





Figure 2. Underwater karst spring of the Vise, Thau pond, Balaruc-les-Bains (Hérault). [Source: © M. Bakalowicz]

These marine clays isolate aquifers by protecting them from marine water intrusion. But they do not exist everywhere, either by lack of deposition or by erosion; aquifers, especially karst ones, then flow directly into the sea. As a result, the superficial karst phenomena developed in the Messinian period, then submerged by the marine transgression of the Zanclean, allow exchanges between seawater and fresh groundwater. This very particular situation is at the origin of known underwater and brackish springs along all Mediterranean coasts where more than 90% of all known coasts in the world are located [4]. Those of Shekka, on the northern coast of Lebanon, are often considered among the most important in the world because of their flow estimated at several tens of m<sup>3</sup>/s in flood [5]. In France, the spring at Port Miou, near Marseille, flows a few m<sup>3</sup>/s of brackish water [6].

These sources are supposed to discharge considerable volumes of fresh water directly into the sea; they are also the subject of abstraction projects, such as those in Port Riou [6] or La Mortola [7]. The detailed study of certain sources [4] [5] [6] shows that the natural salinization of groundwater is inherent in the very functioning of these coastal karst aquifers and that the capture of these sources at sea can only facilitate marine intrusion. This is why it is preferable to seek to capture fresh water from boreholes on land, by monitoring the operation of these sources to provide an "alarm" in the event of overexploitation [8].

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