

# APPLICATION OF NEG ARG FIBRE

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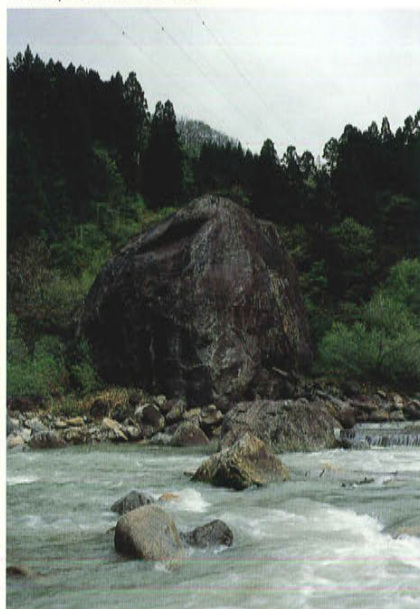
NEG ARG Fibre, manufactured by Nippon Electric Glass Co., Ltd., is used throughout the world as a reinforcement for cement composites, including asbestos replacement products.

## Museum Uses G-Rock to House Theatre —New GRC Product Provides Unique Ambience



The G-Rock theatre

The Hyakuman-kan Iwa



### G-Rock Chosen for Commemorative Museum

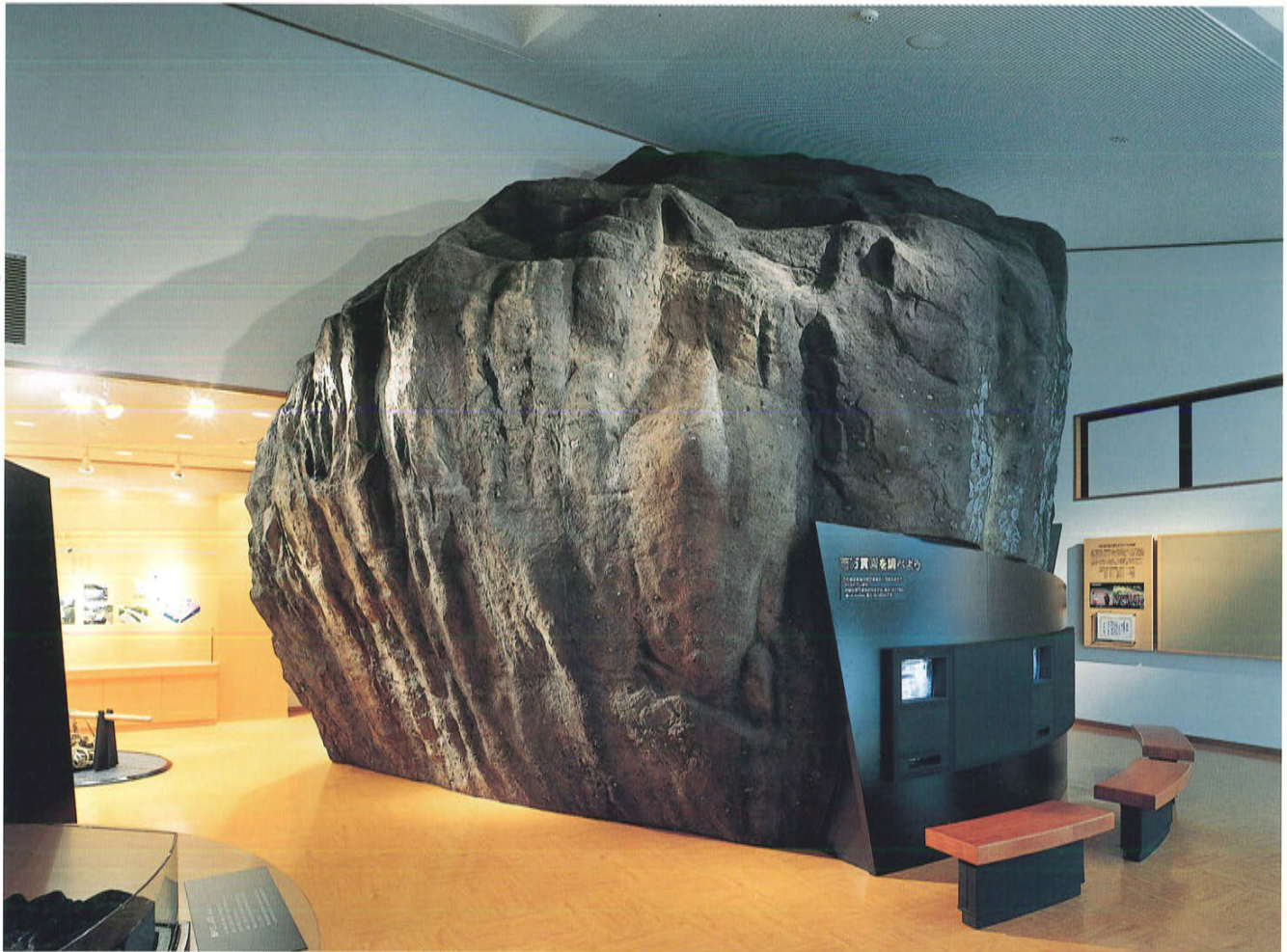
G-Rock was first used in August 2000, when it was employed for the outside wall of a theatre located inside the Hakusan Sabo Science Museum of the Ministry of Land, Infrastructure and Transport. The museum, located on the lower reaches of the Tetsu river, which flows through the Hakusan National Park, was established to administer disaster prevention information relating to the upper reaches of the river, and to put on exhibits pertaining to the long-term dam construction project, and to the history and climate of the Hakusan region. The theatre motif is based on the *Hyakuman-kan Iwa*—a giant rock weighing more than 4,800 tonnes. In 1934, this rock was washed down from the upper reaches of the river by heavy flooding. In the theatre, visitors can get an idea of what the terrible floods were like, and can also experience the seasonal beauty of the region, against the sounds of wind and birds. G-Rock

was selected for the artificial rock panelling used on the theatre. Reasons cited for choosing G-Rock included that it is non-flammable, light and easy to handle, and is environmentally friendly, making good use of waste materials.

### Sabo Theatre, Hakusan Sabo Science Museum

Location:	Shiramine Village, Ishikawa Prefecture, Japan
Owner:	Ministry of Land, Infrastructure and Transport
Design & Construction:	Nomura Co., Ltd.
Material Supplier:	Cretech Co., Ltd.
Material Used:	G-Rock





Half-scale G-Rock model of the *Hyakuman-kan Iwa*. Inside is a theatre.

## What is G-Rock ?

G-Rock is a new, ecological GRC that succeeds in combining light weight with high strength. G-Rock's main constituent is recycled coloured bottle-glass. Two to three million tonnes of this hard-to-process material is generated each year in Japan. Two kilograms of G-Rock represents the recycling of one wine bottle. Before being re-used, the waste glass is sintered and expanded. When used as a filler, this produces a stable, lightweight mortar matrix that is not affected by the corrosive properties of alkalis contained in cement.

This light weight is combined with a high degree of stiffness, making it possible to form GRC products that are thinner and lighter than before. The end result is a major improvement in working efficiency with respect to tasks such as transportation and installation of the material.



The Hakusan Sabo Science Museum





The polystyrene model



Spraying the G-Rock layer on the model



Carvings



Removing the polystyrene

## Tracing the Development of G-Rock

The development of G-Rock was made possible through joint research by Nomura Co., Ltd., a designer of commercial and cultural facilities and displays, and Createch Co., Ltd., a developer of architectural and engineering materials. Nomura is one of the largest companies in the display business and is also well-known for being very active in the area of environmental protection. Nomura's aim was to develop a new, environmentally-friendly material that could be employed to form artificial rocks, monuments and other such items used in displays. Previously the main materials used for such purposes have been GRC and FRP. However, compared to FRP, GRC has a number of drawbacks, such as that its heavy weight makes it difficult to handle and, in the case of indoor applications, makes floor strength a constraining factor. FRP also has a problem, its flammability, which under

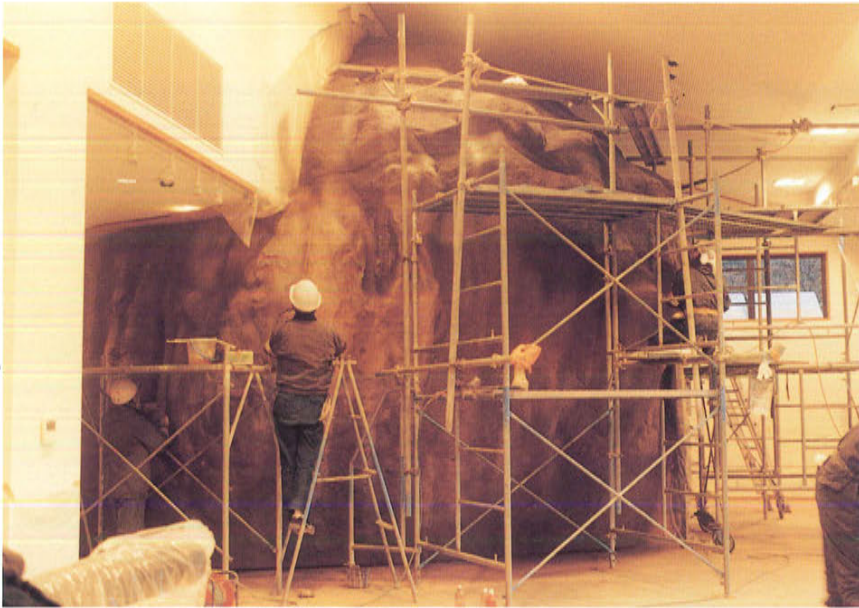
the provisions of the Fire Service Law limits its use indoors. The concept behind G-Rock was therefore to overcome such problems by developing a new, environmentally-friendly material that combines the light weight of FRP with the strength, durability and non-flammability of GRC.

## Recreating the Big Rock

First of all, polystyrene was used to create a half-scale model of the giant rock forming the basic motif. The surface of the model was divided into sections, each measuring 1 to 2m<sup>2</sup> in area, and the G-Rock was then sprayed onto the surface, forming a coating 10mm thick. After the G-Rock had hardened, the polystyrene base was removed. The G-Rock panels thus obtained were then transported and reassembled on-site at the museum. Because this method eliminates the need to

use silicon moulds, it is relatively low-cost and speedy. Moreover, since the panels weigh only around 18kg/m<sup>2</sup>, they can be assembled without using a crane. This construction project showed that although G-Rock is GRC, it has good workability, on a par with that of FRP. As such, in the display market sector, it is expected to be in demand as an FRP replacement material. Also, under the provisions of the so-called "Green Purchasing Law" enacted in 2000, public institutions are required to make increased use of environmentally sound materials, which is leading to increasing interest in ecological materials in Japan. Looking to the future, there is expected to be growing demand for G-Rock, composed as it is of GRC, the first such light, ecological material.





Assembling the panels on-site



The reverse side of the G-Rock panels

## Characteristics of G-Rock

In terms of volume, around 60% of G-Rock consists of recycled glass filler that has a specific gravity of one or less.

Generally speaking, using such a light filler results in a severe degradation in the strength of the mortar matrix. However, in the case of G-Rock, any such weakness of the lightweight matrix is more than compensated for by using special, high-flow cement with a high glass-fibre admixture, producing a major increase in stiffness. Even with the addition of such a high level of glass fibre, fresh G-Rock maintains its high flow characteristics.

This eliminates the need to use a direct spray gun, since the G-Rock can be sprayed on as it is. Fibre strands are only 9mm long, making it easy to spray the material with a hopper-fed spray gun or the like.

Moreover, the glass fibres are premixed with the cement to ensure stable quality and prevent the type of strength variations that accompany the use of direct spray methods.

### Composition of G-Rock

S/C	166% (volume ratio)
W/C	28%
Glass fibre/mortar matrix	6% (volume ratio)

### G-Rock Properties

Specific gravity	1.5
Bending strength	20N/mm <sup>2</sup>
Compression strength	50N/mm <sup>2</sup>
Bending strength of factor (bending strength/specific gravity)	13N/specific gravity



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