Aggregate Program

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Background

Nova Scotia's aggregate resource is an important component of the province's economy. Over the last couple of decades we have seen strong growth in the production and use of aggregate materials, largely reflecting population increases and economic prosperity in the region. Ironically, the factors that have fueled the growth of the aggregate industry have also put pressure on the resource. Issues such as competition for the resource land, land-use conflicts, depletion of reserves, demanding materials specifications, and environmental legislation are increasingly threatening the resource in many parts of the province.

In recognition of growing concerns about this nonrenewable resource, the former Mines and Minerals Branch developed an Aggregate Program in the mid-seventies. Today, its primary goals are: (1) to evaluate the aggregate resource, (2) to assist aggregate producers and communities in meeting their aggregate needs, (3) to promote the wise use of the resource, and (4) to look for new economic opportunities. The program is conducted by one full-time staff member (the author) and a seasonal assistant each year.

The core activity of the Aggregate Program in recent years has been a detailed, systematic examination of the aggregate resource in Nova Scotia on a region-by-region basis. Prioritizing the geographic locations for this research is based on factors such as population base, availability of materials, and anticipated future market demands. The methodology for the program consists primarily of literature research, field investigations, air photo interpretation, and sampling/analytical programs. These regional surveys occasionally lead to more specialized research activities. Examples include diamond-drilling projects for aggregate and dimension stone, and testing aggregate waste fines for agricultural applications.

Another activity which routinely occupies a large portion of time is service to clients. The Minerals and Energy Branch is commonly approached by industry representatives, government agencies, consultants and the general public to provide information on the aggregate resource. Queries can range from locating an aggregate source in proximity to a construction project, to sand for cranberry bogs, to boulder fields for armour stone. Every effort is made to provide the client with the best information available. However, this does not always mean access to information in the form of reports or maps. Many requests involve areas where aggregate maps and reports are not available. For inquiries where published aggregate data are not available we can sit down with the client and discuss the request, using a variety of other data sources or drawing on the geoscientific expertise in the branch. We encourage anyone to use our services and will do our best to meet their needs.

1998 Activities

In 1998 the Aggregate Program focused on field mapping in the western part of the province. This work is part of a continuing study initiated in 1994 to evaluate the aggregate potential in western Nova Scotia. The purpose of the study is to provide a GIS-based digital database and 1:50 000 scale resource maps displaying aggregate deposits, point data, and descriptive fields for each county in the region. The project is being implemented in two phases. The first phase (in progress) will cover the north side of the region or Annapolis Valley area. It comprises Hants, Kings, Annapolis, Digby and Yarmouth Counties. The second phase will cover the south side of the region or South Shore area and consists of Shelburne, Queens and Lunenburg Counties. It is anticipated that the project will take eight years to complete.

The current field season focused on the eastern half of Hants County (Fig. 1), including all of NTS map area 11E/04 and parts of 11E/03, 11E/05, 11E/06 and 11D/13. Field work consisted of an examination of the bedrock and surficial geology in the area for aggregate potential. Many of the exposures examined were located prior to the field season during a preliminary investigation of geological reports and air photos. Others were discovered during the field work, when all navigable roads on an NTS map area were systematically covered. The result was an examination of as many exposures as possible, given the time frame of the field study. This included pits, quarries, road and ditch cuts, railway cuts, stream and shoreline erosional exposures, and excavation sites. Approximately 500 exposures were examined and

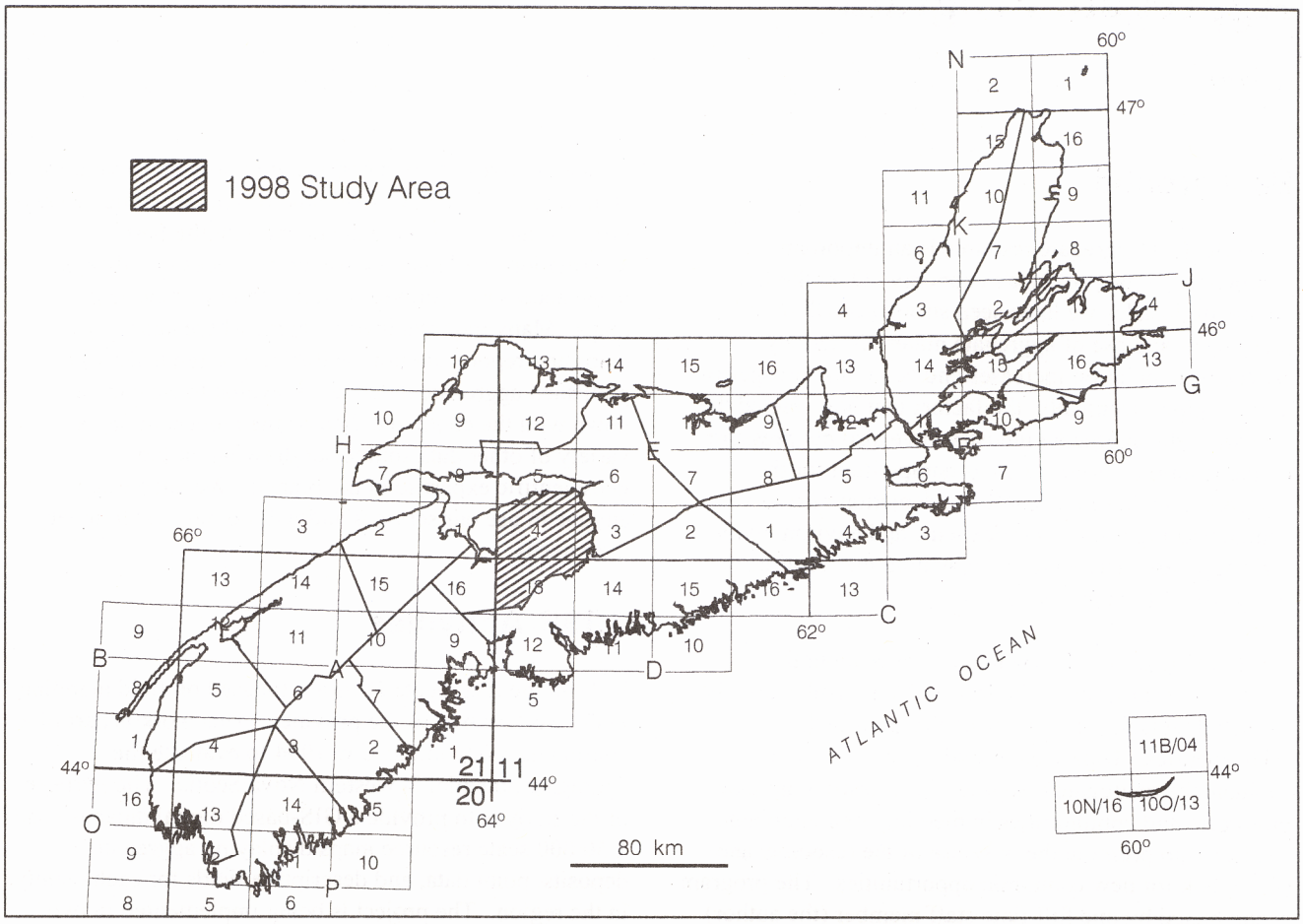

Figure 1. The 1998 field study under the Aggregate Program consisted of NTS Sheets 11E/03, 11E/04, 11E/05, 11E/06 and 11D/13.

described between June 1 and October 10, 1998. A limited sampling program was conducted at selected sites, with samples placed in storage for future aggregate testing. During examination of the bedrock for aggregate purposes, the outcrop was also examined for dimension stone potential. Although not the primary focus of the study, it has been a cost-effective opportunity to examine the geology of the region for other economic possibilities. Depending on the properties of the stone, there may be potential for products such as flagstone, retaining walls, cladding or flooring. Characteristics examined include joint spacing, colour, texture, layering, weathering and competence. The following is a brief discussion of the results of field work in 1998.

Surficial Aggregate Potential

The surficial aggregate potential identified in this study is based on Pleistocene glacial sand and gravel deposits. These glaciofluvial sediments, which were primarily deposited during the melting stages of the last glaciation, are fairly common in eastern Hants County. They consist of ice-contact kame and esker deposits and rare proglacial outwash deposits. Almost all of the occurrences documented have been used in local markets or for private purposes. A small number of new occurrences discovered as part of this study will require follow-up work to assess their potential. Based on field observations, the materials generally appear to contain a moderately high percentage of sedimentary clasts such as sandstone, shale and slate. A small number of the deposits contain unacceptable amounts of pyritic slate clasts. Depending on their proportions, the presence of these deleterious materials can negatively affect the aggregate potential of a granular deposit. The best potential among the glacial deposits appears to be the large sand reserves which still remain in some areas. These materials will continue to be valuable for the metropolitan market, where natural sands are absent.

Bedrock Aggregate Potential

Bedrock in the study area comprises Devono-Carboniferous sedimentary and intrusive rocks and Cambro-Ordivician sedimentary rocks. The Devono-Carboniferous sedimentary rocks consist of sandstone, shale, carbonates and evaporates. They are generally soft and lack durability. The sandstone, shale and carbonates have been used for low-end aggregate products such as fill or for the construction of haulage roads. Shale, in particular, has been used extensively for forest access roads. It is unlikely that any of these sedimentary rocks will produce high quality aggregate. One exception may be a quartzitic sandstone unit which, although not tested to date, appears promising in terms of durability. The primary significance of this unit is its location in an area where aggregate potential is considered low.

The Cambro-Ordivician Meguma Group rocks consist of quartzite and slate. The Goldenville Formation 'quartzite' (an industry term for the more formal rock name 'metagreywacke'), has an excellent reputation as a high quality aggregate and has been produced extensively from a few quarries in the region. The quartzite gets its mechanical strength from metamorphism which caused annealing of the sand grains in the sandstone to produce greater grain-to-grain bond strength. One problem that can occur in this stone is the presence of slate, a material which is considered deleterious for aggregate purposes. Although all Goldenville Formation bedrock contains interbedded slate, only minor percentages are tolerable in high quality aggregate. Predicting the location of quartzite deposits with minimal slate interbeds is severely hampered by poor bedrock exposure in many areas. Therefore, accurately assessing the aggregate potential of the quartzite is not possible without detailed, site-specific work.

The Halifax Formation slate, which is very common in the region, is unsuitable for high quality aggregate. In general, the slate is soft and lacks durability. The competence of the stone appears to reflect the ratio of slate to siltstone present in the bedrock. The presence of interbedded siltstone appears to improve clast strength and resistance to weathering. This probably reflects the fact that siltstone is the fine-grained equivalent of quartzite. The true slate, where the percentage of siltstone is minimal, appears to be very susceptible to water absorption and clast deterioration. Because of its foliation cleavage, slate is easily and economically extracted by ripping. The platy nature of the clasts produced also provides a natural, interlocking support structure when used for applications such as low-traffic haulage roads and the surfacing of driveways. However, all of the slates are typically subject to premature weathering and mechanical wear. An environmental concern in many of the slates in the region is the presence of sulphide minerals which can result in acid drainage problems related to surface runoff.

Devono-Carboniferous granitic rocks, which intrude the Meguma Group sedimentary rocks, are confined to the south side of the study area. Although they apparently have not been extracted for use in the study area, they are being used successfully in other parts of the region. Furthermore, previous studies under the Aggregate Program indicate that these rocks are generally acceptable in producing good quality aggregate. While the intrusives may lack high mechanical strength (LA abrasion loss and petrographic number results are consistently superior in quartzite) they generally pass most aggregate specification tests.

Examination of the study area for dimension stone potential was unsuccessful in identifying any significant new deposits. Some thinly layered sandstones, quartzite with parallel fractures, and slates may be suitable for applications such as retaining walls and flagstone. However, more work is required to establish if there is any economic potential at these locations.

Conclusions

The Annapolis Valley phase of the Western Nova Scotia Aggregate Project is nearing completion. One more year of field work and a clean-up year covering parts of all counties on the northern side of the valley will be required to complete this area. This project has also represented a shift in the way aggregate research is being done under the Aggregate Program. We are now using a global positioning satellite (GPS) receiver and an electronic notebook in the field. The goal for the coming field season is to download the data being gathered in the field into a GIS digital database (ArcView® 3.0) on a daily or weekly basis. This should permit a more efficient and timely delivery of aggregate data in the future. At present, approximately 3000 occurrences have been recorded in the Annapolis Valley region. Of these, 2300 data points have digitally entered into the database. It is anticipated that the first digitally produced maps will be available in the year 2000.