. In case of rockfill type, planning for the spillway would be difficult.
6.	Foundation treatment	Foundation condition is expected to be good and would not require complicated treatment.

Table J3.27 Geological Assessment of Mwachi Damsite

River basin: Mwachi, Sub-basin: 3MD, River: Mwachi

Item		Description
1.	Topography and geology	The site is located in a meandering valley about 1 km upstream from the estuary. Foundation rocks are Jurassic sandstone which are hard and strong. Rock outcrops are visible along the riverbed only. The slopes and the hill tops are covered by residual soils. The area around the damsite is covered by a forest. Alluvial deposits consisting mainly of silt and sandy clay are present along the riverbed and are several meters thick.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	70m
4.	Construction materials	
	Concrete aggregates	Sandstones around the damsite can be used if the weathered zone is not thick.
	Rock	Sandstones can be used.
	Filter	No sands are available around the dam site. Further investigation covering a wider area is required.
	Core	Impervious soil material around the damsite is not sufficient. Further investigation is required.
5.	Dam type	Foundation condition is suitable for both concrete gravity and rockfill dam.
6.	Foundation treatment	The foundation condition is expected to be good and would not require complicated treatment.

Table J3.28 Geological Assessment of at Thiba Damsite

River Basin: Tana, Sub-basin: 4DA, River: Thiba

Item		Description
1.	Topography and geology	Pleistocene basalts and Terciary agglomerates are developed around the Thiba damsite. They lie almost horizontally. The basalts sometimes reveal hexagonal jointing. Heavily weathered pyroclastic materials are observed over these basement rocks with an average thickness of 10-20m. Heavily weathered agglomerates with a thickness of about 4m are also observed in the damsite foundation under the boundary of basalt.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	40m
4.	Construction material	
	Rock	Moderately weathered basalts and slightly weathered basalts are possible rock material sources. A potential quarry site is located about 2 km upstream from the dam site. Joints are well developed in moderately weathered basalts and faint cracks are developed in slightly weathered basalts.
	Filter	Highly weathered agglomerates are suitable for transition materials. They will become gravelly soil through the process of excavation. Quarry site is located about 35km upstream.
	Core	The borrow area is located about 1km upstream from the damsite. The content of fine grained soil under # 74 in particle size is rather high and the plasticity index is about 20. Therefore red soils have enough imperviousness as a core but slightly small resistance for piping.
5.	Dam type	Zoned fill dam. A concrete dam would not be economical in view of the geological conditions.
6.	Foundation treatment	Impervious blanket laying is recommendable as a measure of foundation treatment in view of possibility of heavily weathered agglomerates with a thickness of about 4 m.

Source of Information: Feasibility Study on the Mwea Irrigation Development Project (1988),MOE/ RDNIB/TRDA

Table J3.29 Geological Assessment of Karura Damsite

River basin: Tana, Sub-basin: 4EB, River: Tana

Item		Description
1.	Topography and geology	The site is located between Kiambere dam and Kindaruma dam. The site is already flooded by Kiambere dam reservoir which extends for about 3km further upstream from the site. Foundation rocks are gneisses which are overlain by soils.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	Approximately 20m above the high water level of the Kiambere dam reservoir
4.	Construction materials	
	Concrete aggregates	Not available around the damsite.
	Rock	Not available around the damsite. However, sufficient rocks are easily available, though relatively far from damsite.
	Filter	Not available around the damsite. Further investigation in a wider area is required.
	Core	Residual soils around the damsite are readily available for borrowing
5.	Dam type	Rockfill dam
6.	Foundation treatment	No complicated foundation treatment will be required.

Table J3.30 Geological Assessment of Mutonga Damsite

River basin: Tana, Sub-basin: 4FA, River: Tana

Item		Description
1.	Topography and geology	The site is located on the western edge of the broad basement system erosion plain which exists to the east of Mt. Kenya. Frequent isolated or groups of rock knobs made up of resistant basement rock rise above the generally rolling plain. Overburden at the site consists of a thin covering of residual soil which is mainly sandy gravel or silty gravelly sand. Some silty clay or clayey silt residual soil or weathered alluvium also exists in the project area in relatively small deposits. Bedrock at the site belongs to the Archaean Basement system consisting of metamorphic gneisses or migmatites which have been intruded by small contemporary bodies of granite and pegmatite. A discontinuous sedimentary deposit of a younger calcareous sandstone, limestone conglomerate overlies part of the basement rock in the damsite area on the south side of the Tana river. Degree of weathering and strength of the bedrock are variable. Results from the 1979/80 period investigations indicate that the bedrock is typically weathered to a depth of about 30m. The foliation of the gneissic bedrock trends consistently in a north- northeasterly direction with a moderate to steep dip to the west-northwest. No major faulting was identified in the immediate damsite area.
2.	Possibility of dam construction	The site would be suitable for a dam construction. At Grand Falls site, there exists a possibility of building a high head project that would develop the head right up to the Kiambere tailwater, and would thus preclude this Mutonga project.
3.	Maximum dam height.	50m
4.	Construction materials	
	Rock	The source of rock materials will be mainly various proposed opencut and underground excavations which should yield a useful rockfill. Further, two rock hills located within 3 km southeast of the damsite have been identified as potential sites for rock quarries.

	Filter	Only small quantities of alluvial sand which should be suitable for use as filter material are available in the immediate damsite area. Other larger deposits of usable alluvial material are available in the seasonal Mukindu and the Kanyaka rivers, within 4km of the damsite.
	Core	Three potential borrow areas consisting mainly of silty or clayey residual soil have been identified within 3 km from damsite.
5.	Dam type	Rockfill.
6.	Foundation treatment	No complicated foundation treatment will be required.

Source of Information: Kenya National Power Development Plan 1986-2006 (1987), MOE/KPC

Table J3.31 Geological Assessment of Grand Falls Damsite

River basin: Tana, Sub-basin: 4FB, River: Tana

Item	Description
1. Topography and geology	The terrain in the Grand Falls area is part of the broad basement system physiographic unit which exists as an erosion plain to the east of Mt Kenya. Rising above the plain are numerous rock ridges and knobs composed of resistant gneisses of the basement rock. The Tana River has eroded a moderately deep gorge through this area. Overburden in the project area consists of mainly residual soil existing as a thin widespread mantle overlying a variable weathered bedrock surface. The soil is generally a silty clayey soil with variable amount of sand, gravel and weathered rock fragments. Alluvium in the form of fine to course sand with variable amounts of silt, gravel and cobbles is found in relatively small quantities around the site confined to the banks of the Tana river and the beds of surrounding small seasonal rivers. Colluvial cobbles and bolders are frequently mixed with the alluvial deposite. Bedrock at the site belongs to the Kenya Basement system and consists of Archaean metamorphic gneisses and some rare crystalline limestone. The main rock types are mafic gneisses which sometimes appear magmatic due to the presence of closely spaced felsic bands. Also present are granite gneisses, banded gneisses and calcsilicate gneisses. The bedrock is variably weathered and in many locations was found to be weathered to significant depth. The more mafic gneisses tend to be the most highly weathered. Foliation of the gneissic bedrock strikes consistently to the north- northeast and dips generally steepy to the west-northwest.
2. Possibility of dam construction	Possible
3. Maximum dam height	120m

4. Construction materials

Rock	Numerous rock ridges or rock knobs formed from the resistant hills. Better quality rock exists around the site and would make suitable rock quarry sites.
Filter	Naturally occuring alluvial sand material, believed suitable for use as a filter material, are available in relatively small quantities along the banks of the Tana river and some of the smaller seasonal rivers in the area. Because of limited quantities in the immediate project area, it is likely that granular material will have to been brought in from as far away as the Kalanga river some 9km south of the damsite.
Core	Widespread silty, clayey residual soil which exists in the area as a thin covering over the bedrock, would be suitable for use as impervious materials. Ample supply of suitable residual soil is available for use as impervious fill.

5. Dam type — Rock fill

Source of information: Kenya National Power Development Plan 1986-2006(1987), MOE/KPC

Table J3.32 Geological Assessment of Usueni Damsite

River Basin: Tana, Sub-basin: 4FB, River: Tana

Item		Description
1.	Topography and geology	The Usueni damsite is located on the broad erosion plain which is located east of Mt Kenya. The bedrock in the area belongs to the Precambrian Basement system and consists of strong granite gneiss with minor bands of weaker mafic gneiss. Overburden in the area is generally a reddish brown or brown residual soil existing as a thin widespread mantle overlying a variably weathered bedrock surface. The soil is generally a sandy silty soil with variable amount of clay, gravel and weathered rock fragments. Alluvium soils have been deposited in the valley of Tana river and surrounding seasonal rivers. Foliation of the gneissic bedrock strikes consistently to the north-south and dips generally steeply west. Foliation is most prominent in the more mafic gneisses and is sometimes barely detectable in the granite gneisses.
2.	Possibility of dam construction	The site is suitable for a dam construction. At Adamson's Falls, however,there exists a possibility of developing a high head project that would develop the head right up to the Grand Falls tailwater and would thus preclude the Usueni project.
3.	Maximum dam height	40m
4.	Construction materials	
	Rock	Rock from underground and open cut excavations can be used as rockfill materials. Additional quantities of rockfill can be obtained from the resistant hills about 3km northwest from the damsite or about 5km southwest from the damsite.
	Filter	Filter materials may be available from the seasonal streams near the damsite such as Thangatha River, Mabuura River , Nzauzeni river which enters the Tana river.
	Core	The residual soil available about 6km northwest from the damsite appears to be suitable impervious material. Although it exists as a thin cover over the bedrock, it is believed to be widespread enough for use.
5.	Dam type	Rockfill
6.	Foundation treatment	No special foundation treatment will be required.

Table J3.33 Geological Assessment of Adamson's Falls Damsite

Rive Basin: Tana, Sub-basin: 4GA, River: Tana

Item		Description
1.	Topography and geology	The site is located on the broad erosion plain to the east of Mt. Kenya. The bedrock in the area belongs to the Precambrian Basement system and consists mostly of light coloured strong granite gneiss with minor bands of darker weaker mafic gneisses. There is evidence of numerous quartz veins and pegmatic intrusions in the foliated host rock. In some locations the mafic gneisses contain crystalline limestone bands and metamorphosed remnants of other types of sedimentary rocks. Foliation in the bedrock trends generally north-south and dips steeply upstream. A thin residual soil covers the proposed damsite and the surrounding areas. This soil is derived from the underlying basement gneisses and is expected to consist of silty to sandy clay with variable amounts of rock fragments depending on the degree of weathering of the parent rock. Alluvial soils have been deposited in the valleys of the Tana river and surrounding seasonal rivers.
2.	Possibility of dam construction	Geologically, this site has a possibility for dam construction.
3.	Maximum Dam height	50m
4.	Construction materials	
	Rock	Rock from the underground and opencut excavations should be usable as random rockfill material.
	Filter	Filter material may be available from the seasonal streams near the damsite. Selective processing of the stream bed material may be necessary to remove any undesirable oversize materials such as coarse gravel cobbles and boulders. If volumes are insufficient from the existing stream bed, additional quantities could be obtained by processing quarried rock.

	Core	The residual soil in the vicinity appears to be a suitable impervious material. Although it exists as a thin cover, it is believed to be widespread enough for use in dam construction.
5.	Dam type	Rockfill

Source of information: Kenya National Power Development Plan 1986-2006 (1987), MOE/KPC

Table J3.34 Geological Assessment of Kora Damsite

River Basin: Tana, Sub-basin: 4GB, River: Tana

Item	Description
1. Topography and geology	The Kora damsite is located on the broad erosion plain which exists to the east of Mt. Kenya. Around the damsite there are numerous hills or inselbergs which rise above the surrounding plain. These are formed from resistant basement rocks and occur in groups or discontinuous north-south trending ridges. The damsite is located at one such ridge just east of the mouth of the seasonal Ndajeri river. Overburden in the area is generally a reddish brown residual soil containing angular fragments of variably weathered bedrock. Where present, the residual soil cover is thin and probably does not exceed 1 or 2 m in thickness. Sand and gravel are found in most of the seasonal rivers of which the Ndageri is the largest. At river level on the north bank along the alignment there is a deposit of alluvial sand with some silt and clay. This deposit extends several hundred meters downstream from and more than 1 km upstream from the dam centre line on the north bank. Bedrock in the project area is the Precambrian high grade metamorphic gneisses. Compositions range from a somewhat massive lightly foliated granite gneiss to a strongly foliated dark grey biotite gneisses. The predominantly granite gneisses bed rock is generally strong, however more highly weathered mafic gneisses are formed weaker zones and are expected to underlie some of the lower soil covered areas. The trend of the foliation rock contacts and fold axes is north to south or north-northwest to south-southwest. Foliation plains dip steeply to the east. Large scale folding appears to plunge toward the north at 20 to 30 degrees. The thickness of the weathered bedrock surface would be up to 20 to 30 m thick.
2. Possibility of dam construction	Possible

3.	Maximum dam height	60m
4.	Construction materials	
	Rock	Most of the excavated rock from the tunnels and structure foundations would be usable. Also the numerous ridges and hills, such as Kora hills about 3km south of the river, contain large quantities of what should be quality rock and would make suitable quarry site.
	Filter	Suitable sandy material may be available in the bed of the seasonal Ndajeri river, which enters the Tana river from the north bank immediately upstream from the dam alignment.
	Core	A potential borrow area for impervious or semi-impervious material exists on the north bank of the Tana river in the area immediately upstream from the mouth of the Ndajeri river. The materials are of flood plain origin and consist of mainly sand with some silt and clay. Other areas of possible impervious material are located about 13km downstream from the site and also in the Hameye swamp where the flood plain is wide and continuous. Areas of residual soil in the vicinity of the dam may also prove to be a suitable impervious source.
5.	Dam type	Rockfill

Source of information: Kenya National Power Development Plan 1986-2006 (1987), MOE/KPC

Table J3.35 Geological Assessment at Rumuruti Damsite

River Basin: Ewaso Ngiro, Sub-basin: 5AA, River: Ewaso Narok

Item		Description
1.	Topography and geology	The site is located in a fairly steep valley. The foundation rock is the Miocene Rumuruti phonolite suite which overlies the Precambrian Basement system. The phonolites vary from porphyritic varieties to non-porphyritic lavas and exhibit various degrees of weathering. Major faulting has taken place at the dam site. If the alluvial basin upstream is taken to be a groben, then faults can be presumed to exist at its periphery. A major fault trending at 25 degrees E has been identified at the damsite while another fault is suspected to run parallel to the river in a N-S direction.
2.	Possibility of dam constr.	Possible
3.	Maximum dam height	60m
4.	Construction materials	
	Concrete aggregate	Further investigations and laboratory tests are required to determine whether the phonolites around the damsite can be used for concrete aggregates or not.
	Rock	The phonolites around the damsite can be used as rock materials Abundant soils and strongly weathered rocks are found along the valley slopes.
	Filter	Sands are not available around the dam site. Further investigation in a wider area is required.
	Core	The residual red-brown and lateric soils located close to the site can be used. The lateric soils contain weathered phonolite fragments.
5.	Dam type	Rockfill dam or earthfill dam.
6.	Foundation treatment	No special foundation treatment is required.

Source of Information: Rumuruti Water Supply Preliminary Design Report (1985), MOWD

Table J3.36 Geological Assessment of Kirimun Damsite

River Basin:	Sub-basin:	River:
Ewaso Ngiro North,	5DC,	Ewaso Ngiro North,

Item		Description
1.	Topography and geology	Ewaso Ngiro river flows rapidly northwards forming a narrow deep gorge at the damsite. The geology of the damsite consists of Precambrian Basement granitoid gneisses and banded biotitic gneisses. Overburden and weathered rock layer is estimated to be thin. The rocks are exposed widely from the riverbed to the top of the hills resulting to nearly bare rock surfaces. Foliations are almost N-S in direction and have sub-vertical dips. It is possible that the river flow direction is related to this foliation. Alluvial deposits and other unconsolidated deposits are almost absent.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	About 150m
4.	Construction materials	
	Concrete aggregates and Rock	Granitoid gneisses near the damsite can be used both for concrete aggregates and rock material.
	Filter	No sandy materials are available.
	Core	Residual lateritic soils or sandy silty soils are available about 3 to 4 km west of the damsite.
5.	Dam type	The foundation rock is firm and landform is a V-shaped deep gorge. Concrete gravity dam appears to be favourable. In case of a rockfill type, planning for the spillway alignment would be difficult.
6.	Foundation treatment	No specific difficulty is foreseen.

Table J3.37 Geological Assessment of Crocodile Jaw (Lorkinyang) Damsite

River Basin:	Sub-basin:	River:
Ewaso Ngiro North,	5DC,	Ewaso Ngiro North,

Item		Description
1.	Topography and geology	The site is located in a fairly steep V-shaped valley. Foundation rocks consist of slightly weathered gneisses. The foliations on the banded gneiss are in the same direction as the river flow. Overburden in the area is generally a reddish brown residual soil containing angular fragments of various degrees of weathering. The residual soil cover is thin and probably does not exceed 1 or 2m in thickness.
2.	Possibility of dam construction	Possible. No major difficulties foreseen in construction.
3.	Maximum dam height	70m
4.	Construction materials	
	Concrete aggregates	Gneisses around the damsite can be used.
	Rock	Gneisses can be used.
	Filter	No sands are available around the dam site. Further investigations are required especially along seasonal rivers
	Core	No suitable soils at the dam site. However, suitable soils should exist within a 10km radius from the site.
5.	Dam type	The foundation condition is suitable for both a concrete gravity dam and a rockfill dam.
6.	Foundation treatment	The site does not seem to require complicated foundation treatment.

Table J3.38 Geological Assessment of Archer's Post Damsite

River Basin: Ewaso Ngiro, Sub-basin: 5DA River: Ewaso Ngiro

Item		Description
1.	Topography and geology	The site is located in a broad basement system plain which exists to the north of Mt.Kenya. The terrain of the damsite is resistant hill on the left river bank abutment and low and small ridges with two saddles on the right bank side. Foundation rocks are gneisses in basement system which are very firm. Overburden in the area is a red or red brown residual soil covering the erosion plain with much thickness. A large volume of alluvial sands is found in the riverbed of the Ewaso Ngiro.
2.	Possibility of dam construction	Possible
3.	Maximum dam height	40m
4.	Construction materials	
	Rock and Concrete aggregates	The resistance gneisses located about 4km downstream can be used.
	Filter	The river bed contains large deposits of alluvial sands.
	Core	There exists sufficient red-brown soils within the vicinity of the damsite.
5.	Dam type	Rockfill
6.	Foundation treatment	Sufficient measures to prevent leakage of water should be taken especially at the right bank abutment.

FIGURES

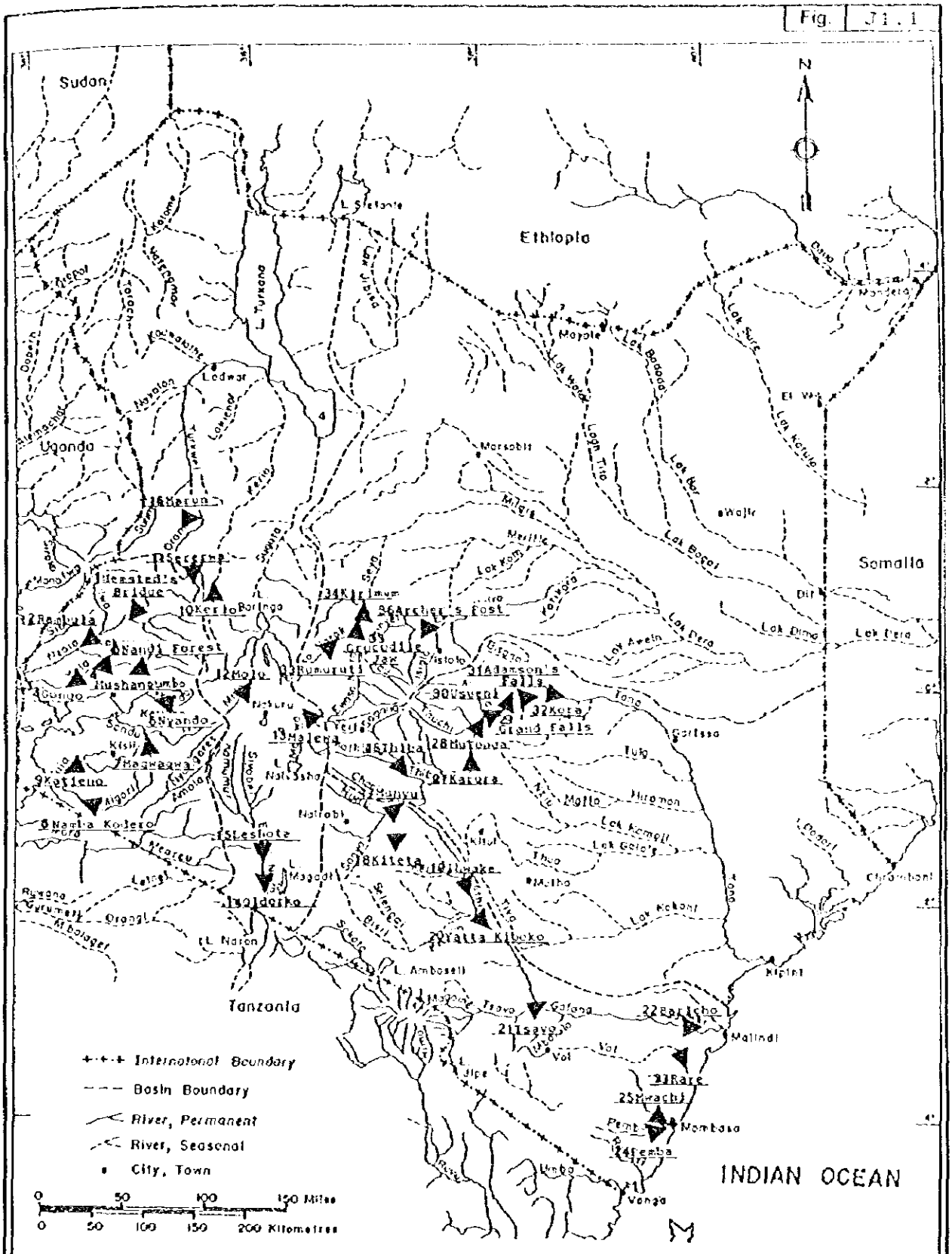

Figure J1.1 Location of Damsites Surveyed

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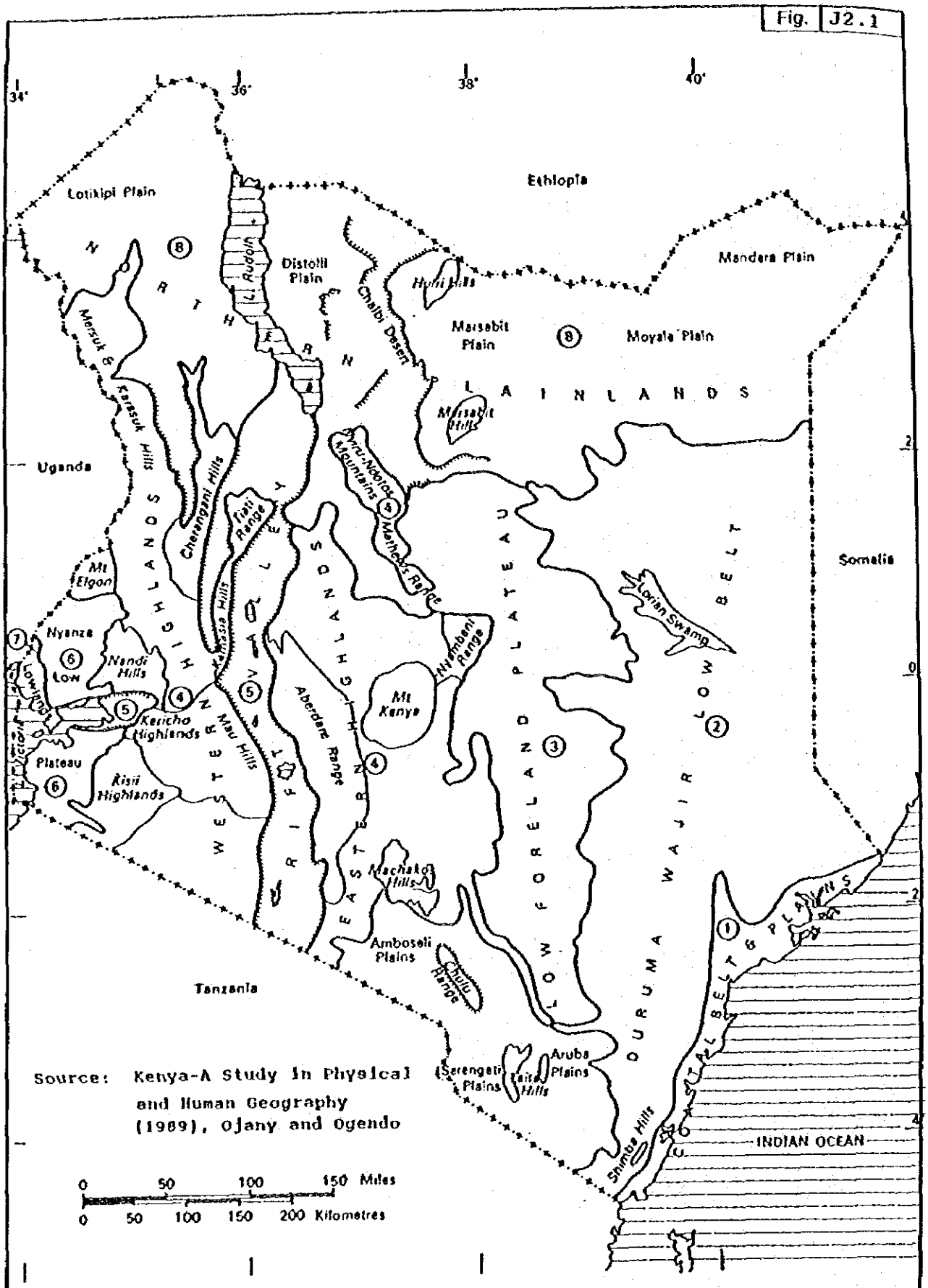

Figure J2.1 Physiographic Regions (Simplified)

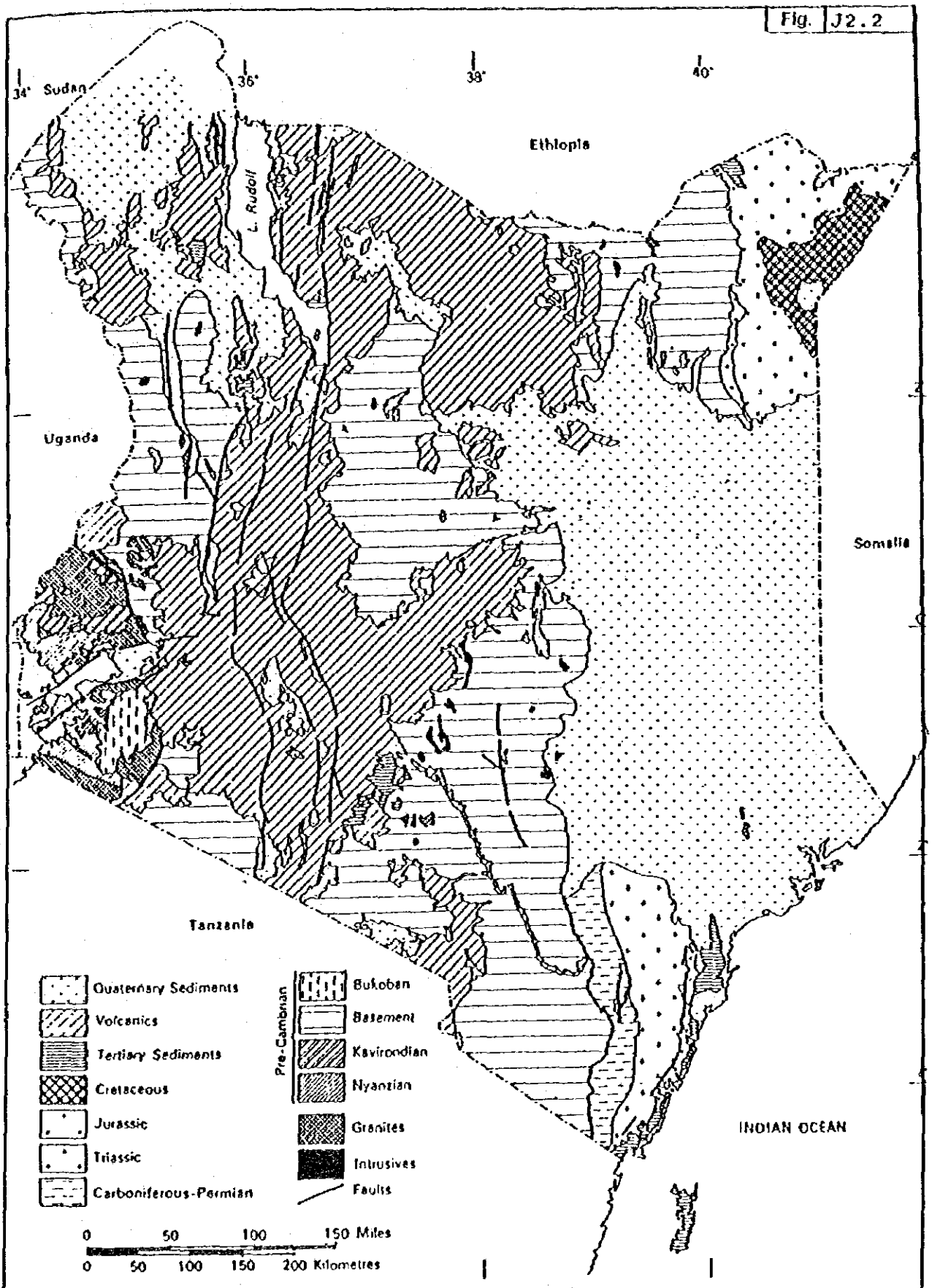

Figure J2.2 Geology of Kenya

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Fig. J3.1

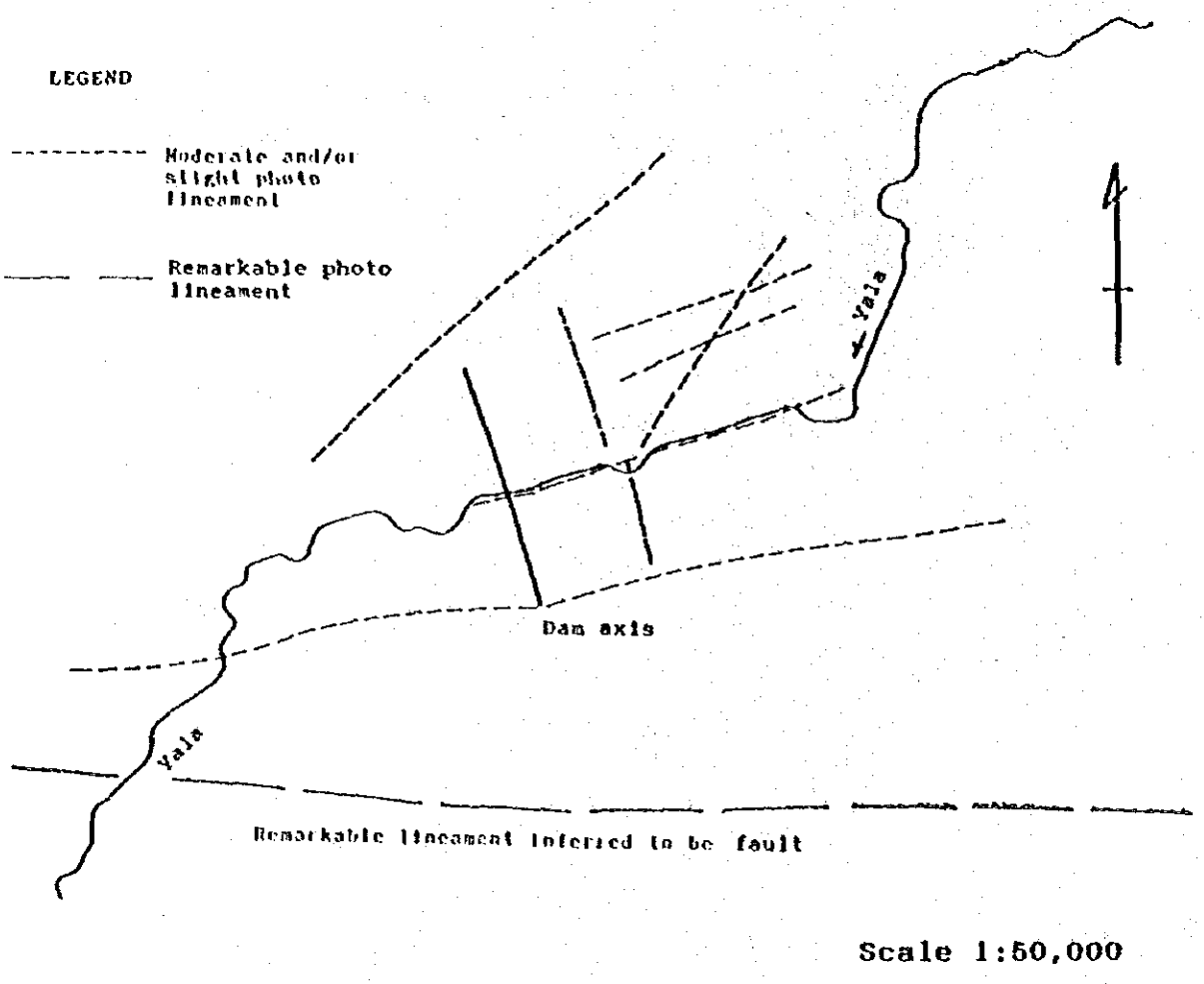

Figure J3.1 Photo Lineament around Gongo Damsite

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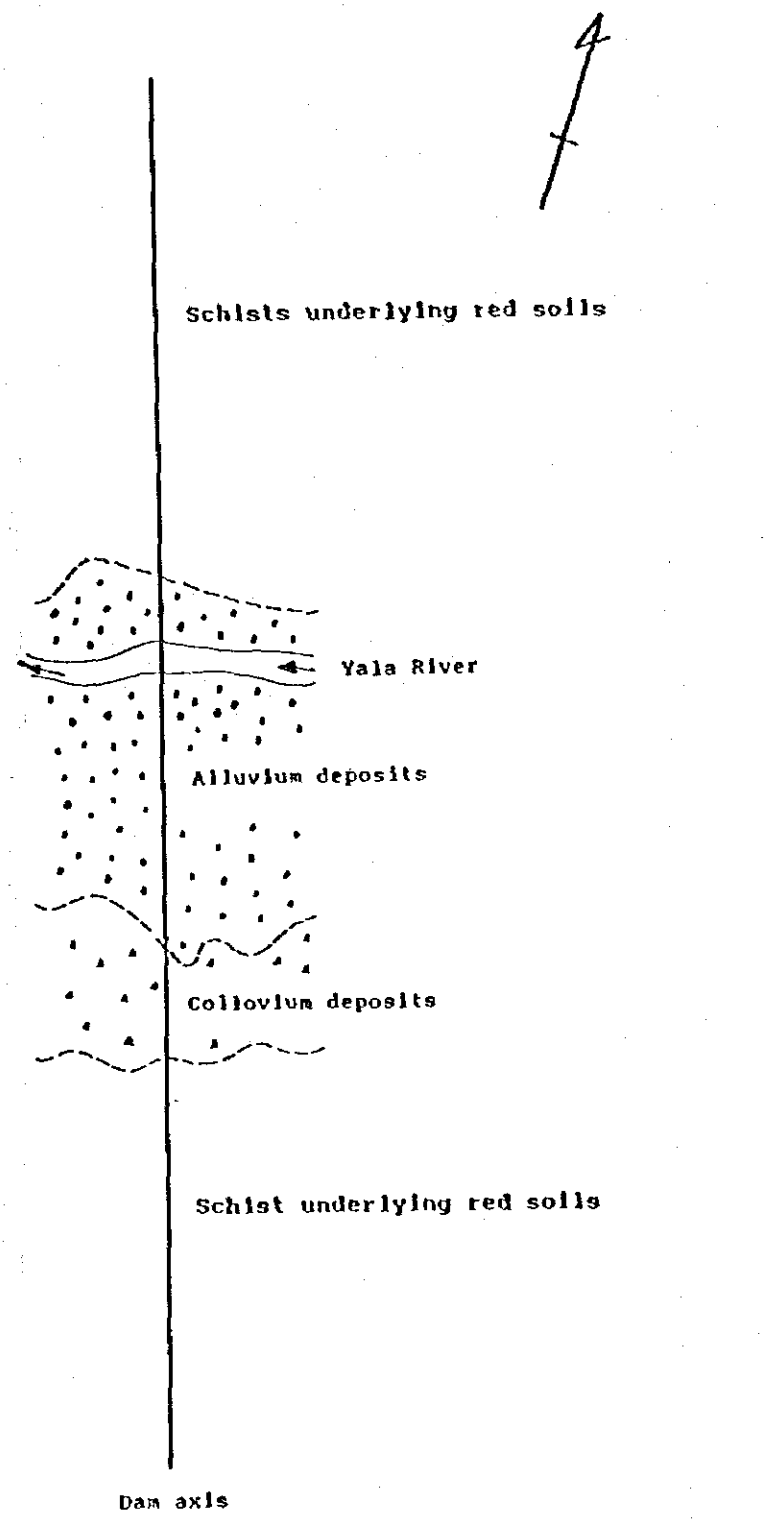
Fig. J3.2



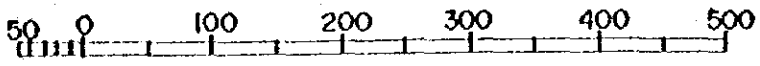


Figure J3.2 Lithological View at Mushagumbo Damsite

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Fig. J3.3

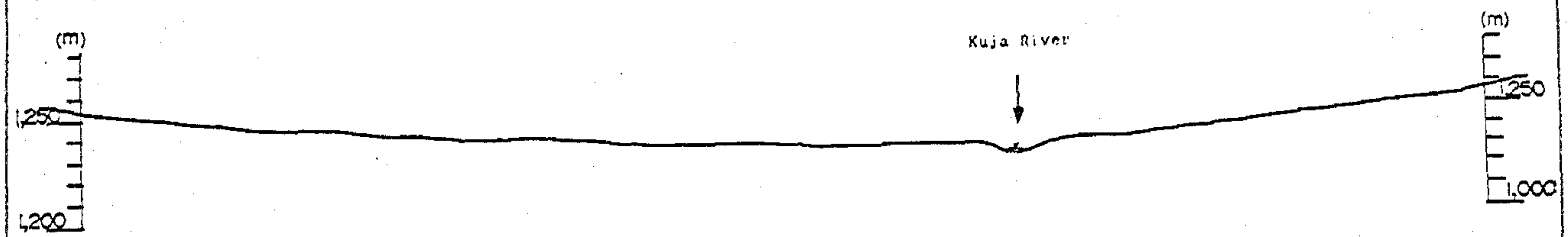

Figure J3.3 **Profile Section of Katieno Damsite**

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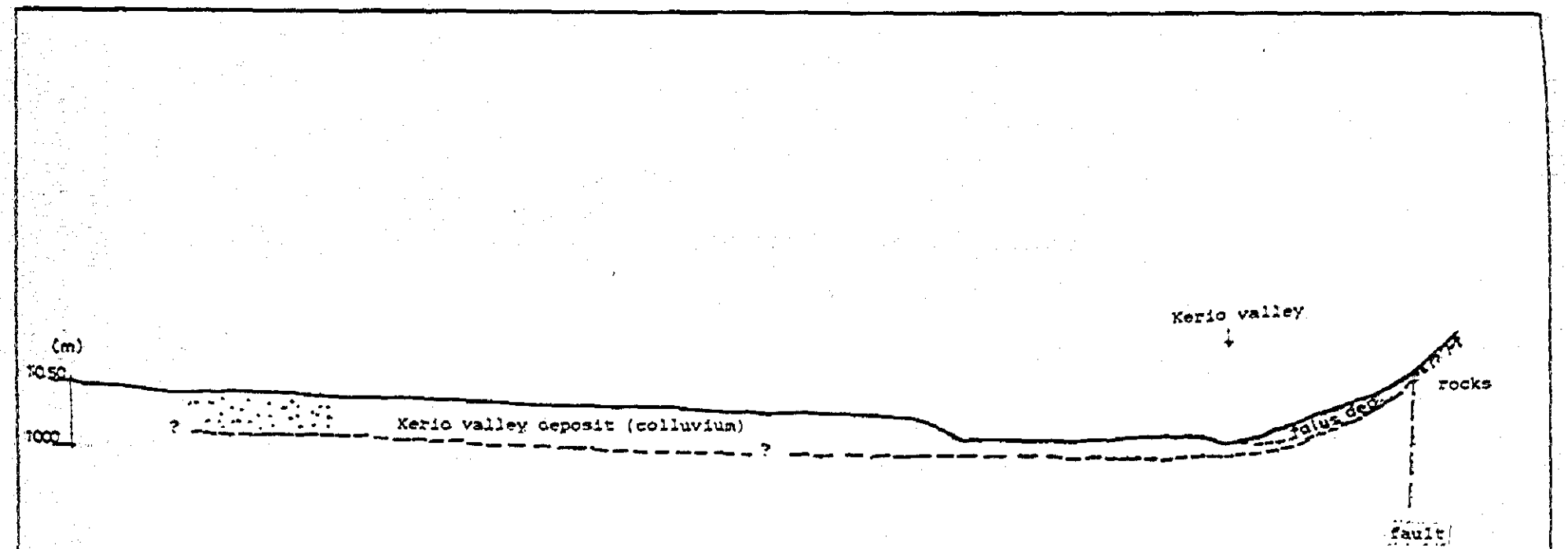

Figure J3.4 **Profile Section of Kerio-A Damsite**

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Fig. J3.4

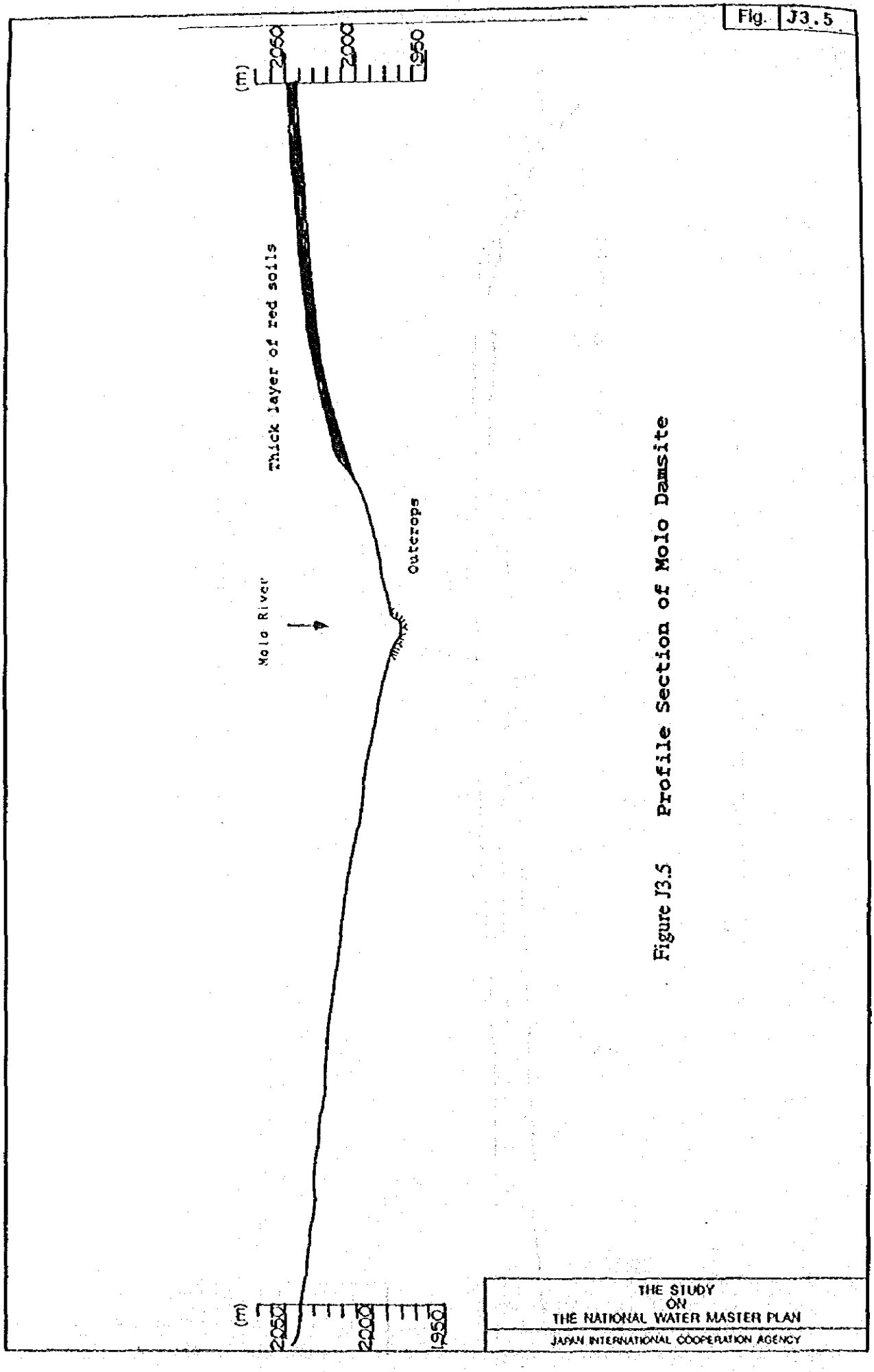

Figure J3.5 Profile Section of Molo Damsite

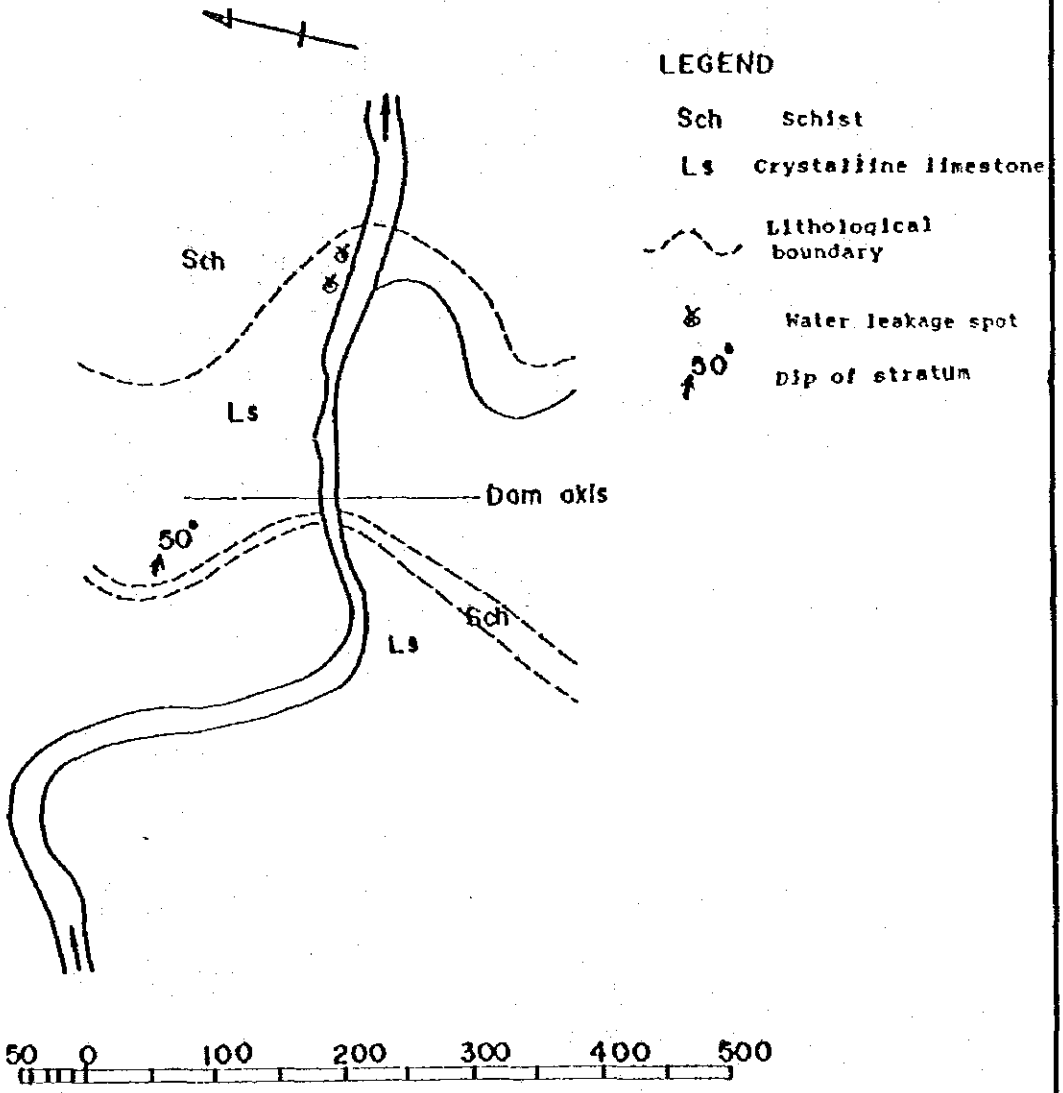

Figure J3.6 Geological View of Harun Damsite

Fig. J3.7&8

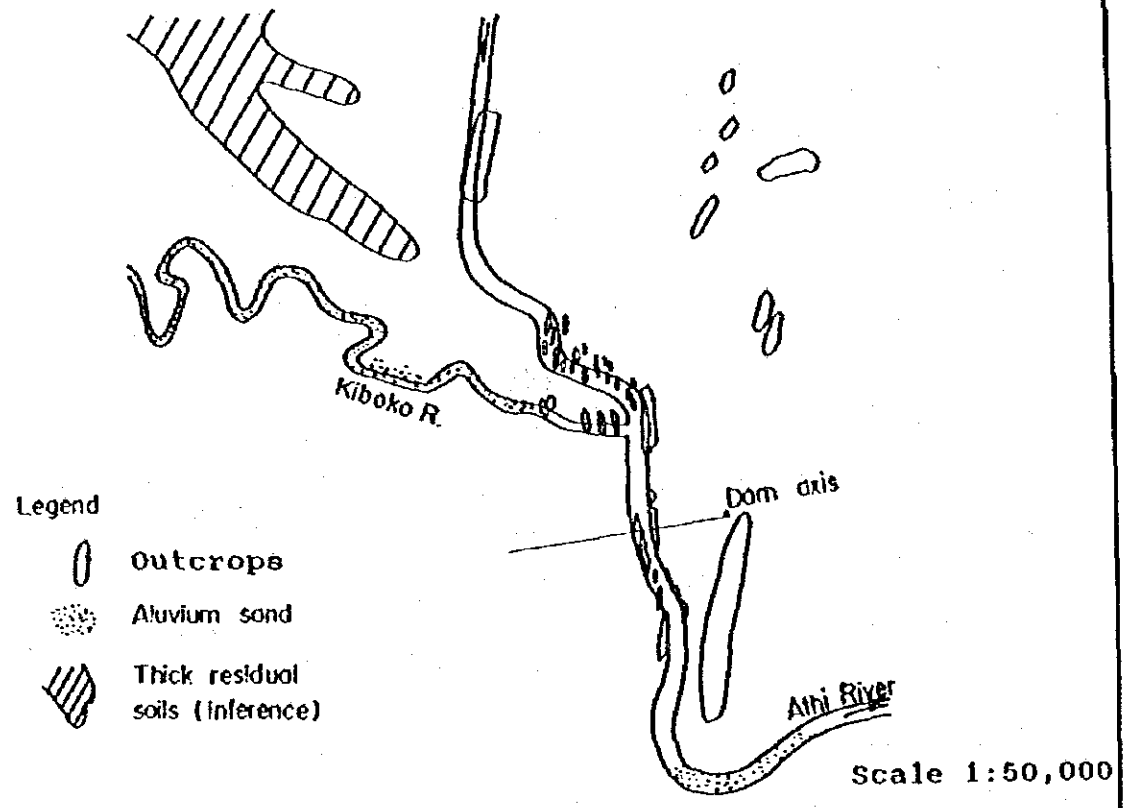

Figure J3.7 Occurence of Outcrops around Yatta Damsite

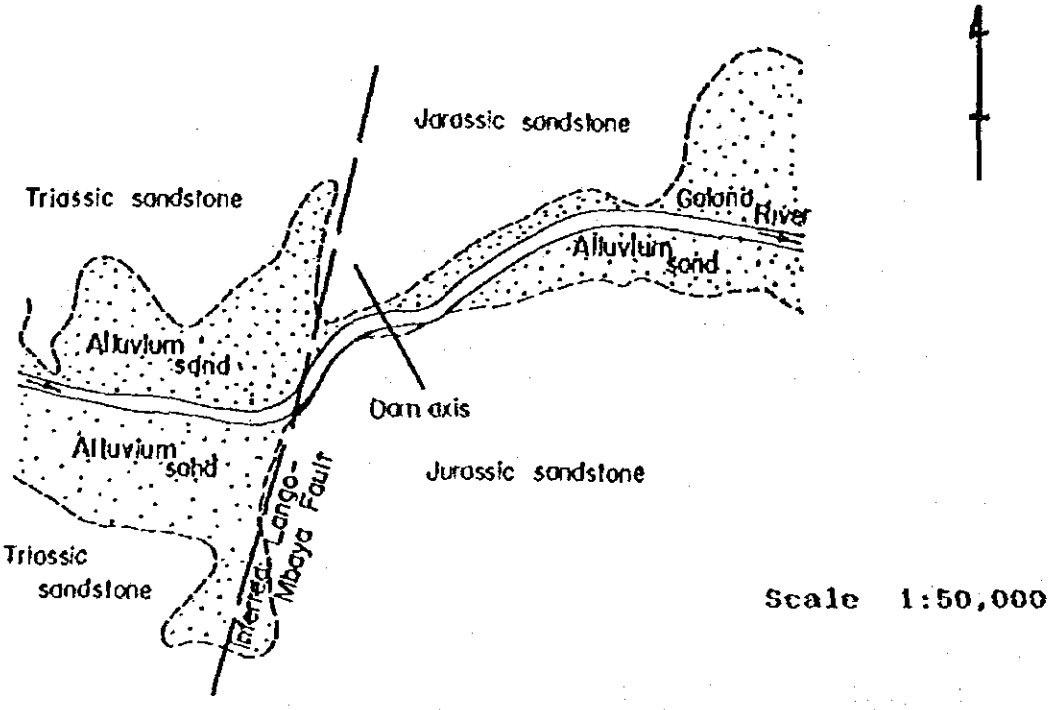

Figure J3.8 Geological View of Baricho Damsite

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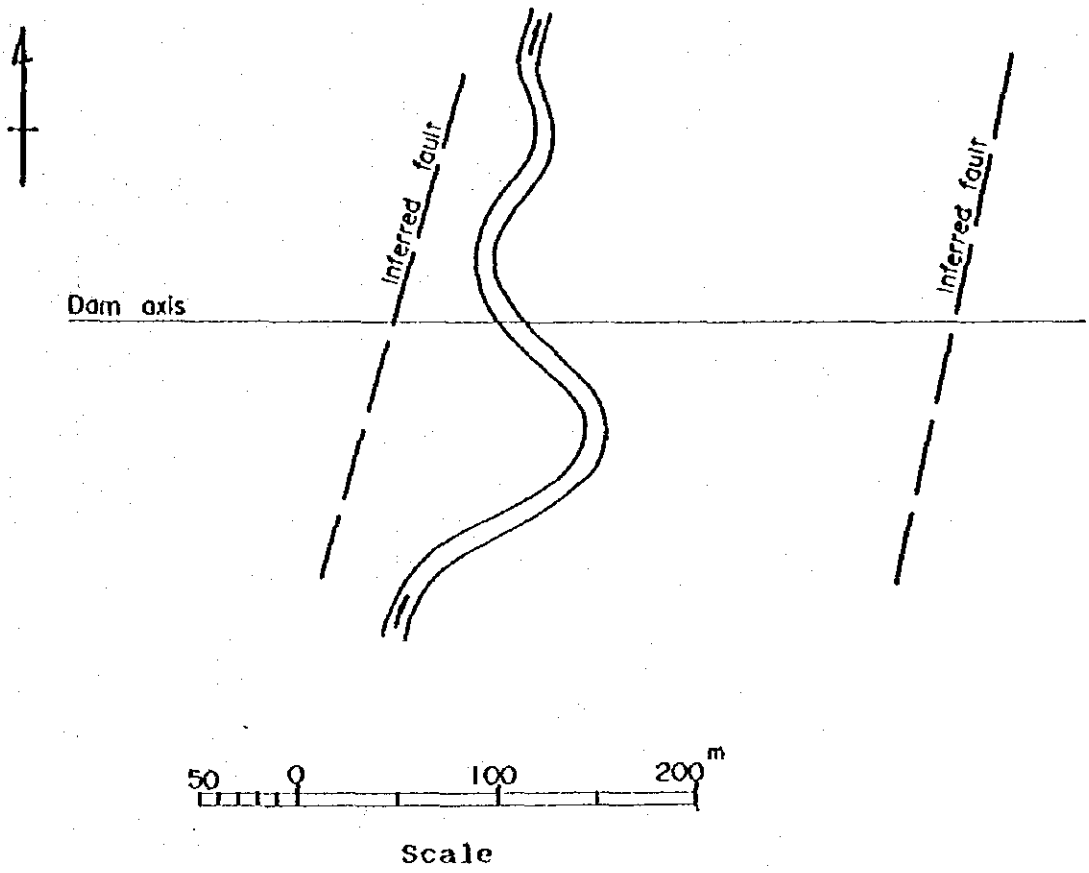

Figure J3.9 Fault Direction at Rumuruti Damsite

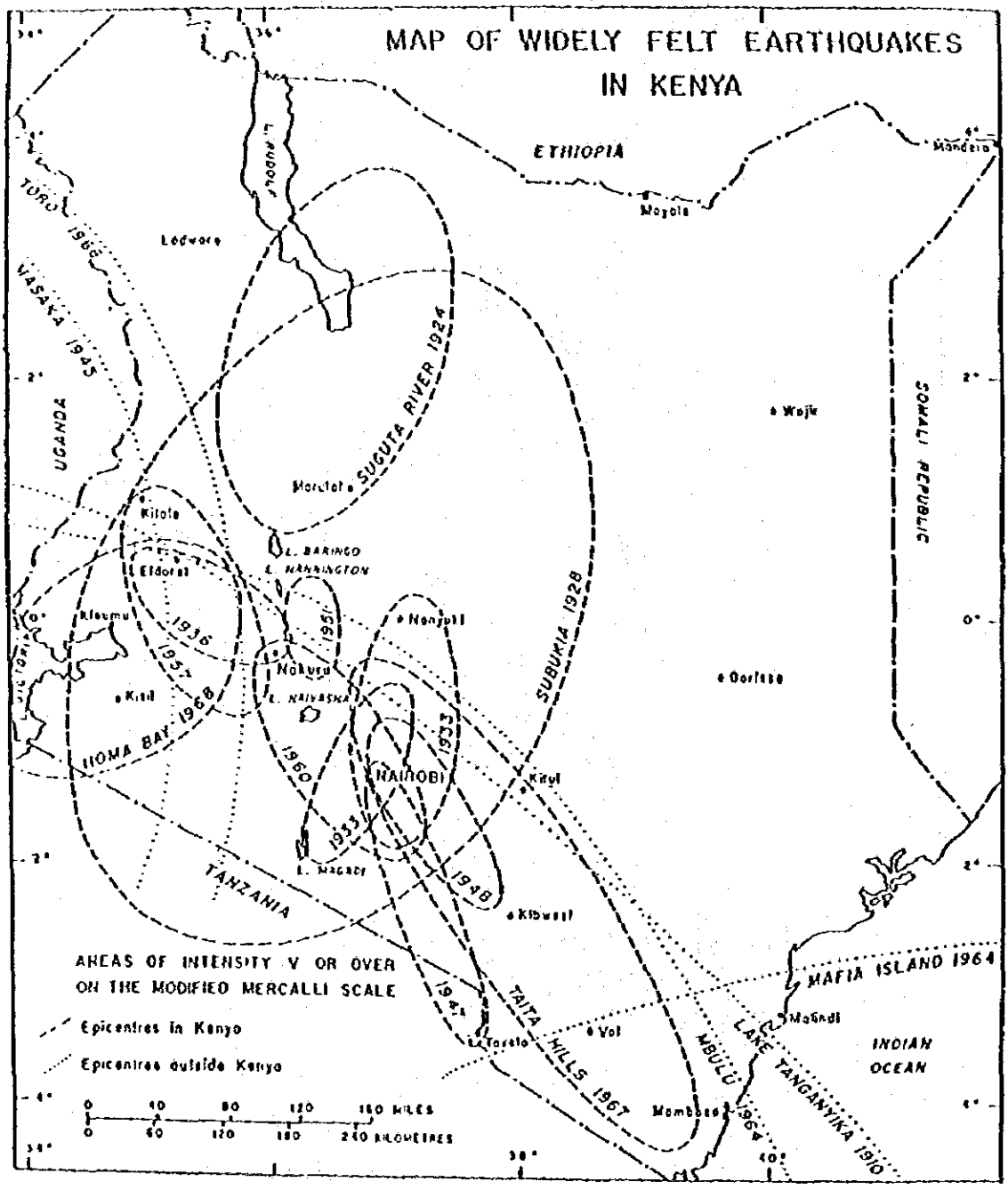

Figure J4.1 Widely Felt Earthquakes in Kenya

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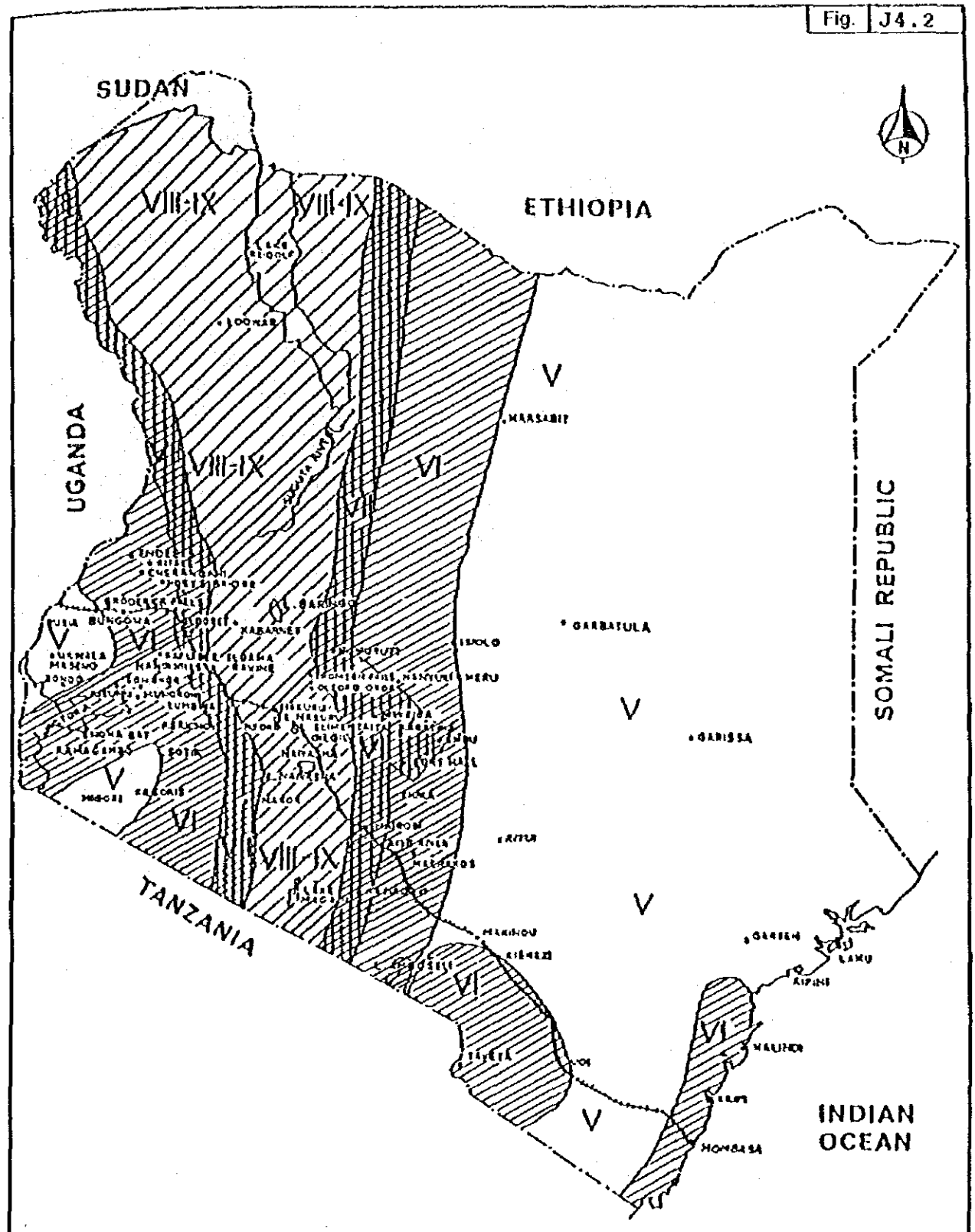

Figure J4.2 Seismic Zoning Map of Kenya

(After I.S. Loupekine)

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