

Ardkill Mor Quarry, Carrickaboy, County Cavan

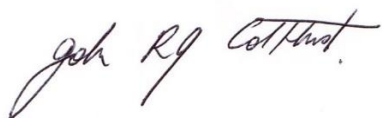
Report for John Nulty Ltd

**Professional Geologist's Report as required by
I.S.EN 932-3:1997**

**Professional Geologist's Report as required by
S.R.21:2014 & A1:2016**

15/10/2020

Prepared by:

A handwritten signature in black ink, appearing to read 'John R. Colthurst'.

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Ardkill Mor Quarry, Carrickaboy, County Cavan

Introduction

This report is compiled to meet a requirement of Standard Recommendation S.R.21:2014 & A1:2016. This S.R. deals with Guidance on the use of I.S.13242:2002+A1:2007 – Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction. Section E.2.4 of S.R.21 requires a geological, chemical and petrographic assessment of the quarry and the end products.

This report also meets a requirement of I.S.EN 932-3:1997 – Tests for General Properties of Aggregates-Part3: Procedure and Terminology for Simplified Petrographic Description. Both reports have been compiled by EurGeol John Colthurst, PhD, P Geo, who is a qualified Professional Geologist.

Quarry Planning, Extraction Methods, and Ground Stability Issues are not part of the remit of this report.

Location

The quarry, operated by John Nulty Ltd, is located in Ardkill Mor Townland, County Cavan. The quarry is located 8km south-southeast of Cavan Town.

The quarry is located on the western flank of Ardkill Mor hill, a very prominent hill rising to an elevation of 268m immediately east of the quarry. The area around the quarry has a relatively thin cover of overburden and there are numerous craggy outcrops in the vicinity. The quarry is surrounded by poor quality scrubby or rocky farmland.



Figure 1. Ardkill Mor Quarry. The active upper quarry is arrowed.

Regional Geology

The quarry is within the tract of Lower Palaeozoic rocks collectively known as the Southern Uplands Belt. The Ardkill area falls just within Tract 4a, at its junction with Tract 3. The two tracts are separated by the Orlock Bridge Fault or Slieve Glah Shear Zone, a major sinistral shear zone which can be traced as far as the Southern Uplands in Scotland.

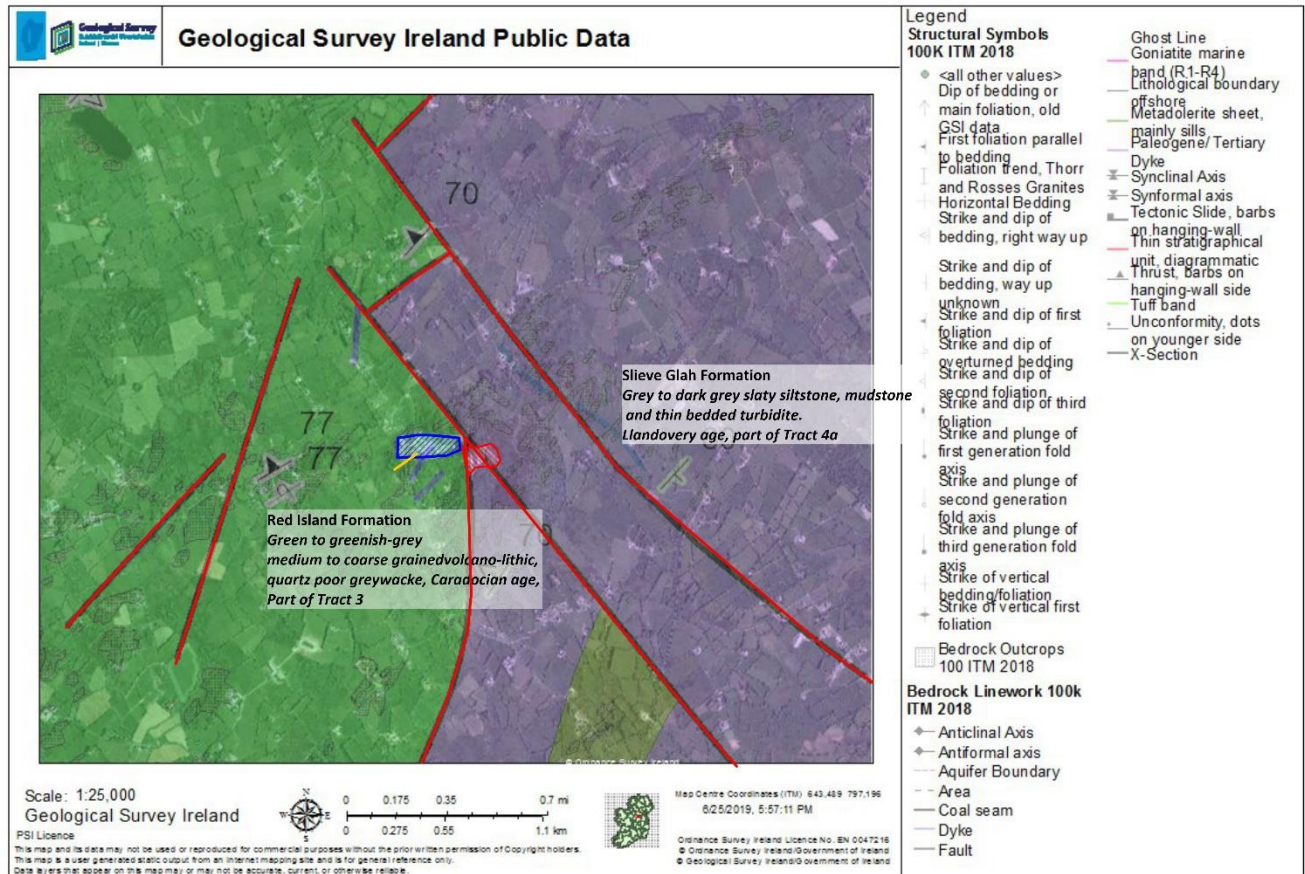


Figure 1. Geological map downloaded from the Geological Survey of Ireland. The old Lower Quarry is outlined in blue and the Upper Quarry outlined in red. The red lines are faults associated with the Orlock Bridge Fault, also known as the Slieve Glah Shear Zone.

Geological Unit	Age	Lithology
Tract 4a Slieve Glah Formation	Silurian, Llandovery	Blue to blueish grey siltstone turbidites, intercalated mudstones, sub-ordinate conglomerates and green greywackes.
Tract 3 Red Island Formation	Ordovician, Caradoc to Ashgill	Green to greenish grey greywackes with sub-ordinate grey to black shales

Table 1 summarises the Lower Palaeozoic stratigraphy of Tracts 3 and 4a. The two tracts are separated by the Orlock Bridge Fault.

Examination of the Quarry

The quarry was visited in 2018, 2019 and most recently on the 6th October 2020, in the company of Garrett Nulty. The Upper Quarry is currently operating, but during 2020 there was also production from the south side of the lower quarry. The main active faces in the Upper Quarry are at the eastern and northern sides of the quarry.



Figure 2. Nulty's Upper Quarry



Figure 3. Nulty's Lower Quarry showing recently blasted area.



Figure 4. Strained, quartz veined, silicified siltstone, Upper Quarry.



Figure 5. Crushed aggregate, produced from greywacke, Lower Quarry

The strata in the Upper Quarry are highly sheared with numerous string-like quartz veins. These veins may initially have been parallel to the bedding but they appear to have been crenulated and re-folded. The rocks are extremely hard and have been silicified. More thinly bedded sandstone /siltstone sequences have been boudinaged with lenses of greywacke sandstone within sheared siliceous siltstone units. Occasional lenses of black silicified mudstone are present but these are discontinuous due to the intense shearing.

Pyrite is occasionally developed on late fracture surfaces and within cross-cutting quartz/calcite veins.

The quarry is probably not typical of much of the sedimentary sequence in the Longford/Down Inlier.

The presence of the Orlock Bridge Fault zone is responsible for the extremely high strain and the intense silicification.

The Orlock Bridge Fault Zone is described “*as marked by abundant folded and disrupted, phyllonite parallel quartz segregations and protomylonitic to mylonitic textures. The phyllonitic fault zone fabric overprints the earlier, regional S1 cleavage, but pre-dates c.400Ma Caledonian dykes*” (***Geology of Longford and Roscommon, Sheet 12, Geological Survey of Ireland***).

The strata in the Lower quarry are less deformed and silicified than those in the Upper Quarry. Very strong, thickly bedded medium to coarse grained greywackes are dominant and siltstones are less common. Quartz veining is not as intense and the rock is less sheared than in the Upper Quarry.

A felsite dyke is present in the south-western corner of the Lower Quarry (indicated in yellow in Figure 1). This dyke is intruded into a dark carbonaceous shaly unit, locally investigated unsuccessfully as a source of coal!



Figure 6. Felsite intrusive, cream coloured, in the lower quarry.

Physical and Chemical Testing

The quarry carries out regular tests on the aggregate it produces. Certificates for the test results were supplied to the Professional Geologist. Recent test results are summarised in the accompanying table and the original certificates are available from John Nulty Ltd.

Test	Testing Company	Material tested	Date	Result	S.R 21 Compliance
Water Absorption (% of dry mass)	Testall	Clause 804 SR21, T1, 0-31.5mm	13/10/2020	1%	Pass, must be $\leq 2\%$
Apparent Particle Density	Testall	Clause 804 SR21, T1, 0-31.5mm	13/10/2020	2.76	Not Specified in S.R.21
Los Angeles Coefficient	Testall	Clause 804	10/6/2020	18	Pass, must be ≤ 30

Total Sulphur Content	Testall	Clause 804 SR21, T1, 0-31.5mm	23/9/2020	0.1%	Pass, must be $\leq 1\%$
Acid soluble Sulphate as SO ₄	Testall	Clause 804 SR21, T1, 0-31.5mm	23/9/2020	<0.1%	Pass, must be $\leq 0.2\%$
Sulphate Aqueous Extract mg/l SO ₄	Testall	Clause 804 SR21, T1, 0-31.5mm	23/9/2020	103mg/l	Not specified in SR 21:2014
Magnesium Sulphate soundness	Testall	Clause 804/S.R.21, T1	13/10/2020	18%	Pass, must be $\leq 25\%$
Grading	Testall	Clause 804/S.R.21, T1	12/10/2020	f=3.7	Satisfactory
Flakiness Index	Testall	Clause 804 SR21, T1, 0-31.5mm	12/10/2020	23	CL 804 Must be ≤ 35
Geological Examination	Geologist	Quarry, Clause 804 SR21, T1, 0-31.5mm	6/10/2020		Satisfactory
Thin Section Petrography	Testall	Clause 804 SR21, T1, 0-31.5mm	22/9/2020	Pass	Only required if Total Sulphur is >0.1%
Methylene Blue	Testall	0-2mm fraction in S.R..21	23/9/2020	0.9g/Kg	Not specified

S.R.21 requires suitable material to contain less than 10% sedimentary mudrock. There is no sedimentary mudrock present. Any mudrock present is a very durable silicified metamorphic rock rather than a sedimentary mudrock.

S.R.21 states that material with a total sulphur value $\leq 0.1\%$ is always acceptable and material with a value of >1% is not acceptable. Material which falls between these two values may be acceptable but additional work, including petrography, must be completed to determine the nature of the pyrite or other sulphur bearing minerals. The total sulphur value of 0.1% means that the aggregate is always acceptable in terms of S.R.21.

The Professional Geologist can select a single product suitable for testing for Los Angeles Value, Water Absorption and Magnesium Sulphate Soundness. The quarry has submitted Clause 804 material for WA, LAV and MSS testing. All of the results are S.R.21 compliant and the geologist is satisfied that the testing is adequate.

The chemical tests, Total Sulphur and Acid Soluble Sulphate, must be done on all of the products unless the Professional Geologist advises that the tests carried out on one specific product are applicable to the others. The tests have been done on Clause 804/S.R.21, T1 material and Total Sulphur and Acid Soluble Sulphate values are low. The geologist is satisfied that the values are representative of all of the material.

S.R.21, Table E.1 sets out the necessary testing required on the aggregates. This should be complied with and a full record of the test results must be kept. Test frequencies may be revised based on the advice of the Competent Person (Professional Geologist), see NOTE 1, Table E.1

Test	Table E1	Recommendation of Professional Geologist
Magnesium Sulphate Soundness	1 per year	1 per year
Water Absorption	2 per year	1 per year
Los Angeles Coefficient	2 per year	1 per year
Acid Soluble Sulphate	Quarterly	Twice a year
Total Sulphur	Quarterly	Twice a year
Geological Examination	Quarterly	1 per year
Thin and polished sections	As required depending on Sulphur values	Not required unless Total Sulphur values are above 0.1%

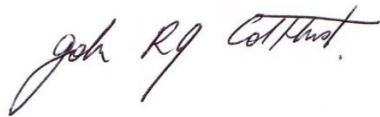
The table calls for a geological examination on a quarterly basis. The Professional Geologist may revise the frequency of this geological examination. In the case of Ardkill Mor Quarry, annual examination should be adequate, but if there are any significant changes in the geology or in the operating methods the geologist should be contacted immediately.

Statement of Compliance

The Professional Geologist is satisfied that, subject to Certification by NSAI or another suitable body, providing grading specifications are met, based on his examination of the quarry, together with the chemical and physical test results, the material from Ardkill Mor **is suitable for use as unbound granular fill (hardcore) for use under concrete floors and footpaths and that it meets with SR21: 2014 & A1:2016 guidelines.**

S.R. 21, Table E.1 sets out the necessary testing required on the aggregates.
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13/10/2020
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