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1965/86

AN INVESTIGATION OF THE COTTER AND OTHER FAULTS NEAR THE CORIN DAMSITE, UPPER COTTER RIVER, A.C.T.

by

W. Oldershaw

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CONTENTS

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SUMMARY

The western spur at Corin Damsite (Site E), Upper Cotter River, consists of beds of sandstone and banded siltstone folded on north-westerly fold axes. Wedges of porphyry are faulted against these strata by a series of faults that trend north-north-west. The faults have been truncated by the north-trending Cotter Fault along which a block of phyllite has been thrust upwards and eastwards against the complex of porphyry, siltstone and sandstone.

The zones of sheared brittle rock along the north-westerly faults may connect with lenses of sheared rock along the Cotter Fault zone and form leakage paths through the western spur of the damsite.

INTRODUCTION

The Cotter valley has been eroded along the Cotter Fault, one of the major fault zones in the Canberra area. The river does not follow the fault closely; the fault passes to the west of the left abutment of Corin Damsite (Site E) and crops out within the proposed storage area. Three weeks were spent in May and July 1964 making a detailed examination of the left abutment to delineate the Cotter Fault and to evaluate the possibility of leakage along it. The detailed descriptions and stereographic analyses of the faults and associated structures given in this report are intended as background geological information for the planning of remedial measures should serious leakage occur along the Cotter Fault.

Best and Hill (1962) have described the geology of the damsite and a further detailed investigation of the site, including 3000 feet of drilling, costeaning and sluicing of portions of the abutments will be reported upon by Best. The location of Corin Damsite is shown in Figure 1.

ROCK TYPES

The area mapped consists of Ordovician (?) phyllite in the west, thrust against silicified sandstone, thinly-bedded indurated siltstone and shale to the east, with infaulted wedges of porphyry. (See Figure 2).

Phyllite

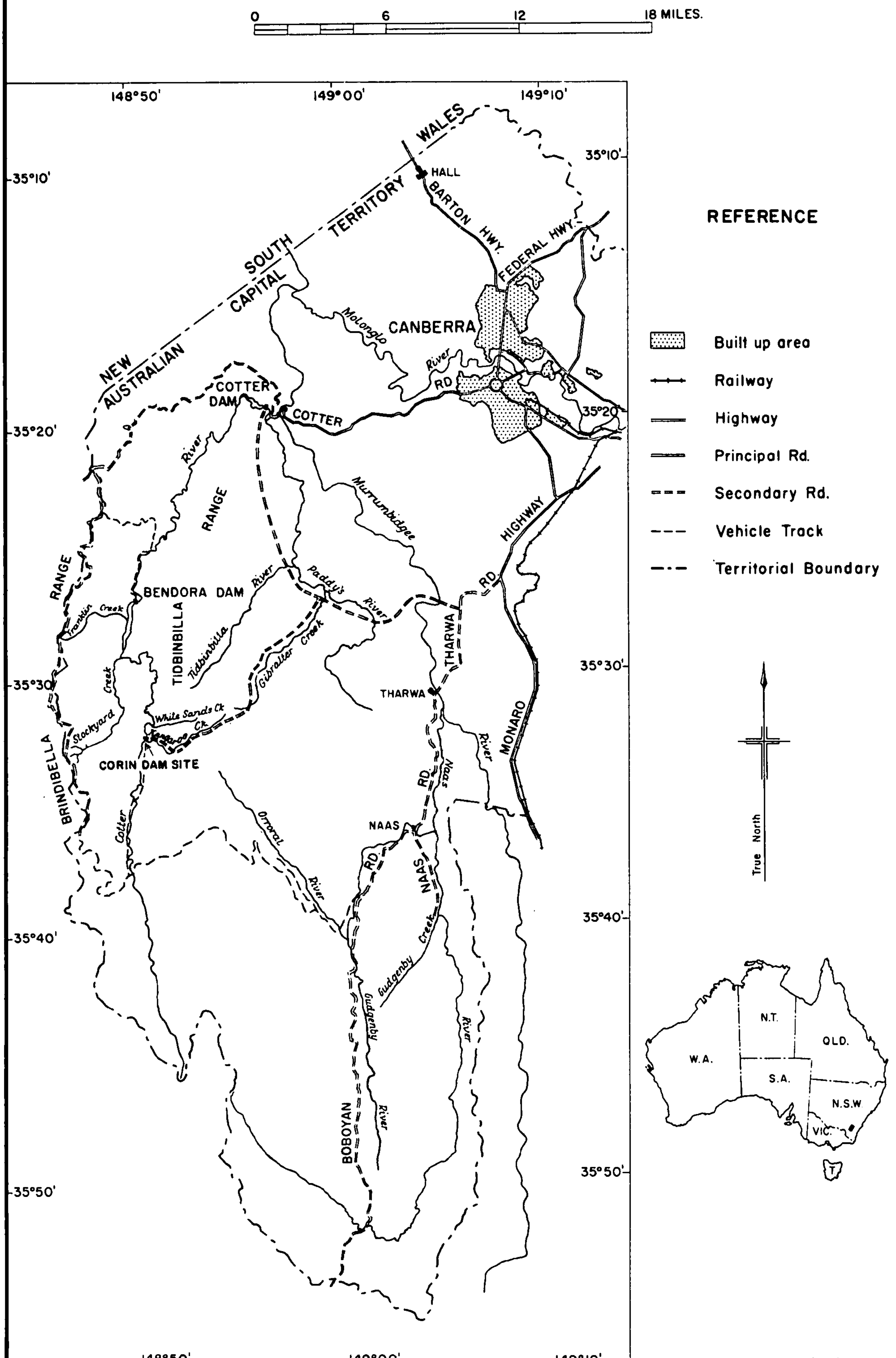
The phyllite consists of alternating beds 1-2 inches thick of fine-grained silicified siltstone and beds of soft olive-green phyllite. The structure is best displayed in the phyllite. There is a contorted mineral foliation which strikes about 175°* and is intersected by a later shear foliation that strikes 190°. Both dip steeply west. In drillholes D.D. 6 and P. 2 the foliation dips at 60-70° but the outcrops on the steep slopes have been distorted by hillside creep which has decreased the dip of the foliation to 50-60° at the ground surface.

Under the microscope the bands of phyllite are seen to consist of parallel, minute, flakes of sericite with scattered limonite dust and minute chips of quartz. The sericite flakes are parallel to the major compositional banding, which may be bedding or metamorphic foliation. In a thin-section across the foliation the folia are seen to be intersected at an angle of about 20° by closely-spaced parallel shear planes. The sericite flakes close to the shear planes have been bent parallel with them. Veins and pods of quartz have been sheared into trails of minute sutured

* All bearings are from Magnetic North.

FIG. 1

LOCALITY MAP
CORIN DAMSITE



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grains of quartz. Extensive limonite staining occurs along the planes.

This superimposed shear foliation is more closely spaced, the granulation of the quartz veins has been more severe and the limonite staining is more intense near the eastern margin of the phyllite mass, than elsewhere(see, for example, specimens R17659, R17755, R17756 and R17794). Most of the handspecimens show a lineation in the plane of the foliation plunging at 50-70° towards 250°. The lineation is due to the intersection of the mineral foliation with the later shear foliation. Many handspecimens contain polished surfaces parallel to the major foliation and a few show slickensides pitching 70° to the north down the foliation plane.

Slicified Sandstone

The silicified sandstone crops out boldly as bands of boulders and as monoliths of white silicified sandstone which superficially resembles quartzite. Bedding planes are rarely discernable except in the river bed and in the bulldozed trenches. The sandstone is overlain by a series of alternating beds of white sandstone and black shale, 1 to 3 feet thick, which represent a transition between the sandstone and the overlying banded siltstone.

Under the microscope, the sandstone (R9394, R9485 and R3995) is seen to be a silicified lithic quartz sandstone composed of well packed, poorly sorted, rounded to subrounded grains (0.1 - 2 mm across) of clear quartz; cloudy quartz, a few grains of chert, and fragments of shale. Some of the quartz grains have sutured margins, but most are coated with secondary quartz (in optical continuity with the grains it encloses) which cements the grains together and fills the interstices.

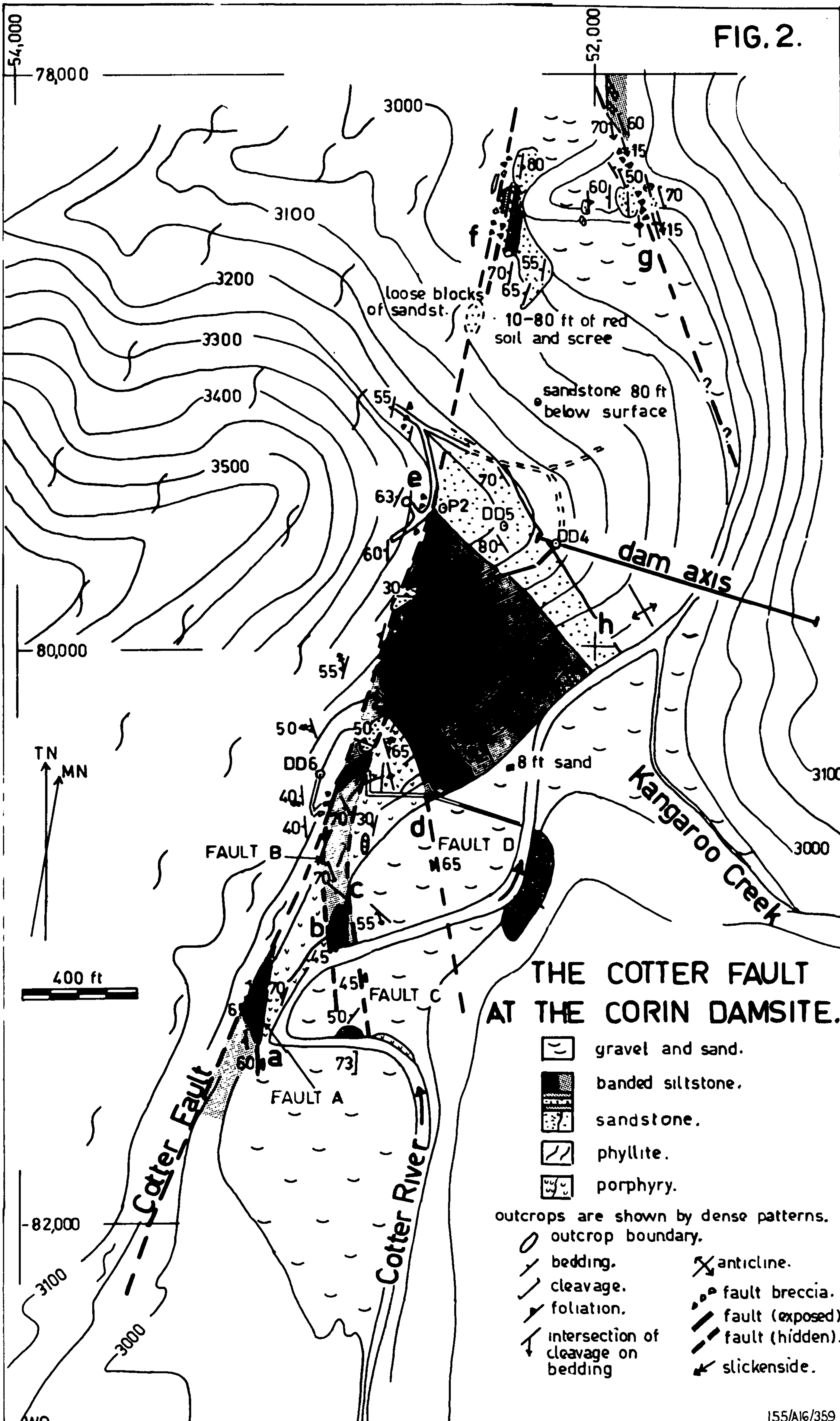
Pyrite forms 1 to 2 percent of the rock and occurs as groups of cubes and isolated cubes in the fragments of shale and in the matrix of the rock. The corners of some cubes invade the adjacent quartz grains. The cubes of pyrite were probably formed by the mobilisation and crystallisation of disseminated pyrite in the fragments of shale during the folding and metamorphism of the rock.

The silicified sandstone is a hard, compact, brittle rock which is impermeable to water except where it has been fractured by faulting, folding and by differential movement along sandstone-shale interfaces.

Banded Siltstone

The banded siltstone consists of alternating beds of light-grey siltstone and dark-grey shale from 1 to 2 cms thick. Under the microscope the beds of siltstone are seen to differ from the beds of shale only in their greater proportion of small rounded grains and angular chips of quartz set in a sparser clay matrix (R9486, R17793). The matrix consists of chips of quartz, flakes of brown illite, colourless penninite, colourless sericite and granules of limonite. The matrix is cut by a prominent set of minute sub-parallel fractures normal to the bedding giving a false cleavage. The false cleavage varies in intensity over the rock and is iron-stained.

Close to faults the banded siltstone is sheared and silicified. It commonly breaks with a hackly fracture, but some fractures show slickensides, smeared pyrite and limonite stains. Under the microscope the sheared siltstone (R17657, R17753) is seen to be a structureless mosaic of minute grains and fragments of quartz set in a matrix of illite, sericite, and limonite. Large crystals of quartz and veinlets of quartz have been broken up into groups and trails of sutured interlocking grains. The sheared siltstone contains more pyrite (up to 5 percent) than the unsheared siltstone. The pyrite occurs as small pods and isolated crystals. Some of the cubes of pyrite are fringed by pressure shadows of quartz.



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X-Ray diffraction patterns of the clay fractions from R9486, R17657 and R17659, taken by Mr. S.C. Goadby, were partly obscured by quartz lines, but the characteristic lines for illite and kaolinite were found. The characteristic lines for montmorillonite were obscured and so its presence could not be confirmed or disproved.

Porphyry

The porphyry is a compact granular grey rock, except at the margins of the several masses where it is extensively sheared, foliated and iron-stained.

Under the microscope, the fresher parts of the porphyry (R17658, R17752) are seen to consist of embayed phenocrysts of quartz, up to 1 cm. across, altered phenocrysts of orthoclase, and plagioclase, set in a fine-grained matrix of quartz and feldspar.

The quartz has an unusual "cross-hatched" polarisation and is strained and fractured. The orthoclase occurs as irregularly-shaped remnants set in masses of kaolinite and sericite which are probably pseudomorphs of the original orthoclase phenocrysts. The plagioclase occurs as irregularly shaped, poorly twinned phenocrysts crowded with veins and patches of sericite. Small wisps of penninite with minute granules of magnetite along the cleavage planes are remnants of an altered mafic mineral, probably biotite. The groundmass consists of amoeboid intergrowths of quartz and feldspar crowded with limonite dust. Accessory apatite and magnetite are scattered through the matrix.

Close to the margins of the porphyry masses the porphyry (R17660, R17751, R17754) has been sheared parallel to adjacent faults. The quartz crystals have been granulated and sheared out into trails of quartz granules. The feldspars have been broken, altered, and sheared out into wisps of chlorite and sericite, some of which are iron-stained. The groundmass shows extensive granulation.

STRUCTURE

The western spur at the Corin damsite consists of a north-west trending anticline which has been cut by several faults dipping at 45-50^{o} towards 250^{o} and by a later major fault zone, the Cotter Fault, which dips at 70^{o} towards 275^{o} (see Figure 2). In the southern part of the spur the earlier faults emplaced wedges of porphyry into the folded sandstone and siltstone succession. The Cotter Fault is a major high-angle reverse fault which has thrust a block of phyllite and siltstone upwards and eastwards against the faulted sandstone, siltstone and porphyry.

FAULT "A" 53, 200 W; 81, 300 S

At "a" (Figure 2) banded siltstone has been thrust upwards to the east over sheared and shattered porphyry. A 40-foot length of Fault A, exposed in a small gully at 53,200 W; 81,300 S, contains two sub-parallel slightly undulose fault planes, about 12 inches apart, which strike 170^{o} and dip 60^{o}W. (see stereogram, Figure 4).

The banded siltstone strikes 140^{o} and dips 65^{o} SW; it has a vertical fracture cleavage that strikes 155^{o}. The siltstone in the hanging wall of the fault is sheared along planes which strike 170^{o} and dip 75^{o} W. It has been silicified and has a hackly fracture and irregular jointing.

The porphyry in the footwall of the fault is extensively sheared; shear planes strike 180^{o} and dip 70^{o} W. The porphyry farther below the fault is broken by limonite-stained, irregularly oriented joints 4 to 6 inches apart. Some of the joints are polished and grooved showing that relative movement has occurred.

FAULT "B" 52,900 W; 81,000 S.

The sheared porphyry at "b" has been thrust upwards to the east along Fault B over sheared and silicified banded siltstone. The thrust plane is well

FIG. 3.

MAJOR FAULTS AT THE CORIN DAMSITE.

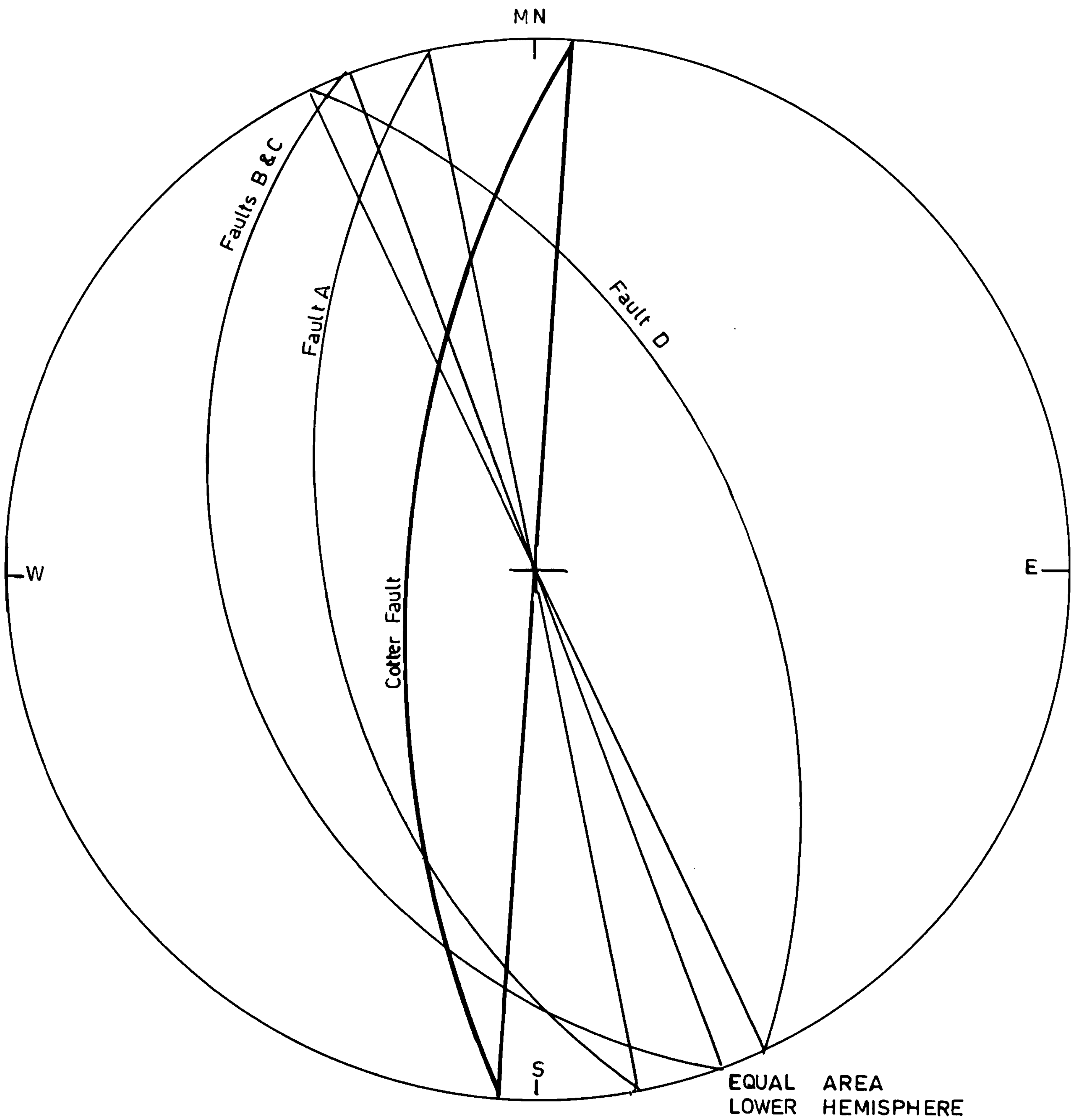

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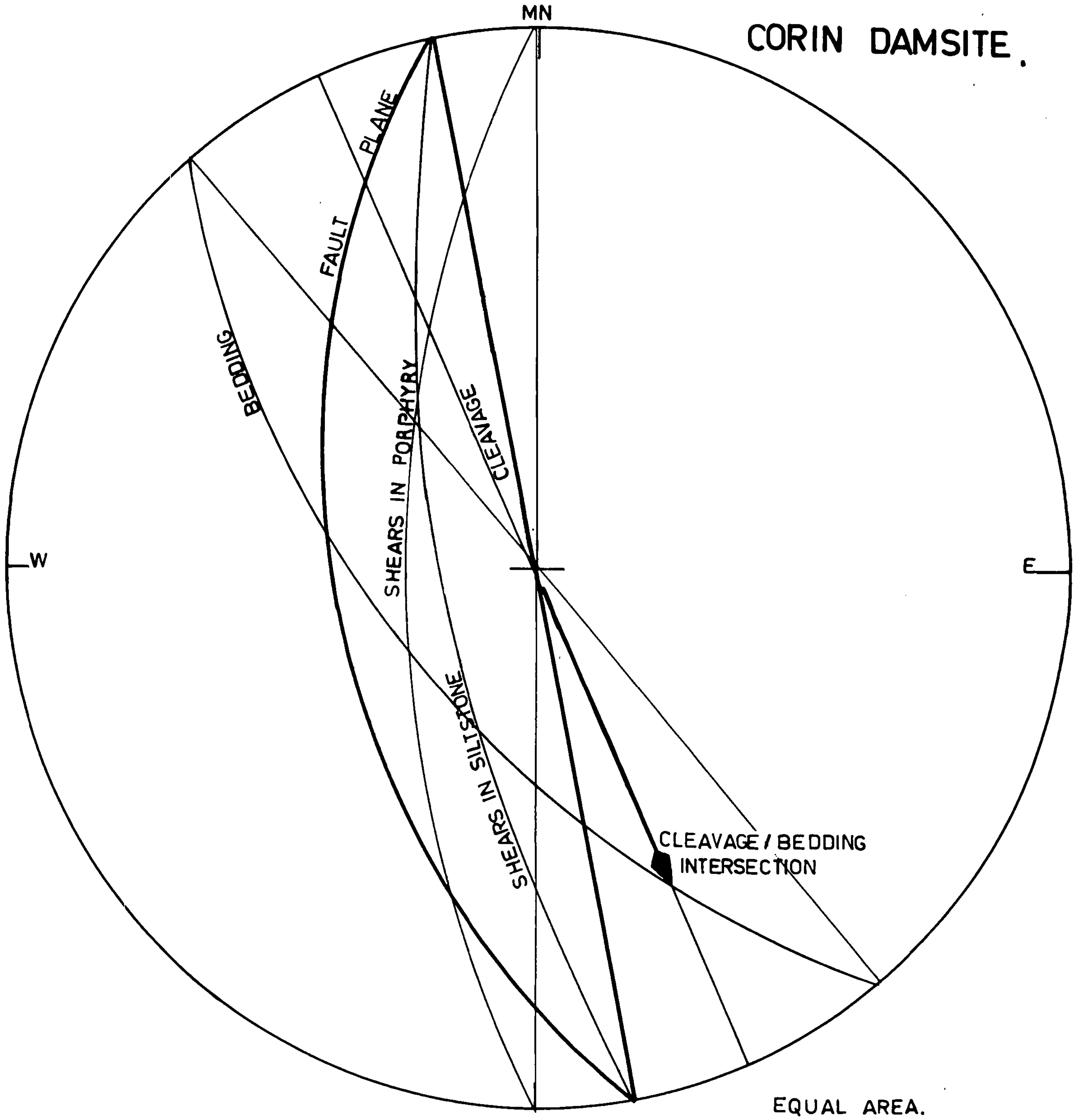
FIG. 4

STEREOGRAM OF FAULT 'A'

53,200W 81,300S

CORIN DAMSITE.



EQUAL AREA.
LOWER HEMISPHERE.

exposed; it strikes 160° and dips 45° W. The overlying porphyry is cut by several minor thrusts (see stereogram, Figure 5) and by open, limonite-stained, joints. It is crumbly and deeply weathered.

The siltstone immediately below the thrust plane is a silicified structureless rock with irregularly oriented joints and hackly fracture surfaces. It contains small pods, blebs and veinlets of pyrite a few millimetres across. The siltstone farther east strikes 140° and dips S.W. at 30-55°. It is cut by a well marked fracture cleavage which strikes 150° and dips 70° S.W. The bedding/cleavage intersection plunges 15-20° S.E. A shear foliation strikes 170° and dips 60° W.

The position of the fault was traced northwards for 200 feet by detailed outcrop mapping of the contiguous siltstone and porphyry. Farther north the fault is hidden by slopewash from the phyllite to the west of the Cotter Fault.

FAULT "C"

Fault C, separating the siltstone at "b" from the block of porphyry to the east, is not exposed (Figure 2). Its presence is inferred and its position was determined by detailed outcrop mapping on the steep southward-facing slopes to the east of drillhole D.D. 6. Its extension southward is inferred from the juxtaposition of porphyry and siltstone on the river bank at 52,850 W; 81,350 S. From its inferred position and the intersection of postulated strike lines with the contours, the fault would appear to dip westwards at 45°, parallel to fault B.

D.D. 6 terminated close to the calculated position of the fault plane (see Figure 6). The last few feet of core consist of contorted and sheared, pyrite-rich, banded siltstone similar to that found close to the other fault planes. The water loss during the pressure testing of this rock was only 0.01 gallons per minute per foot at 100 pounds per square inch gauge pressure. Had the hole been continued a short distance it would probably have determined the position of the fault and established the presence of shattered porphyry in the footwall of the fault; the permeability of the crush zone along the fault could also have been tested.

The porphyry close to the fault is extensively sheared along planes which dip steeply west-south-west. Many of the planes are polished and grooved downdip.

The structural orientation of the block of siltstone between faults B and C is the same as that of the main mass of banded siltstone east of Fault D. The position and structure of the lens of sandstone in the northern end of the block, north-east of drillhole D.D. 6 (Figure 2), cannot be deciphered owing to lack of exposure. There is a foliation in the sandstone, marked by wisps of shale, which is either bedding or jointing; it strikes 120° and dips at 50° NE. Yet the intersection of 26 feet of brecciated sandstone between 80 feet and 106 feet in D.D. 6, in the footwall of the Cotter Fault, suggests that the sandstone dips steeply westwards with roughly the same altitude as the banded siltstone. Therefore the foliation of the sandstone is not the bedding.

The lens of sandstone further north, at 52,700 W; 79,800 S, also has a foliation which dips north i.e. 30° N, with strike 080°. Outcrop is very poor and the relationship of the sandstone to the surrounding strata could not be deciphered. It may be part of the lens of sandstone to the south or it may be a separate lens brought up along part of the Cotter Fault.

FAULT "D"

Fault D (at "d", Figure 2) dips to the east, whereas the adjacent faults dip to the west. The thrust plane is poorly exposed and crops out only in a few places, but its position can be determined, within a few feet, between 52,600 W; 80,500 S and 52,750 W; 80,150 S on the steep south-facing hillside east of D.D. 6.

FIG. 5.

STEREOGRAM OF FAULT 'B'

52,900W 81,000S

CORIN DAMSITE.

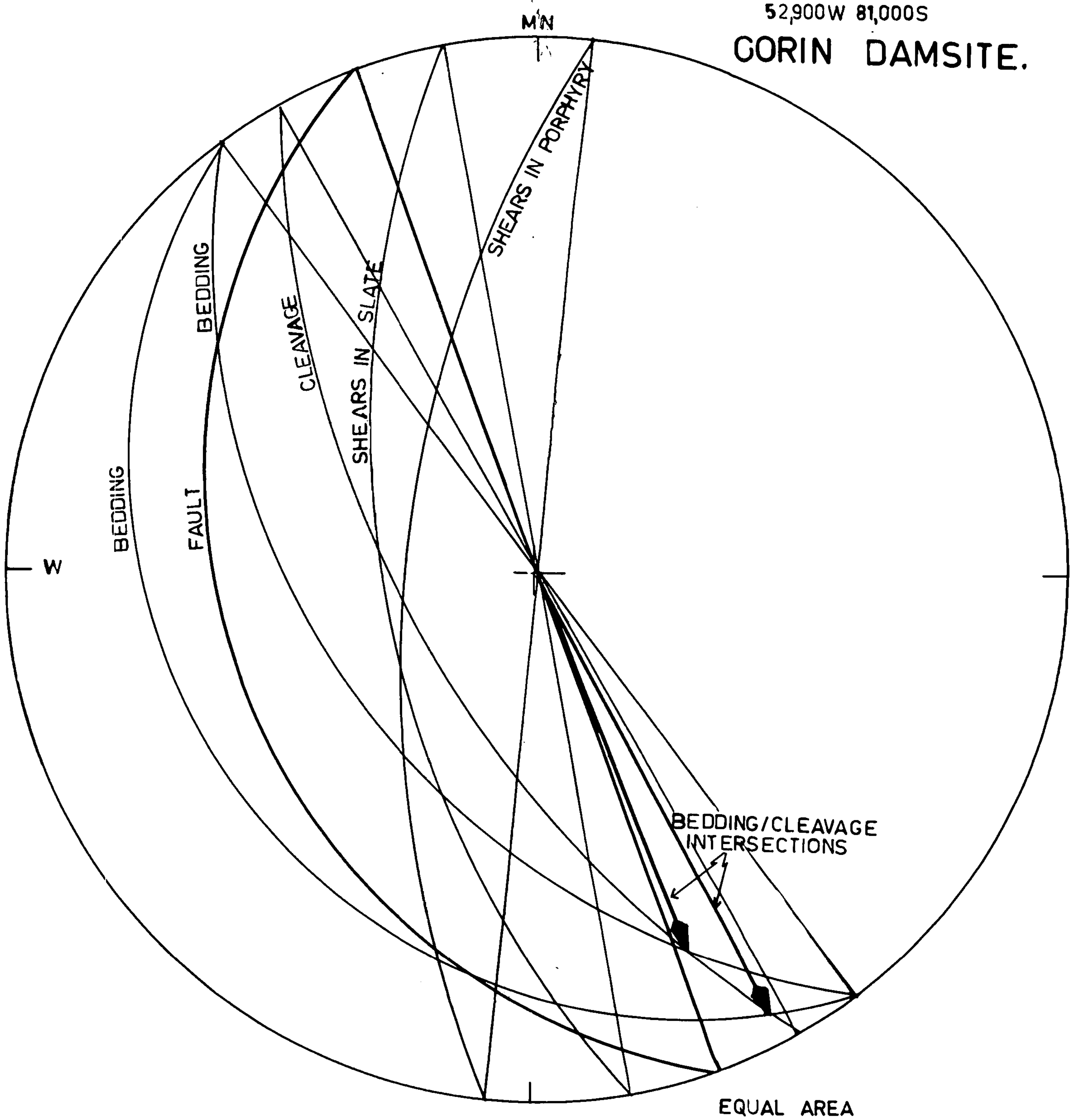


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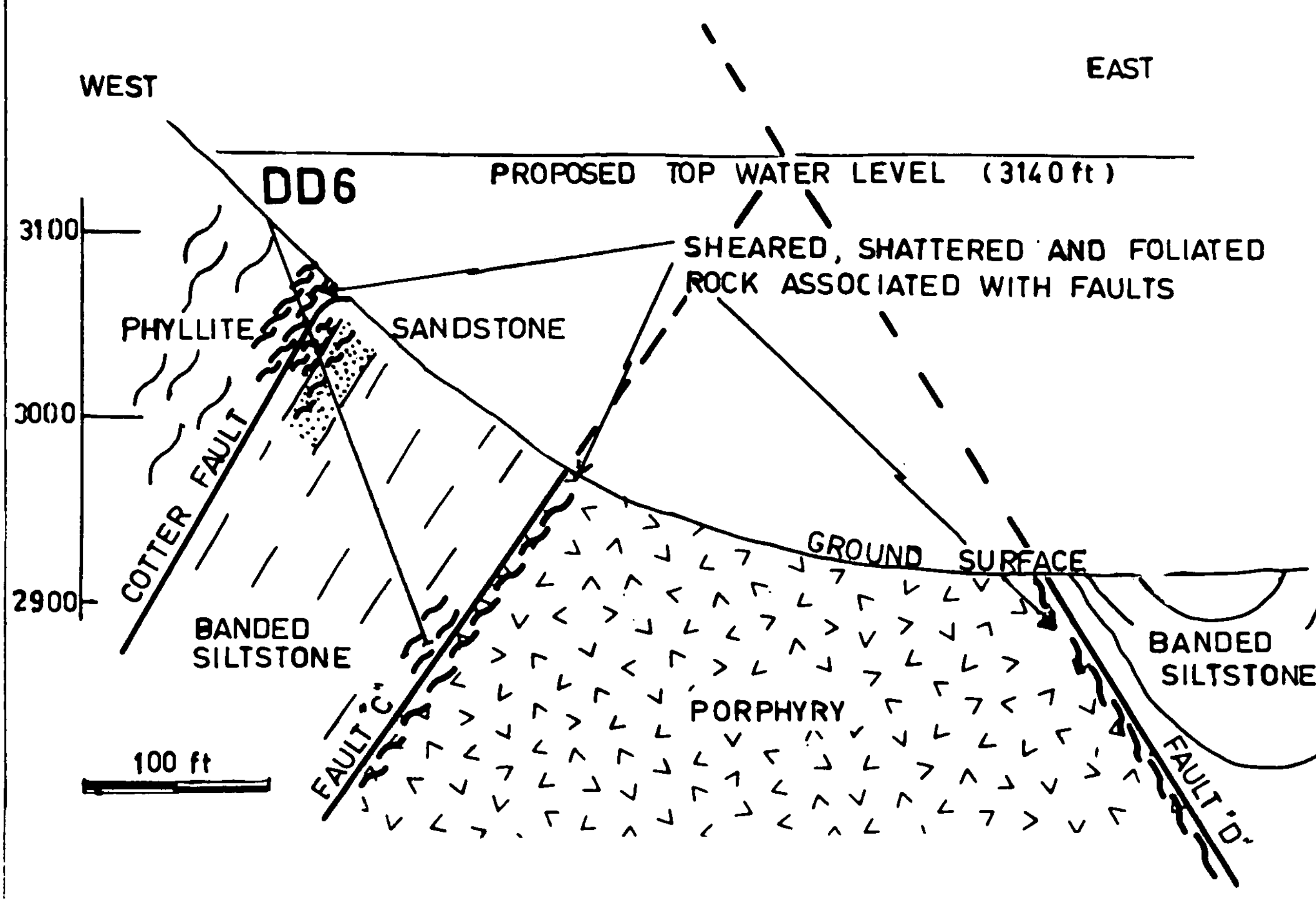
FIG. 6.



EAST–WEST SECTION THROUGH D.D.6.
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The central part of the wedge of porphyry to the west of the fault is massive but is well jointed. Close to the fault, however, the porphyry is extensively sheared along steeply dipping planes trending 155°. R17754, from close to the fault at 52,700 W; 80,300 S, is strongly sheared along planes which strike 150° and dip 65° NE, parallel to the fault. This foliation is cut by a later vertical shear foliation which trends 150° and has a well-marked vertical grooving.

The banded siltstone appears to have moved along the fault westwards over the porphyry. The siltstone close to the fault is strongly silicified and crops out as a prominent ridge. It has a well-marked foliation which strikes 135° and dips 60-70° NE (see stereogram, Figure 7). The bedding is folded around minor axes plunging at 15° S.E. Forty yards away from the fault, the bedding in the siltstone strikes 140° and dips 60° S.W., the cleavage is vertical and trends 150°, and the bedding/cleavage intersections plunge 15° S.E.

Fault D trends south-east and at 52,500 W; 81,500 S faults banded siltstone to the east against porphyry to the west.

Fault D appears to post-date the adjacent westerly dipping faults for it truncates fault C; it antedates the Cotter Fault.

Another east-dipping fault, probably a continuation of Fault D, was found by D. Maggs at 53,700 W; 91,500 S, two miles to the south. Here banded siltstone has been thrust upwards and westwards against a block of porphyry to the west. The fault appears to be a multiple fault zone, for there are slivers of porphyry 3 to 6 feet across in the siltstone, and the numerous veins of quartz in the zone have been sheared and slickensided. Both the cleavage in the siltstone and the well-marked foliation in the porphyry dip eastwards at 80°. The crystals in the porphyry are streaked out down dip and there is extensive grooving which trends down dip.

There are four north-north-west trending faults within 800 feet across the strike west of fault D, whereas no faults were found for 1400 feet to the north-east of the fault until the north-north-west trending fault through "g" was encountered (see Figure 2). Fault D is a reverse fault dipping to the east, and the fault pattern of the eastern block may be different from the fault pattern to the west; the thick bed of sandstone extending from "e" to "h" (Figure 2) may have been more resistant to faulting. On the other hand, exposure is poor to the north-east of fault D and it is possible that there are hidden north-north-west trending faults (e.g. the eastern margin of the sandstone ridge).

THE COTTER FAULT

The Cotter Fault appears to be a zone of closely-spaced parallel thrust planes, dipping westwards at 60-70°, along which the phyllite to the west has been thrust upwards and eastwards against the sandstone, siltstone and porphyry. Several zones of crush breccia were found in drillhole D.D. 6, at "e" and at "f" (Figure 2) but none could be traced far. The position of the fault zone between these localities was mapped as the eastern limit of the phyllite, which was readily determined.

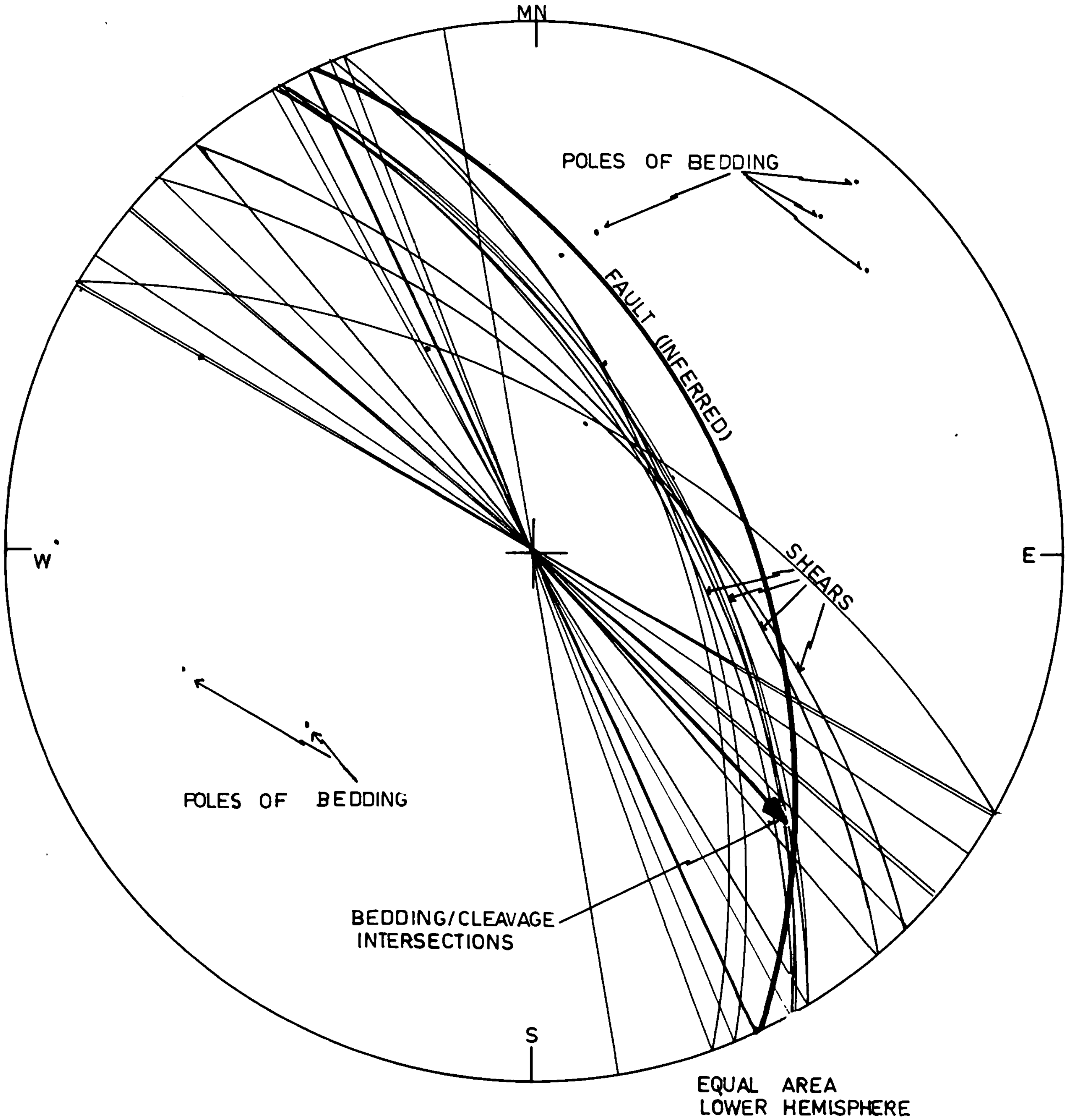
A fault breccia (R17657) near D.D. 6 was found to consist of sheared lenticles of contorted shale and siltstone, and fragments of quartz and mylonitized porphyry. The rock is cut by veins of quartz. The undulose shear planes are coated with limonite and manganese stains, and are slickensided.

A crush breccia near drillhole P2 was found to consist of sheared lenticles of contorted grey shale and black shale. The breccia is cut by irregular undulose shear planes coated with limonite and manganese stains.

Crush breccia crops out over an oval area 30 feet by 10 feet at 52,350 W; 78,500 S ("f", Figure 2). Parts of the breccia consist of mylonite, with a vertical foliation that trends 180-190°, and which contains streaked out lenses of slate,

FIG. 7.

STEREOGRAM OF FAULT 'D' CORIN DAMSITE.



THE STEREOGRAM SHOWS THE COINCIDENCE OF THE SHEARING IN THE SILTSTONE ABOVE THE FAULT WITH THE INFERRED POSITION OF THE FAULT.

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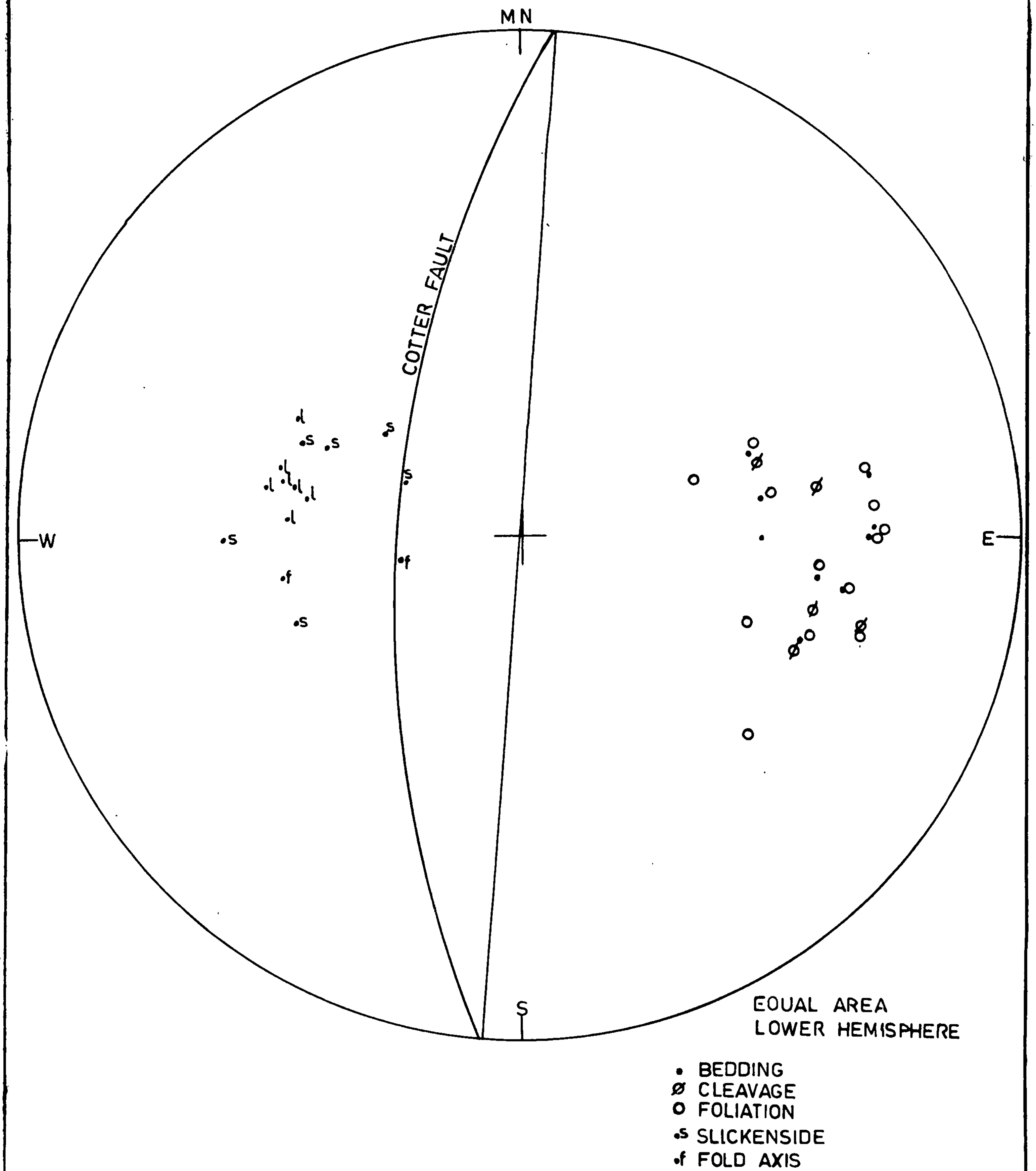
FIG. 8.

STEREOGRAM OF THE STRUCTURE OF THE PHYLLITE TO THE WEST OF THE COTTER FAULT AT THE CORIN DAMSITE.



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siltstone and sandstone 1 to 12 inches long. Other parts of the breccia consist of randomly oriented, contorted, and irregularly shaped blocks of black slate. The foliation planes in the mylonite and on some of the lenses of rock show strong slickensides. Most of the slickensides trend parallel to the foliation of the mylonite; some are vertical and some horizontal. A few slickensides, on small blocks of sandstone, trend normal to the foliation.

Extensive movement along numerous zones in the phyllite has produced a shear foliation trending about 190°. In places this shear foliation has obliterated the earlier foliation (or bedding). Elsewhere the shear foliation intersects the earlier foliation at angles of about 20° and the intersection of these two planes produces the marked lineation plunging down dip which can be seen in most specimens of the phyllite.

The lenses of sandstone between drillhole D.D. 6 and point "e" (Figure 2) were probably sheared off the bed of sandstone extending from "h" to "e" (Figure 2). This suggests a minimum west-side-upwards movement along the Cotter Fault of 1000-3000 feet, or west-side-south movement of 500-1500 feet. The slickensides found on some planes of movement pitch steeply north at 70° and show that there were both horizontal and vertical components in the movement.

LEAKAGE PATHS

The main object of the investigation was to evaluate the possibility of leakage from the reservoir via the Cotter Fault, which crops out along the western side of the reservoir and across the western spur of the damsite. There appears to be little possibility of leakage along those parts of the fault zone where phyllite is faulted against the banded siltstone because the fault breccias there (R17657) consist of contorted lenticles of shale set in an impermeable clay matrix. The permeability of the siltstone and phyllite in the lower part of drillhole P2 was found to be less than 300 feet per year. However, parts of the fault zone are permeable. The top 56 feet of P2 and the top 106 feet of D.D. 6 could not be pressure tested owing to caving. Shattered sandstones intersected in both drillholes were found to have permeabilities of 2,000 feet per year.

There is a strong possibility of groundwater movement along the minor north-north-west trending faults which are truncated by the Cotter Fault. The faults are bordered by zones of shattered porphyry and sandstone. Should these zones abut lenses of shattered sandstone in the Cotter Fault zone, and a continuous leakage path along the Cotter Fault exist, the west side of the valley would contain connected masses of shattered rock which would constitute a leakage path through the western spur (Figures 9 and 10). The outcrops of the fault zones on the west side of the Cotter valley will be submerged by the reservoir, and they have little soil cover to act as a seal.

The wedge of porphyry between the faults A and B is about 200 feet wide and extends about 400 feet southwards from the Cotter Fault, which truncates it (Figure 9). The porphyry is well exposed in the river cliff between "a" and "b" and on the rocky hillside above. It is a non-porous crystalline rock, but it has been shattered and sheared, especially near the faults bounding it, and it is deeply weathered. It is broken by open, limonite-stained, joints 4 to 6 inches apart, many of which show slickensides. The porphyry has very little soil cover and will be submerged by the reservoir. It will therefore readily become saturated.

The fact that water can leak along the fractured marginal zones of the porphyry was shown by seepage of drilling fluid from D.D. 6 at a small spring on the river bank at "b" , more than 600 feet away from, and 150 feet lower than the collar of the hole (E.J. Best, personal communication). The fluid escaping from D.D. 6 probably seeped southwards for 200 feet along the upper weathered part of one of the shatter zones in the Cotter Fault until it encountered the shattered porphyry abutting the Cotter Fault. It then percolated through the shattered porphyry in the hanging wall of fault B to emerge at the small seepage at "b" (Figure 9).

The wedge of porphyry between faults C and D crops out over a rocky hillside 200 feet across and 150 feet high. It probably extends 400 feet northwards to the Cotter Fault, which truncates it at depth, and over 1000 feet southwards under the sand and gravel-covered floodplain (Figure 9). The rock is shattered and sheared, especially near the faults bounding it, and is deeply weathered. It is cut by open limonite-stained joints 6 to 12 inches apart, many of which are slickensided. The outcrops will be submerged by the reservoir and there is little soil cover to reduce leakage into the rock.

Two lenses of shattered sandstone occur above the wedge of porphyry between faults C and D (Figures 9 and 10). The southern lens, just to the north-east of D.D. 6, crops out below the top water level of the reservoir. Only the sandstone crops out; not the contiguous strata. Because of this, the structure could not be resolved; the sandstone may be interbedded with the siltstone and dip steeply westward (26 feet of shattered sandstone were intersected in D.D. 6), or it may be a fault-bounded lens. The sandstone in D.D. 6 could not be pressure tested because it caved readily. The siltstone immediately below had a permeability of nearly 2,000 feet per year.

None of the strata surrounding the northern lens of sandstone crop out. This lens may be a continuation of the southern lens, for both have a north-dipping foliation. Alternatively it may be a fault-bounded lens brought up along part of the Cotter Fault. This northern lense of sandstone may be faulted into contact with the thick bed of sandstone which extends 800 feet from the river bank at "h" to the Cotter Fault at drillhole P2 (Figure 9).

The last-mentioned bed of sandstone could also provide a leakage path from the reservoir to the Cotter Fault. The top and bottom of the bed are extensively shattered, probably by differential movement along the siltstone/sandstone interface during folding. Between 70 and 140 feet depth D.D. 5 penetrated a wide zone of shattered sandstone with permeabilities of 2500 feet per year.

The Cotter Fault north of drillhole P2 is covered by red soil and sandstone scree up to 80 feet thick, but lenses of sheared sandstone crop out at "f" and at 52,400 W; 78,900 S (Figures 9 and 10).

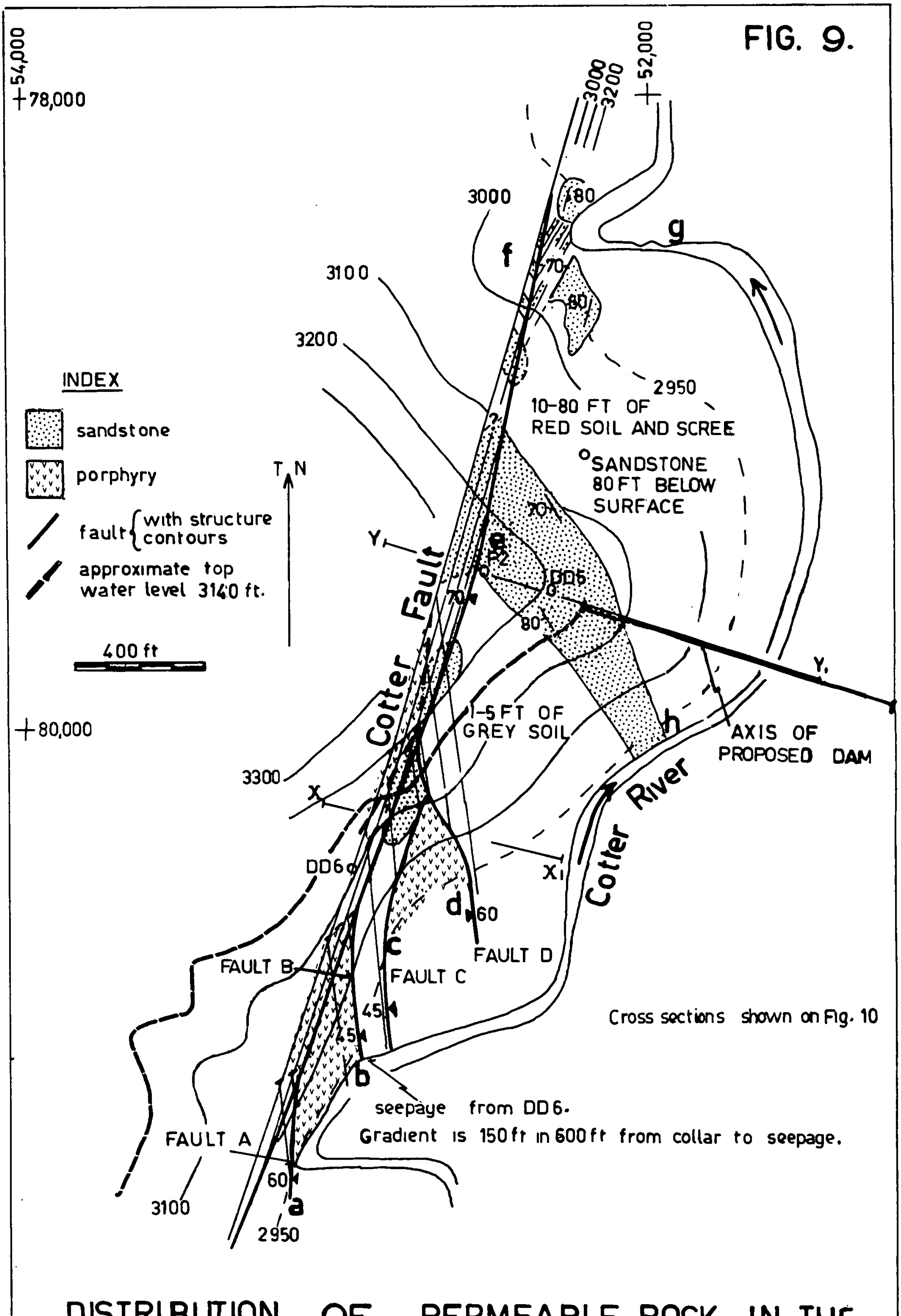
At "f", a sequence of sandstone 200 feet thick strikes 005^{o} and dips steeply westwards. The sandstone is overlain by a series of alternating thin beds of black shale and sandstone similar to the transition beds above the thick bed of sandstone at "h". The shale beds contain fault breccias (e.g. 52,350 W; 78,500 S), which indicate that extensive movement occurred along them. The sandstone could not be traced further south owing to the thick soil cover. A low mound of loose blocks of sandstone, each 1-3 feet across, at 52,400 W; 78,900 S is either a continuation of the bed at "f", or a fault-bounded lens brought up along the Cotter Fault zone.

The sandstone at "f" is probably the continuation of the thick bed of sandstone at P2 folded round the north-west trending anticlinal axis exposed in the dam foundations. Both sandstones are overlain by similar interbedded sandstone and shale. The northern slope of the west abutment ridge may be a dip slope on the sandstone. Alternatively, the sandstone at "f" may be a fault-bounded lens brought up along the Cotter Fault.

Fractured sandstone may be continuous between "f" and P2 (Figures 9 and 10), but there is not enough exposure to prove this. Backhoe holes show that there is at least 10 feet of red soil over the area, and 80 feet of soil and sandstone scree was found over the sandstone bedrock along the line of the most westerly proposed spillway. More exposures are needed if this part of the fault is to be mapped.

CONCLUSIONS

The west-dipping Cotter Fault zone has a series of closely-spaced parallel reverse faults along which a block of well-foliated phyllite on the western side has



DISTRIBUTION OF PERMEABLE ROCK IN THE WESTERN SPUR OF THE CORIN DAMSITE.

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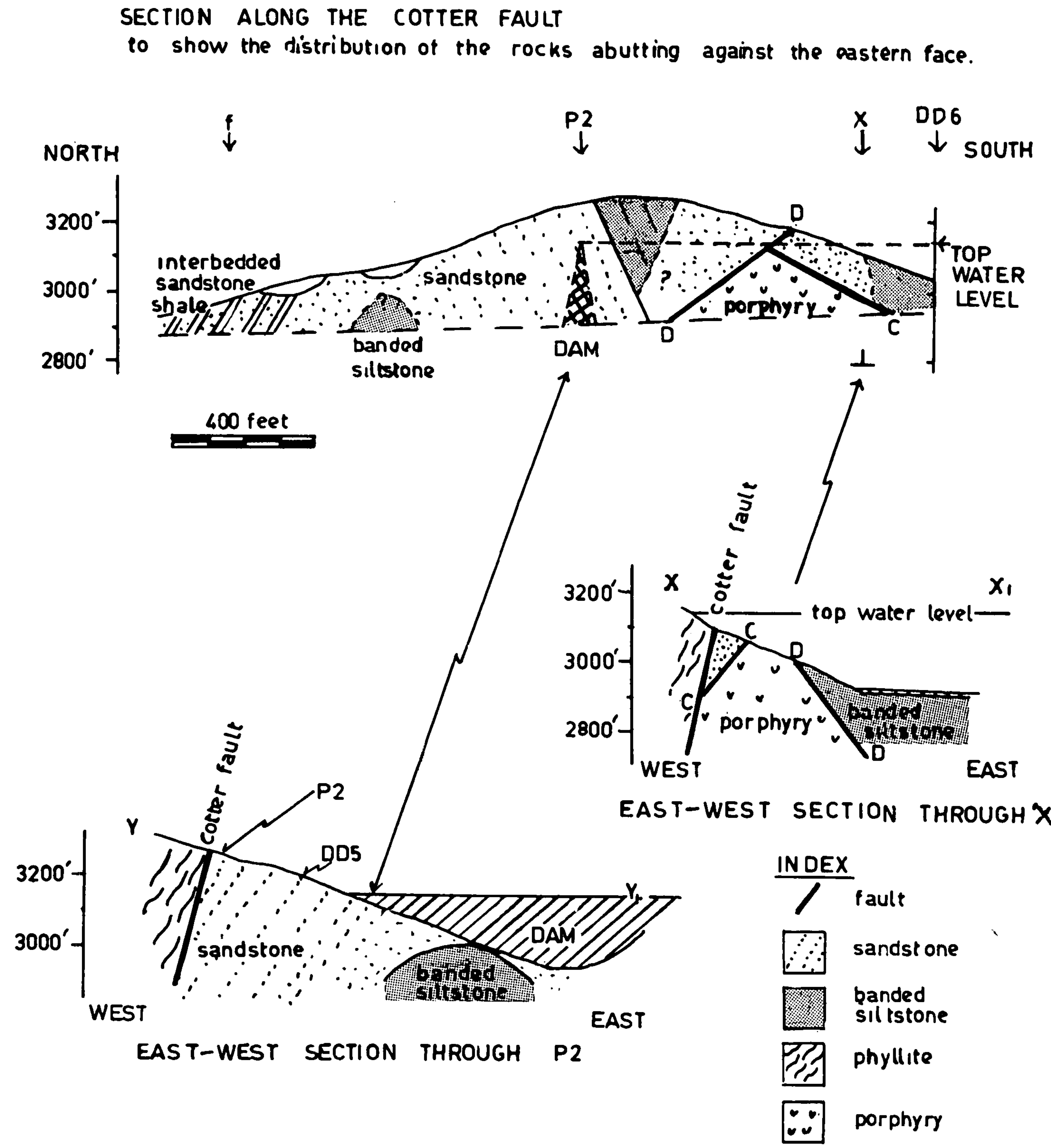
FIG. 10.



INTERPRETIVE GEOLOGICAL SECTIONS, CORIN DAMSITE

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See Fig 9 for locations of Section

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been thrust upwards to the east against a succession of sandstone, siltstone and shale beds containing wedges of porphyry. The latter were faulted in along north-north-west trending faults which are bordered by zones of shattered rock. The faults are truncated by the Cotter Fault, and the associated shatter zones may abut lenses of shattered sandstone along the Cotter Fault. If the lenses of shattered rock are interconnected, the left abutment ridge of the damsite is traversed by permeable shattered rock which crops out both in the reservoir and downstream from the dam. In these circumstances, leakage could be expected, provided fault pug and sheared phyllite and siltstone do not provide a continuous barrier. The amount of leakage would depend on the hydrostatic head, the permeability of the shattered rock, its equivalent cross-sectional area, the length of the leakage path, the sealing effect of soil at the point of ingress, and the effectiveness of remedial grouting.

RECOMMENDATIONS

Exposure along the northern part of the Cotter Fault is too poor to allow the continuity and structure of the shattered sandstone along it to be proved. A costean is required across the mass of loose blocks of sandstone at 52,400 W; 78,900 S (Figure 9) to expose the underlying sandstone to determine the structure (there is an access track to the area).

There are probably hidden north-north-west trending faults between fault D and the fault passing through "g" (Figure 2). Some of these may be revealed during the sluicing and detailed mapping of the dam foundations, but in order to examine the area south-west of the dam it is recommended that the bulldozed track from D.D. 4 towards D.D. 6 be deepened a few feet to bedrock. This will allow the continuity and structure of the banded siltstone to be determined and the transition beds at the top of the sandstone to be studied.

Further mapping of temporary exposures on the left abutment of the dam and on the right bank of the river downstream of the dam is needed to clarify the structure of the area.

It is very likely that the grout curtain will have to be extended westwards from the dam to beyond the Cotter Fault at "e". It is recommended that some of the grout holes be cored, because careful examination of the cores will reveal more information about the structure and permeability of the fault zone and will help to determine the vertical and lateral limits of the grout curtain.

REFERENCE

BEST, E.J. and HILL, J.K., 1962 - Geological Investigations at Damsite "E", Upper Cotter River, A.C.T. (1961). Bur.Min.Resour.Aust. Rec. 1962/140.