

none, and that usually means no quarries. Quarries are rather scarce in southern and southwestern counties.

Early Quarrying in Iowa

Quarrying in Iowa began when the first pioneers came into the state, and as settlement moved westward, it might almost be said that quarrying moved with it. At least it was an industry undertaken almost at the start wherever there was rock available — usually limestone, sandstone to a less degree. Some of the earliest forts were of stone. Stone for the buildings at Fort Atkinson, in Wineshiek County (constructed in 1840), came from a closely adjacent quarry. Stone was a natural material for foundations of houses and barns, and thence the use spread to the construction of entire buildings. There are many public buildings and churches of native stone in Iowa, dating back to early days.

Varied Uses of Stone

Stone was also used on the streets for curbing, gutters, and paving blocks. Even crushed or broken stone might be spread on the streets and roadways. Dams were made of it. Thinly bedded rock, "flagstone," was made into sidewalks. There was a wide use in bridges, particularly the piers, on both highways and railroads. The railroads needed broken rock as ballast and for the protection of embankments. All of these uses developed as the years went on.

Lime

Along with limestone for structural purposes came its quarrying and use in the manufacture of lime. Limestone when burned or calcined is converted to the substance commonly called quicklime. This was used in cement and mortar, and as agricultural lime. Lime made from Iowa limestone was consumed in considerable quantities in the early days, and there were lime kilns, large and small, widely scattered over the eastern part of the state. Ultimately the industry became concentrated in areas outside of the state and disappeared in Iowa.

Portland Cement

The introduction of Portland cement led to many changes which continue through the years. No longer were great quantities of stone quarried in Iowa for use in the building of houses, churches, and public buildings. No longer was it used as flagging, in the form of paving blocks, or as bridge piers. Concrete and brick took over where limestone had held sway. The quarrying of stone for the making of lime had decreased, and finally ceased. Only within the past few years has it been resumed.

As the population grew, along with the need for more and better roads, there arose the demand for road-surfacing material. Presently in various places stone, again mostly limestone, was being quarried, crushed, and used as roadstone. The

next step was in the use of Portland cement concrete for highway construction.

Portland cement concrete requires not only cement and water, it also requires coarse and fine rock particles, called respectively coarse and fine aggregate. So with the increasing use of Portland cement concrete came a great increase in the quarrying of limestone for aggregate. Aggregate was, and is, also used in the construction of asphalt pavements. And, of course, these types of concrete were used in sidewalks, and the Portland cement concrete for all sorts of construction.

Crushing plants producing aggregate turn out a large amount of "fines," material which has been removed from the aggregate by screening. Thus is produced our familiar agricultural limestone, spread on the fields for its beneficial effects in reducing soil acidity and contributing calcium. Its use was encouraged by the government as part of the conservation program, and in many places quarries were opened for the production of it alone.

Then plants for the manufacture of Portland cement came to Iowa, and presently were quarrying enormous tonnages of limestone and shale from locations in the vicinity of Winterset, at Mason City, and at Buffalo.

The Picture Today

So, here we stand today: only a few quarries in the state producing building stone, also called

dimension stone, for buildings and other structural purposes; one quarry producing stone for the manufacture of lime; large quarries producing limestone and shale for Portland cement manufacture; quarries throughout the state wherever limestone can be found — some large, some small — producing crushed or broken rock for its many uses: aggregate, roadstone, filter beds, riprap, and agricultural limestone. The production of crushed rock for use as railroad ballast has all but ceased, replaced by crushed slag, imported from outside the state.

Gypsum

Gypsum is quarried at Fort Dodge. The material is of excellent quality and lies directly beneath the subsoil, at a depth of about fifty feet. One use is as an additive to Portland cement concrete to slow the setting time. Another is in the manufacture of plaster, wall board, and building tile. At first, gypsum was quarried from the outcrops. Then drift and shaft mines developed. Finally, in the middle twenties, quarrying was again resorted to. Gradually, mining has been abandoned, and today the quarrying of gypsum in the vicinity of Fort Dodge is a large industry.

Quarrying Methods

Now, what can be said of quarrying methods? For the dimension or building stone, most important in the beginning, the method was much the same as it had been over the centuries. The sur-

face of the bed was cleared, holes were drilled by hand at intervals along a line, and then pressure was applied in the holes until finally the rock split along the line. The depth to which the holes were drilled depended upon the thickness of the bed. Large blocks were removed in this manner. As late as 1906 a directory of Iowa quarries shows that much of the work was still done by hand.

Mechanical Power Introduced

The introduction of mechanical power brought changes. The holes were no longer drilled by hand. A steam engine could supply the power. The use of compressed air for the operation of the drill came later. Also, there were other changes in the production of dimension stone. One was the introduction of the channeling machine. This had a row of rotating drills. The machine moved down a line on the cleared bed, cutting holes to the desired depth. After a line of holes to the appropriate length had been cut, and this might be a length of several rods, the long block would be wedged loose, tilted on its side, and then cut into smaller blocks.

Wire saws were introduced. Limestone is softer than steel, and is easily scratched with a knife. The saw, operating from a machine moving along a line on the cleared bed, actually cut a groove in the rock. Then the block, again several rods long, could be wedged loose, tilted and cut into smaller pieces.