Reports and Journals

Cooper, A.J., and Gartner, J.F., 1984, "Glacial Geology, a Key to Aggregate Investigations in Canada" Bulletin of Engineering Geology and the Environment, 29 (1), 39-42.

Abstract:

Most aggregates mined in Canada are from glacial materials. Four examples are cited to demonstrate the role of glacial geology in aggregate investigations.

The first example illustrates how the results of a major engineering geology terrain study in northern Ontario are used to locate sand and gravel. The second and third examples show how stratigraphic interpretations helped in the location of buried aggregate in both western and eastern Canada. Finally, progressive study of a kame deposit located in southern Ontario has allowed delineation of the best aggregate resources within the landform.

Gajewski, L.S. and Uścinowicz, S., 1993, "Hydrologic and Sedimentologic Aspects of Mining Aggregate from the Shipsk Bank (Baltic Sea)" Marine Georesources & Geotechnology, 11 (3), 229-244.

Abstract:

Investigations aimed at obtaining knowledge about the environmental effects of mining aggregate from the sea bottom were carried out on the Stupsk Bank. Special attention was given to the magnitude and reach of changes of hydrologic conditions, in that to changes in concentration of matter suspended in sea water, and to dynamics of the sea bottom—change of bottom relief, resulting from both natural causes and from mining of the aggregate.

Taboada, J., Vaamonde, A., Saavedra, A., 1999, "Evaluation of the quality of a granite quarry" Engineering Geology 53, 1–11.

Abstract:

The determination of the quality of a mass of granite with a view to its exploitation for ornamental purposes is carried out by means of the identification of the geological, geotechnical and aesthetic factors that characterize the granite. In order to draw up an optimal exploitation method for any given granite deposit, an assessment of the relationship existing between these factors and the quality of the block is of the utmost importance. Using as a starting point, data based on the observation of these factors at an extraction bank, a simple linear index was elaborated using multivariant techniques, permitting the classification of each block in terms of quality. Subsequently, using geostatistical techniques, the index is applied to areas of the extraction bank for which there are no a priori data, with a view to predicting possible areas of maximum quality.

Included is a description of an application whereby the quality of a granite quarry was evaluated on the basis of 569 observations at an extraction bank. The methodology developed may be considered an objective quality evaluation method applicable to ornamental rock quarries

Benardos, A.G., Kaliampakos, D.C., Prousiotis, J.G., Mavrikos, A.A. and Skoparantzos, K.A., 2001, "Underground Aggregate Mining in Athens: a Promising Investment Plan" Tunnelling and Underground Space Technology, 16 (4), 323-329.

Abstract:

The introduction of stricter environmental regulations regarding the operation of open-pit quarries in the wider area of Athens has resulted in the closure of many quarrying operations. The aggregate production cannot further ensure the meeting of demand in the area and alternative schemes are being examined so as to provide long-term solutions to that issue. This paper focuses on the development of underground aggregate exploitations in the region, providing the basis for an in depth financial appraisal supported by the mine design process which also involves the utilisation of the underground space. It is proved that beyond the environmental advantages offered by this particular solution, underground limestone mining is also an attractive investment plan. Critical importance to the latter plays the space utilisation process that can be looked as a real estate development project.

Langer, W.H., 2002, "A General Overview of the Technology of In-Stream Mining of Sand and Gravel Resources, Associated Potential Environmental Impacts, and Methods to Control Potential Impacts" Rep. no. OF-02-153, USGS.

Abstract:

The purpose of this paper is to describe, by way of selected examples, the broad range of potential impacts, and to describe some techniques to prevent or limit those impacts. The paper begins with an overview of the sand and gravel industry in general. It then describes in-stream mining of sand and gravel including extraction, processing, and reclamation. It follows with a generalized description of stream dynamics. It concludes with a discussion of the potential environmental impacts from in-stream mining and some of the techniques that can be employed to limit those impacts.

Lolcama, J.L., Cohen, H.A. and Tonkin, M.J., 2002, "Deep Karst Conduits, Flooding, and Sinkholes: Lessons for the Aggregates Industry" Engineering Geology 65 (2-3), 151-157.

Abstract:

Limestone aggregate quarries in deeply penetrating karst terrain are often at considerable risk of artesian inflow from groundwater or surface water channeled through the karstic aquifer. The inflow occurs through what are likely to be complex conduits that penetrate hundreds of feet into bedrock. Rates of inflow can exceed the operation's pumping capabilities proving to be uneconomic to manage over the long term. Over time, inflow rates can increase dramatically as turbulent flow through the conduit erodes its soft residual clay-rich fill. One recent investigation observed an inflow rate of more than 40,000 gpm from a surface water source. Floodwater persistently laden with sediment is an indicator of conduit washout and implies increasing inflow rates over time.

Conduits carrying floodwater can exist in a variety of forms: along deeply penetrating geologic faults, joints, or following the path of preferentially eroded bedding. Preferential

structural deformation along faults or bedding can enhance dissolution during subsequent interaction with groundwater. The resulting conduit may be a complex combination of many geological features, making the exploration and remediation of the pathway difficult.

Sinkholes at the site can occur within several contexts. Pre-existing subsidence structures can reactivate and subside further, forming new collapse sinkholes within soil directly overlying the conduit. Cover-collapse sinkhole development can be a direct result of increasing downward groundwater velocities and subsurface erosion associated with the enlargement of a conduit. Normal operation events such as a quarry blast can also provide a significant new linkage between the groundwater and the quarry, allowing rapid drainage of the groundwater reservoir. With such drainage and erosion of karst-fill, sinkholes will develop over localized water table depressions, most significantly over enhanced permeability zones associated with fractures. Paradoxically, although the rise in quarry water level will lead to regional reduction in the hydraulic gradients, on local scales, drainage of the groundwater reservoir increases gradients and leads to the development of cover-collapse sinkholes.

Recommended methods for preliminary site investigation can include a detailed review of geological literature and drilling logs to compile a conceptual model of the site. A fracture trace analysis with EM geophysics can confirm the locations of major faults and fractures. Fingerprinting of the various water sources to the quarry and the water in the quarry is an inexpensive and effective means of identifying the source and likely direction of the groundwater and surface water flow. Automated geophysical equipment on the market for performing rapid resistivity and microgravity surveys speeds up the site screening process during reconnaissance exploration for deep structure. It is recommended that mine planning fully incorporate this information so that quarry operators can take proactive measures to avoid catastrophic and costly flooding events.

Weeks, J.M., Sims, I., Lawson, C. and Harrisson, D.J., 2003, "River Mining: Assessment of the Ecological Effects of River Mining in the Rio Minho and Yallahs Rivers, Jamaica" Rep. no. CR/03/162N. British Geological Survey.

Abstract:

This report is one of a series of Technical Reports on alluvial mining of sand and gravel aggregate in developing countries, most of which relate to Jamaica. The key objective of this report was to investigate the effects of sand and gravel mining activities at the rivers Yallahs and the Rio Minho in Jamaica using indices of biological diversity.

Newell, R.C., Seiderer, L.J., Simpson, N.M. and Robinson J.E., 2004, "Impacts of Marine Aggregate Dredging on Benthic Macrofauna off the South Coast of the United Kingdom." Journal of Coastal Research, 20 (1), 115-125.

Abstract:

A survey of benthic macrofauna in the vicinity of a coastal marine aggregate dredging site off the south coast of UK was carried out in 1999. The object of the survey was to determine impact of marine aggregate dredging on community composition, the extent of impact outside the boundaries of the dredge site, and the rate of recolonization and recovery of the fauna following cessation of dredging. Part of the site was intensively dredged by vessels at anchor whilst other parts were less intensively exploited by trailer dredger. The impact of dredging

within the intensively exploited anchor dredge site was limited to the dredged area. Impacts included a suppression of species variety, population density and biomass, as well as differences in species composition compared with the surrounding deposits. In contrast, trailer dredging had no impact on community composition of macrofauna within the dredge site.

No suppression of benthic community structure was recorded beyond 100 m from the dredge site. Species variety, population density, biomass and body size of macrofauna was enhanced for as much as 2 kilometers in each direction along the axis of the tidal streams. Whether this reflects organic enrichment derived from the dredge site warrants further investigation.

The rate of restoration of biomass following dredging was slower than that recorded for species diversity and population density. The data for the North Nab study site allow a generalised recolonization sequence to be constructed for coastal deposits.

Hitchcock, D.R., and Bell, S., 2004, "Physical Impacts of Marine Aggregate Dredging on Seabed Resources in Coastal Deposits" Journal of Coastal Research, 20 (1), 101-114.

Abstract:

A detailed study of the seabed surrounding dredge pits created during the mining of marine aggregate from a small licence off the south coast of the United Kingdom ("Licence Area 122/3") has been completed. Over 350 km of high-resolution sidescan sonar imagery and 177 sediment samples have been obtained over a study area extending 10 km either side of the dredge zone (representing one full tidal excursion) in order to identify far-field effects on both physical and biological resources of the seabed.

The physical results presented here for Area 122/3 clearly show that the physical impact of dredging (without screening) on the seabed is limited to a zone within approximately 300 m downtide of the dredge area. This will generally be within the dredge licence boundary due to operational procedures. There is no evidence of suspended sediments falling to the seabed beyond this zone and causing significant changes, which may be manifested as infilling of small pits by fine sediments, siltation within crevices or development of migratory sand ripples. However, there is some statistical evidence from grab sampling that surface sediments have a greater sand fraction within the excursion track of the plume, than those sediments either side. Despite this small change in seabed particle size distribution, the benthic communities do not exhibit a detectable impact, as reported in the accompanying paper by Newell et al. (2002).

Analysis of ADCP backscatter data supports recent evidence for development of a near bed benthic boundary plume some 2–4 metres thick and a few tens of metres wide which extends beyond the limits of the dredge activity. On an extraction licence undertaking cargo screening, this near bed plume may exceed 4.5 kilometres downtide. Such a phenomenon provides a potential mechanism for impacting physical and benthic resources well beyond the dredge licence boundary and requires further investigation.

Persson, L., Göransson, M., 2005, "Mechanical quality of bedrock with increasing ductile deformation" Engineering Geology, 81, 42– 53.

Abstract:

Most of the rocks in Precambrian shield areas have experienced a complex structural and metamorphic evolution, processes which have a strong influence on bedrock quality. The properties vary on both a local and a regional scale. It is highly beneficial to know the variations in detail when exploiting the rocks for industrial purposes. The main objective of the investigation was to study the variation of rock mechanical properties in an originally more or less isotropic rock at various stages of ductile deformation. The rocks investigated were Paleoproterozoic and with ages of ca. 1.80–1.88 Ga, and the areas chosen for sampling were situated north-east of Lake Vanern (Kristinehamn; 10 samples), south of the city of Eskilstuna, South Central Sweden (5 samples) and south of Ödeshög, near Lake Vattern in southern Sweden (7 samples). The 12 samples from the latter two areas are described in this investigation, while the 10 samples from Kristinehamn have been published earlier (Göransson et al., 2004). A comprehensive study of various parameters of importance for bedrock quality has been performed on all samples, e.g. studded tyre test (STT) and Los Angeles test (LA), uniaxial compressive strength (UCS), ultrasonic velocity, perimeter measurements of mineral phases, and petrographic and chemical analyses. The weakly deformed and massive (more or less isotropic) rocks show a tendency towards better properties of abrasion (STT) than the strongly deformed rocks and this can also be said for UCS, reflecting the greater ability of rocks to split along foliation planes. This is not entirely unambiguous, as the more deformed rocks, such as the mylonites, may have varying properties. This depends on the combined effects of, e.g. grain size, recrystallisation and foliation. However, the brittleness (LA) shows somewhat better values with increased deformation. This may depend on higher amounts of dark minerals, as their existence does not affect this test as much as in the case of abrasion tests. The perimeter values of the mineral phases display generally higher values, i.e. grain boundaries for the more strongly deformed rocks are more complicated. However, the values for the investigated mylonites may vary between low and high. The lower value may be due to dynamic recrystallisation and the creation of triple points (static recrystallisation) making the rock weaker. Besides, the development of a strong foliation may decrease rock strength despite the usually finer grain size. The results show that it is extremely important to consider all possible variations of bedrock before classification and exploitation, as the bedrock material in fact is highly heterogeneous.

Raisanen, M., 2005, "Quality assessment of a geologically heterogeneous rock quarry in Pirkanmaa county, southern Finland" Bulletin of Engineering Geology and the Environment, 64, 409-418.

Abstract:

The geological features and mechanical properties of metamorphosed volcanic and sedimentary rocks from a quarry in southern Finland were studied. Resistance to wear (from the studded tyres test and Los Angeles test) and petrography were used as quality indicators. The study reported was undertaken some 5 years after the opening of Pirkanmaa rock quarry in order to optimize the environmental and economic benefits. The study draws attention to the importance of the assessment of geologically heterogeneous rock quarries which makes it possible to produce a wider range of aggregates from the same quarry for various construction purposes, maximize the crushing process and minimize changes in aggregate quality.

Olaleye, B.M., 2010, "Influence of some rock strength properties on jaw crusher performance in granite quarry" Mining Science and Technology, 20, 204–208.

Abstract:

The influence of rock strength properties on Jaw Crusher performance was carried out to determine the effect of rock strength on crushing time and grain size distribution of the rocks. Investigation was conducted on four different rock samples namely marble, dolomite, limestone and granite which were representatively selected from fragmented lumps in quarries. Unconfined compressive strength and Point load tests were carried out on each rock sample as well as crushing time and size analysis. The results of the strength parameters of each sample were correlated with the crushing time and the grain size distribution of the rock types. The results of the strength tests show that granite has the highest mean value of 101.67 MPa for Unconfined Compressive Strength (UCS) test, 6.43 MPa for Point Load test while dolomite has the least mean value of 30.56 MPa for UCS test and 0.95 MPa for Point Load test. According to the International Society for Rock Mechanic (ISRM) standard, the granite rock sample may be classified as having very high strength and dolomite rock sample, low strength. Also, the granite rock has the highest crushing time (21.0 s) and dolomite rock has the least value (5.0 s). Based on the results of the investigation, it was found out that there is a great influence of strength properties on crushing time of rock types.