Sandstone Aquifers

Aquifers in sandstone are more widespread than those in all other kinds of consolidated rocks (fig. 8). Although the porosity of well-water, groundwater is relatively high in sandstone, the permeability is considerably lower than in consolidated rocks that consist primarily of shale or dolomite. To understand the nature of groundwater movement in sandstone, consider the following characteristics of sandstone aquifers:

1. **Porosity and Permeability**: Sandstone aquifers are characterized by their porosity and permeability. Porosity refers to the fraction of the volume of the rock that is empty space, which water can occupy. Permeability, on the other hand, is a measure of the rock's ability to transmit water. Sandstone, being composed of grains of various sizes, has variable porosity and permeability.

2. **Secondary Openings**: Sandstone aquifers commonly contain secondary openings such as joints, fractures, and solution cavities. These openings significantly enhance the permeability of the rock, allowing water to flow more freely through the aquifer.

3. **Lithification**: Faulting of sandstones following lithification can greatly complicate the movement of water in the aquifer. Lithification is the process by which the rock is transformed into a more rigid, less permeable form.

4. **Confining Units**: The Cambrian–Ordovician aquifer system, for example, consists of confining units, which are layers of impermeable rock that separate the aquifers. These units prevent saltwater intrusion and help maintain the purity of the groundwater.

5. **Aquifer System**: The Cambrian–Ordovician aquifer system is composed of large-scale, predominantly sandstone aquifers that extend over parts of seven States and three segments of the Michigan Basin. The aquifers are named from the principal geological formations that comprise them. Confining units of poorly permeable sandstone and dolomite separate the aquifers. Located primarily in the north-central United States, the aquifer system extends over a large portion of north-central Minnesota, northwest Wisconsin, and the Illinois Basin.

6. **Use and Management**: Many sandstone aquifers are parts of complexly interbedded sandstones, siltstones, and shales. The aquifers are highly productive in many places and provide large volumes of water for all uses. However, they are vulnerable to pollution, and their use must be managed to ensure their long-term sustainability.

**Figure 22**: The Cambrian–Ordovician aquifer system in the north-central United States (fig. 22) is composed of large-scale, predominantly sandstone aquifers that extend over parts of seven States and three segments of the Michigan Basin. The aquifers are named from the principal geological formations that comprise them. Confining units of poorly permeable sandstone and dolomite separate the aquifers. Located primarily in the north-central United States, the aquifer system extends over a large portion of north-central Minnesota, northwest Wisconsin, and the Illinois Basin.

**Figure 23**: Movement of water in the Cambrian–Ordovician aquifer system moves along short flow paths toward small streams. Movement of water in the Cambrian–Ordovician aquifer system is shown in fig. 23. The aquifers are named from the principal geological formations that comprise them. Confining units of poorly permeable sandstone and dolomite separate the aquifers. Located primarily in the north-central United States, the aquifer system extends over a large portion of north-central Minnesota, northwest Wisconsin, and the Illinois Basin.