An Comisiun Pleanala

64 Marlborough Street

Dublin 1

D01 V902

Denis O'Gorman and others

Ballinagoul, Kilmallock,

Co. Limerick

Post code V35ET78

e mail : mrioghna@hotmail.com

5/10/25

Re; the Proposed development of Garrane Green Energy windfarm at Garrane, Ballynagoul, Creggane and Charleville, Co. Limerick

Case reference: 323635

FORMAL OBJECTION TO THE PROPOSED DEVELOPMENT OF GARRANE GREEN ENERGY WINDFARM

Dear Sir/Madam

We wish to formally object to the proposed Garrane windfarm of 170-172 metre turbines. We strongly urge the Inspector to investigate the following observations:

Threat to wildlife habitat

- There is a geothermal spring on my land that is approx 100 metres from the proposed turbine no.1 as shown on the map included (appendix A). This geothermal spring called the Ballynagoul Geothermal Spring was discovered in 1988 by the Geological Survey of Ireland UCC, on my land. A subsequent well was bored to a depth of over 500 metres in December 1988 in which the water was found to be at a natural temperature of 16 degrees celsius.

The Proposed development of Garrane Green Energy windfarm at Garrane, Ballynagoul, Creggane and Charleville **threatens a sensitive hydrological feature.** This goes against the principle of "proper planning and sustainable development," a key consideration for An Coimisiún Pleanála.**The potential long-term damage outweighs the benefits of the wind turbine** because of:

1. **The unique nature of the spring.** Geothermal springs are rare and are often of ecological or scientific interest.(See Appendix A- paragraph 5 and maps)
2. **The construction and operational risks.**
   - **Construction phase:** Groundworks, drilling, and excavations for the turbine foundation. Contamination can occur from concrete, fuel, or accidental spills.
   - **Operational phase:** Ongoing maintenance activities and potential leaks from the turbine's hydraulic systems may contaminate this geothermal spring on my land
   - The 100 metre distance is **an insufficient buffer zone,** particularly given the vulnerability of the geothermal underground water systems

In relation to the geothermal spring on my land An Coimisiún Pleanála must consider:

- **The EU Water Framework Directive:** This is highly relevant as it aims to protect and improve all water bodies.
- **The EU Habitats Directive:** If the spring or its surrounding habitat supports protected flora or fauna.
- **The Planning and Development Act 2000 (as amended):** This legislation provides the framework for all planning decisions in Ireland.

It is a **serious omission** that the developer has not even mentioned the Ballynagoul Geothermal Spring which is on my land approx 100 metres from turbine no.1 in its **Environmental Impact Assessment Report (EIAR)** of the proposed development area. This development is **a massive threat** to this unique and vulnerable water system.

- I have lived here all my life and I have observed flocks of migratory birds such as swans and geese follow the track of the river Mague to the lagoons in the area. The river and the lagoons especially are a **critical natural habitat.**

- It has always been observed, known and acknowledged and witnessed from the generation before us, that this area has been a natural flood plain and a proposed **5km access roadway** through this area would **block or redirect floodwater,** increasing the risk of localised flooding with serious consequences for biodiversity, agriculture and residential homes.

  It is a major oversight that Garrane Green Energy **has not addressed the issue** of the sensitive floodplain or the potential displacement of migratory birds.

Proximity to the substation

- The proximity of the proposed sub station is an unacceptable distance **of 250m approx from my residence** at Ballinagoul. There has been **no direct contact** with us whatsoever from Garrane Green Energy despite the company saying that they have directly contacted all the residents nearest the substation.

This lack of consultation undermines the basic principles of public participation in the planning process and demonstrates disregard for the rights and welfare of local residents.

Height of the wind turbines

- The height of the proposed wind turbines 170-172 metres and their sheer size **clearly suggest that this area is unsuitable for wind energy**..This also raises concerns about whether the proposal is being guided by energy potential or opportunism at the expense of a rural community.

Sightlines, RoadSafety and Risk to National Gas Pipeline

- The main entrance to the turbines and substation, on the L1537 road, is on a **double bend.** The Bruree side of that entrance has **non-existent sightlines** whatsoever. Claims of a 75 metre sightline by Garrane Green Energy are inaccurate and misleading.The proposed new entrance was **illegally opened up** in recent years, by the farmer, **without any planning permission**, a fact supported by original maps. These maps show clearly that there is no sightline.

  There is no detailed safety assessment of this windfarm entrance at the double bend in the planning documents, a dangerous omission.

- On the Charleville side, **25 metres** from this new entrance is the **main Cork to Dublin gas pipeline** which was constructed in the early nineties. All the thousands of truck loads of stone and concrete needed to build these turbines with an average weight of 50 tons per truck will be crossing this pipeline over the period of construction.This raises a huge **safety risk** of rupturing the gas line and the **deterioration of the existing local**

road as it was never meant for this type of volume and weight of traffic. It presents **liability concerns** in the event of an accident or rupture in the gas pipeline

There is no safety assessment of the impact on the gas pipeline or detailed safety assessment of the deterioration of the L1537 Road in the planning documents.

The next generation

- These proposed wind turbines, if they go ahead,will prevent future generations of families from living in the area, building new dwellings or renovating existing dwellings, including my own sons who would hope to build new or to extend my existing property in the near future. The wind energy company has the right to refuse planning once the turbines are up.

  This proposal will **sterilise future residential development**,block families from remaining in or returning to the area and will **undermine the long-term viability** of our community.

Noise and Flicker

- Since hearing about the proposed wind farm, I have researched witness accounts about **noise pollution and flicker** from the turbines and have discovered that the consequence of noise and flicker is unbearable because these turbines are so high and so close. **Persistent low-frequency noise disturbs sleep and mental wellbeing.**
- **Shadow flicker effects** and **electrical appliance flicker effects** caused by the wind turbines are proven to have neurological and psychological impacts.

Garrane Green Energy's planning documentation **downplays** these very real health impacts and **fails to adequately address** them.

Garrane Green Energy's windfarm proposal represents **a completely inappropriate take over of a rural and ecologically sensitive area**. It threatens:

- The **rare geothermal spring** named the <u>Ballynagoul Geothermal Spring</u> on my land.
- Critical **wildlife habitats and flood defences.**
- **Road safety and national gas pipelines.**
- The **health and future** of local residents and
- The **viability of rural family life and community continuity.**

The lack of proper consultation, environmental concern, and road analysis make this application flawed and dangerous.

We strongly urge An Bord Pleanála to reject this proposal in its entirety.

Yours Sincerely,

Denis O'Gorman

Ríoghna O'Gorman,

Theresa O'Gorman

Rory O'Gorman

Páidí O'Gorman

Joe O'Gorman

<u>**See APPENDIX.a** paragraph 5 of the enclosed report and also enclosed are maps of the Ballynagoul Geothermal Spring on my land.</u>

EN3G-0066-IRL

AN INVESTIGATION OF LOW ENTHALPY GEOTHERMAL RESOURCES IN IRELAND

P. M. BRÜCK AND F. X. MURPHY
Department of Geology, University College, Cork, Ireland

Summary

A reappraisal of known warm springs in Ireland and the discovery of a number of additional ones enabled the selection of several sites with geothermal potential for further investigation. Field mapping and detailed geophysical surveys in the areas adjacent to these springs has permitted the formulation of hydrogeological models accounting for their origin. The warm springs are confined to carbonate terrains and are invariably associated with fault zones. Exploratory boreholes have confirmed the importance of faulting. The primary permeabilities of these Carboniferous limestones are generally very low. However, they often have high secondary permeabilities due to faulting. Limestone solution within the fault zones and along adjacent joints has enabled the formation of an interconnected network of cavities and fissures. Weathering and dolomitization of the limestone along the faults has also contributed to the permeability. These zones provide conduits which allow warm water to migrate to the surface from depth. The location of geothermal production boreholes is thus constrained by the presence of such structures.

1. INTRODUCTION

The main aim of this project is to assess the potential for the exploitation of low enthalpy geothermal resources in the Republic of Ireland with the aid of several 500m deep boreholes. As an initial part of the study, a reappraisal of all known warm springs (Fig. 1) was undertaken. These had been located in earlier EEC funded projects (Brück and co-workers, 1986; Burdon, 1983). The geological setting of each spring was examined and hydrogeological models were constructed to account for their origin. The most promising springs from the point of view of temperature and geographical location were selected for further examination. Detailed field mapping of the district around each spring was undertaken together with geophysical surveys with the help of the Applied Geophysics Unit of University College, Galway.

In addition a number of previously unrecorded warm springs were discovered, particularly in Co. Limerick, in the Newcastlewest (Fig. 2) and Charleville-Kilmallock regions (Fig. 3), at which geological and geophysical surveys were also undertaken. Several tepid springs were also noted. These have temperatures of 2-3° above that of normal shallow circulating groundwater. Detailed investigations, as outlined below, were undertaken at a number of sites selected by this initial study.

2. THE BALLYNAGOUL SPRINGS

In the Charleville-Kilmallock region of Co. Limerick a number of warm springs (15.5°C) were known to be localized along a fault at the foot of Knocksouna Hill (Brück and co-workers, 1986, Cooper and co-workers, 1983). During the present study additional warm springs were discovered a short distance south of Knocksouna at Ballynagoul. Three springs with a constant temperature of 16.5°C occur in a cluster and a fourth with a temperature of 15.5°C lies about 500m to the east (Fig. 4). The total discharge from the four springs is about 22,000 litres/hour.

It was decided that further examination of the site was justified. A detailed geophysical survey was undertaken. This revealed the presence of a thick layer of glacial drift across eastern Ballynagoul. The bedrock surface was shown to be highly irregular. Vertical electrical soundings indicated that the overburden often exceeds 20m in thickness. A low resistivity zone was encountered in the vicinity of the main cluster of springs.

Three exploratory 5cm diameter cored boreholes were drilled in December 1987. BG 1, was located within the main cluster of springs and was drilled to a depth of 110m. It penetrated a sequence of Dinantian dark grey biomicrites with interbedded argillaceous horizons and shale wisps. In general the limestone is highly impermeable with porosities of less than 0.5%. However, between depths of 60-80m, a strongly weathered and dolomitized zone was encountered. Although this was a narrow diameter borehole it yielded a large volume (20,000 - 23,000 l/hr) of warm (16.5°C) water under strong artesian pressure. Borehole BG 2 was located 150m NW of BG 1 and was drilled primarily to provide structural and lithological control. It penetrated a lower stratigraphic level within the Dinantian than that of BG 1, comprising pale grey thickly bedded relatively non-argillaceous calcarenite. A trachytic intrusion was encountered at the base of the borehole (75m). The limestone was unweathered and contained few open fissures or cavities, nevertheless a small artesian flow of water with a temperature of 12°C was obtained. The third borehole, BG 3, was located close to the eastern spring. It was drilled to a depth of 42m and penetrated a sequence of Dinantian dark grey biomicrites with abundant, closely spaced thin chert bands or nodules. A very small artesian flow of tepid water (11.8°C) was also obtained.

A detailed micropalaeontological study was subcontracted. The results (Jones, 1988) prove that BG 2, encountered the lowest stratigraphic level ranging from mid-late Arundian to lower Holkerian. BG 1 and BG 3, encountered limestones of Holkerian-lower Asbian age.

The age dating indicates that a fault with a minimum displacement of 150m separates BG 1 and BG 2. It is considered that this fault provides the conduit which allows deeply circulating warm waters to reach the surface from depth.

At the time of writing a 500m deep borehole is being drilled within this area, located between BG 1 and BG 2 at a site which geophysical surveys have shown to be a zone of low resistivity. This borehole should provide valuable information concerning the nature of the aquifer, the mechanism by which the warm water reaches the surface and temperatures at depth, as well as giving an indication of the volume of warm water present.

3. THE HYDROCHEMISTRY OF THE BALLYNAGOUL WATERS

Water samples from the Ballynagoul springs and boreholes were regularly analysed. The chemistry of all the springs and boreholes is virtually identical and is similar to that of the Knocksouna springs 1km to the NW (Brück and co-workers, 1986). The results of the analyses have been plotted on a trilinear Piper diagram, enabling the hydrochemical facies to be determined (Fig. 5). The analyses all lie within the calcium-type and bicarbonate-type fields indicating that the water has been derived from a carbonate aquifer which the high Mg content suggests is extensively dolomitized.

4. THE NATURE OF THE AQUIFER

Many of the springs in both Munster and Leinster (see 7 below) discharge from within, or close to, the top of the Dinantian Waulsortian limestone and are often associated with faults. The primary permeability of the limestone is very low. However, during the Variscan orogeny Ireland experienced weak to moderate compression and broad open folds with thrusts and numerous cross faults were produced. The Waulsortian limestone lacks discrete bedding surfaces and consequently deformed in a more brittle manner than the underlying and overlying well-bedded strata. Faults were developed and these now represent localized zones of high secondary permeability. Fault zones within the Waulsortian tend to be strongly brecciated and their wall rocks are usually intensely jointed. Secondary dolomitization has often occurred along these zones due to the migration of Mg-rich fluids. This indicates the importance of faults in increasing the permeability and localizing fluid flow. In addition, the dolomitization of the limestone has also contributed to the permeability.

A detailed study of joint and fracture patterns within the limestone of the Newcastlewest and Charleville-Kilmallock regions was conducted. N-S joints predominate (Fig. 2). Where the Waulsortian outcrops the joints are often opened out by limestone solution; sometimes aperatures several centimetres wide have developed. It is considered that these form a labyrinth of interconnected fissures which enables fluid circulation to take place. The increased joint frequency associated with faults also provides a significant contribution to the secondary permeabilities.

5. A HYDROGEOLOGICAL MODEL FOR THE BALLYNAGOUL SPRINGS

The Ballynagoul springs occur on the northern limb of a major syncline. The recharge area is believed to lie further south in the Ballyhoura Mountains, an anticlinal inlier of largely Devonian "Old Red Sandstone" with a core of Silurian sedimentary rocks (Fig. 6). Rainwater readily infiltrates through the weathered bedrock surface and percolates into the less weathered sandstone along joints, bedding surfaces and through intergranular pore space. Migrating down-dip the water eventually encounters a major fault on the northern limb of the Ballyhoura Anticline which juxtaposes Old Red Sandstone against Waulsortian limestone. The water migrates across the fault zone into the limestone and continues its downward flow towards the hinge region of the syncline where it becomes heated as a consequence of the effects of the natural geothermal gradient. This warm water then migrates up-dip along the northern limb of the syncline. The presence of a significant fault provides a conduit which allows the warm water to rapidly escape to the surface. The conduit may be produced by "piping" (Mayo, Muller and Ralston, 1985) due to localized hydraulic cleaning and/or solution channelling within the fault zone.

6. MALLOW

During the previous phase of EEC funded geothermal research, warm springs which occur at Mallow, in north Co. Cork, were studied in detail (Brück and co-workers, 1986). Consequently it was considered that further work in this region was unnecessary. However, as a result of the EEC study, Cork County Council drilled a 75m deep demonstration and production well in 1986, in the grounds of Mallow Mart which yielded a very large supply of warm water (19.5°C). A pump rate of almost 4,000 l/sec. produced a drawdown of less than 2.5m over a 43 hour period.

In 1988 sufficient funds were obtained to deepen this borehole to 500m. The aim was to determine whether zones of warmer water occur at depth. The borehole was fully cored and is located entirely within the Waulsortian limestone. The core was logged by the authors as part of the present project and downhole geophysical measurements were made by the Applied Geophysics Unit, University College, Galway. The core of 5cm diameter was almost invariably fresh and unweathered below a depth of 90m. Cavities and fissures were absent and there was little evidence of limestone solution and dolomitization. Temperature logging of the borehole revealed the presence of anomalously high temperatures in the upper 90m with a cooler zone between depths of 62-78m (Fig. 7). Below this the temperature initially dropped, then stabilized at 120-150m before gradually increasing again due to the geothermal gradient. At the base of the hole a temperature of approximately 18°C was obtained. Thus no significant increase in temperature over that present at the top of the borehole occurred.

These results indicate that the warm water must travel laterally for some distance at shallow levels utilizing the increased permeability due to weathering and solution channelling which are often intense close to the bedrock surface in limestone terrains. It is considered that the water is derived from the same source that supplies the Lady's Well warm spring located just 200m to the east (Brück and co-workers, 1986). It thus seems likely that significant water circulation is confined to a fault zone at depth. A "pipe-like" conduit which has developed along this allows the water to migrate towards the surface where it discharges at Lady's Well and the Mallow Spa as well as circulating through the weathered bedrock close to the surface. The failure of the deepened borehole to encounter any further inflow of warm water indicates the difficulty of obtaining water at depth in a discontinuous aquifer whose permeability is secondary as a consequence of fracturing, dolomization and limestone solution.

7. WARM SPRINGS IN LEINSTER

Warm springs in Leinster, also all located in Dinantian limestones, were previously studied by the firm Minerex Ltd., on behalf of the Geological Survey of Ireland (Burdon, 1983). As part of the present study three springs, Kilbrook, St. Gorman's Well and Louisa Bridge (Fig. 1) were selected for further examination with the aim of siting a 500m deep borehole at one locality. Kilbrook is the warmest spring in Ireland (23°C) and has a consistently large discharge. A detailed geophysical survey conducted in the area around the spring indicated the presence of a very thick cover of glacial drift which sometimes exceeds 50m. Two low resistivity zones were identified which are considered to represent saturated faults within the bedrock. The spring occurs at the intersection of these faults. The fault intersection must represent a zone of greatly increased permeability in which a "pipe-like" conduit has developed. This allows the warm water to reach the surface from depth.

At Louisa Bridge it was unfortunately not possible to conduct a geophysical survey due to cultural interference. There is little bedrock exposed in the region. Thus geological controls upon the origin of the spring can only be surmised. However, it is considered that a cross fault, transecting the Celbridge Syncline, provides the conduit which allows the warm water to reach the surface from the syncline core.

Field mapping was conducted in the region around St. Gorman's Well. It is readily apparent that the spring occurs on or close to the faulted contact between the Waulsortian limestone and the overlying Visean

"Calp" limestone. Further work has yet to be undetaken at this site and on the basis of the results obtained from all these three localities a decision will be made upon the location of a 500m borehole to be drilled in 1989.

8. CONCLUSIONS

This study has shown that in Ireland warm springs are confined to limestone terrains. They are associated with faults, particularly within the Waulsortian limestone, although some springs discharge from the upper contact of the Waulsortian or close to faults within the overlying well-bedded Visean limestone.

The primary permeabilities of these limestones are generally very low. They often have a porosity of less than 0.5%. However, during Variscan deformation, the limestones particularly the Waulsortian, behaved in a highly brittle fashion, producing faults with broad zones of breccia and intense jointing within the wall rocks. These acted as zones of high secondary permeability. The circulation of Mg-rich fluid along some faults resulted in the dolomitization of the wall rocks which increased the permeability. Solution channelling and opening of fissures along joints also made a significant contribution to the permeability. Thus with time, an interconnected network of fissures and cavities developed in close association with fault zones, allowing water to circulate to depths at which it became heated due to the geothermal gradient. The upward migration of the warm water was again localized by fault related zones of high secondary peremeability. Rapid migration to the surface takes place along "pipe-like" conduits produced by hydraulic cleaning and limestone solution along fault zones.

Large volumes of warm water are considered to occur in the hinge regions of limestone cored synclinal structures such as those of the Charleville-Kilmallock area and the Celbridge Syncline. However, the siting of production wells in such areas is highly speculative since a large volume of warm water will be extracted only if a zone of high secondary permeability is intersected.

REFERENCES

BRÜCK, P. M., C. E. COOPER, M. A. COOPER, K. DUGGAN, L. GOOLD, and D. J. WRIGHT, (1986). The Geology and Geochemistry of the Warm Springs of Munster. Ir. J. Earth Sci., 7, 169-194.

COOPER, C. E., P. M. BRÜCK, K. DUGGAN, L. GOOLD, and D. J. WRIGHT, (1983). The Warm Springs of Munster, Ireland: Final Report. Dept. of Geology, University College, Cork. RS 83/9.

BURDON, D. J. (1983). Irish Geothermal Project, Phase 1. Unpublished report to the Geological Survey of Ireland. Minerex Ltd., Dublin, 150/75/15.

JONES, G. L. (1988). Micropalaeontology report on boreholes BG 1, BG 2, BG 3, Ballynagoul, Co. Limerick. Unpublished report, Conodate, Dublin.

MAYO, A. L., A. B. MULLER, and D. R. RALSTON, (1985). Hydrochemistry of the Meade Thrust Allochton, southeastern Idaho, U.S.A. and its relevance to stratigraphic and structural groundwater flow control. J. Hydrol., 76, 127-61.

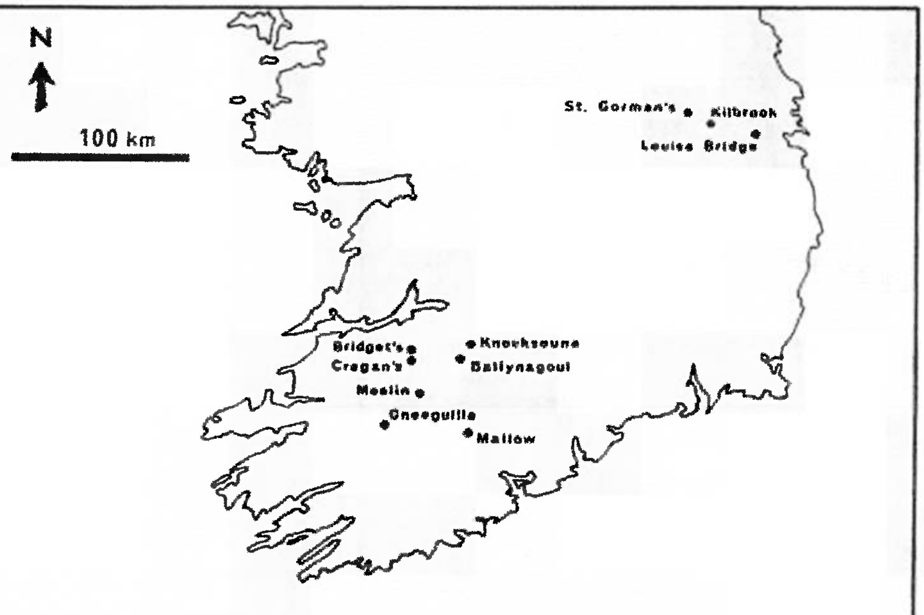

FIGURE 1 Location map showing main warm springs studied

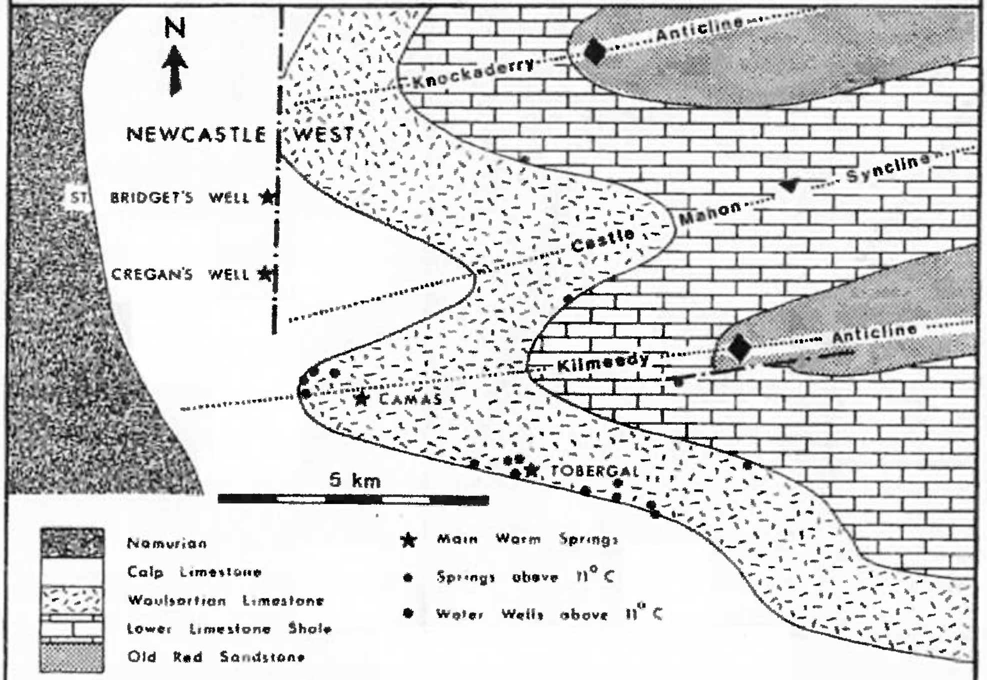

FIGURE 2 Geological map of the Newcastle West region showing the location of warm springs and boreholes with anomalously high temperatures

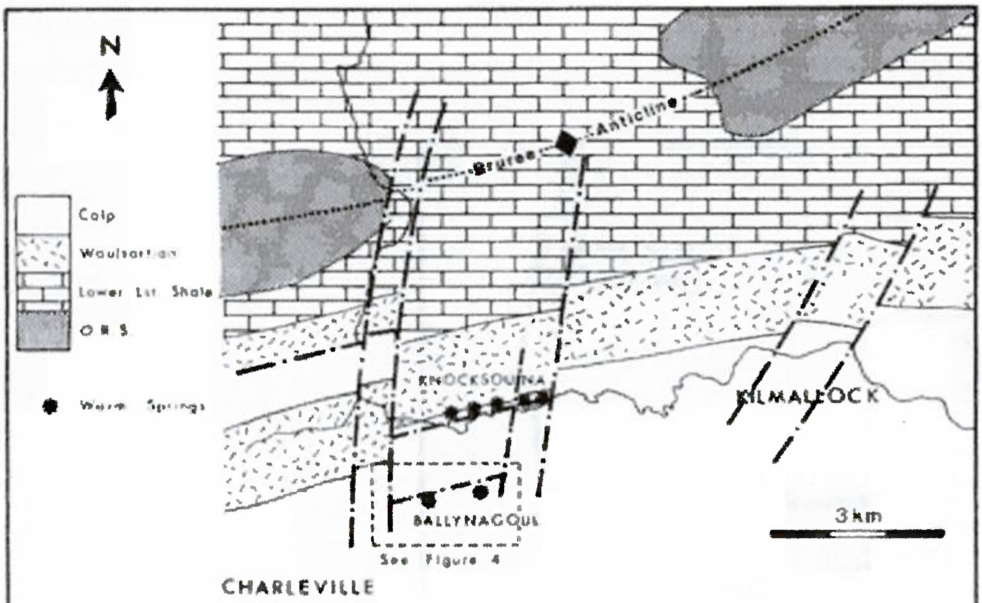

FIGURE 3 Geological map of the Charleville - Kilmallock region showing warm spring localities

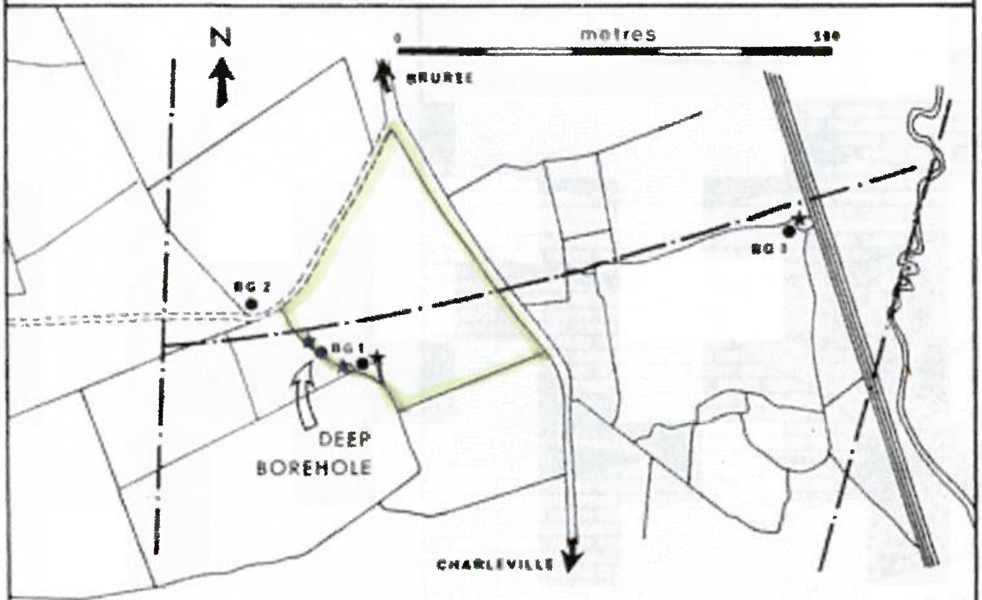

FIGURE 4 Geological map of Ballynagoul showing warm springs and borehole sites

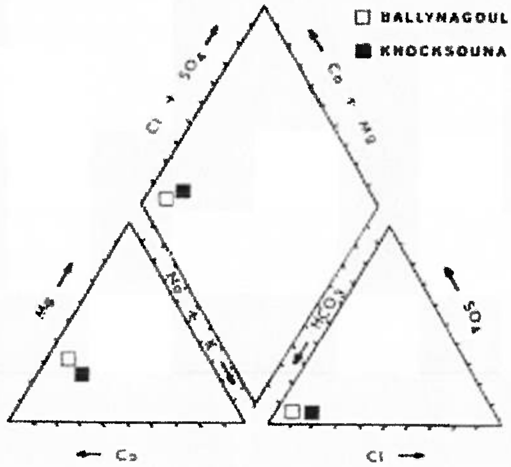

FIGURE 5 Hydrochemical analyses for Ballynagoul and Knocksouna plotted on trilinear diagrams

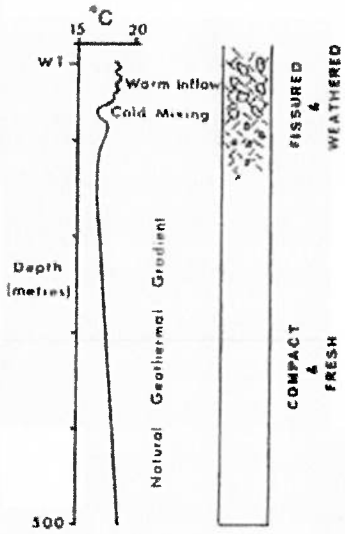

FIGURE 7 Temperature log of the Mallow borehole

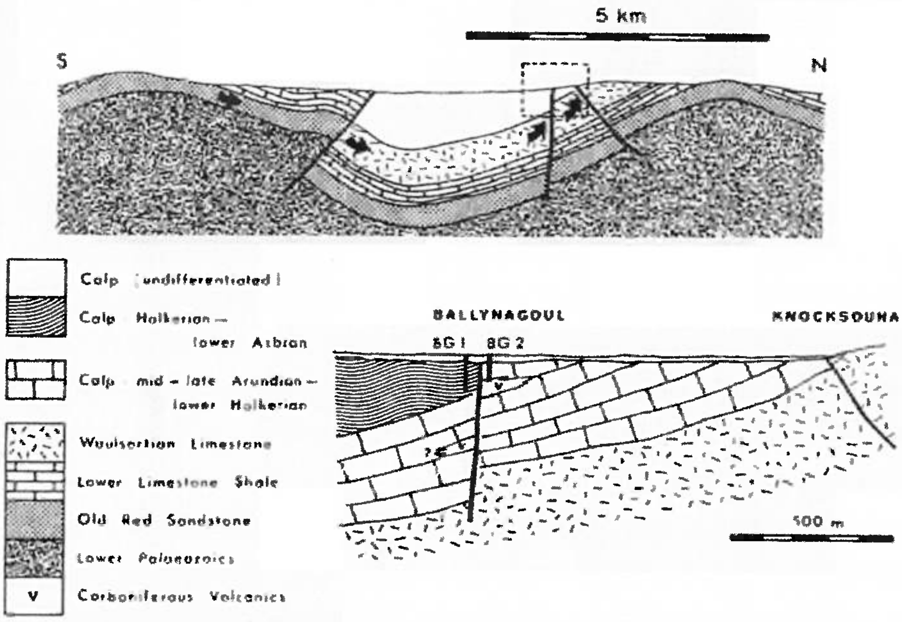

FIGURE 6 Geological cross – section through the Charleville –Knocksouna region showing water migration pathway