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The application of CO2 EOR techniques in the western part of Moesian Platform

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Introduction

The application of Enhanced Oil Recovery (EOR) techniques is encouraged by the current oil price and the growing global demand for oil. Among them, carbon dioxide (CO2-EOR) is a technology to improve oil production combined with geological sequestration. This method began to be associated with CO2 geological storage in the past two decades. Although much of the CO2 is recycled and reinjected for hydrocarbon production, a significant quantity of CO2 is permanently stored in the reservoir. The most famous CO2-EOR project is Weyburn–Midale CO2 Project in Saskatchewan (Canada). In Romania, CO2 injection experiments were designed for several oil fields: Bradesti–Bibesti–Balteni, Samnic.). The short CO2 injection experiments were applied to wells in the following oil reservoirs: Bradesti, Bibesti, etc. Relating to the efficiency of the enhanced production from oil fields, the most favorable ones for operation by injection of CO2 are located near sources of CO2 because the transport costs are relatively low. Bradesti and Balteni structures for example, positioned on the western side of the Moesian Platform, is very well explored until now concerning its hydrocarbon potential due to their specific geological conditions. Bradesti structure it consists of a dipping zone descending from north-northwest to southeast with a stratigraphical column specific to the Moesian Platform (Triassic, dogger, and Sarmatian), presenting all its main sedimentation cycles with cumulative thickness exceeding 6000–7000 m in most subsided areas. Depression deposits suffered during their evolution an important thermal metamorphism that enables a great part of them to generate hydrocarbons. This feature correlated with the specific structural arrangement provides the necessary conditions for the existence of exploitable petroleum accumulations. Such deposits are the structures Bradesti, Balteni, Bibesti, Samnic, and others. These reservoirs and sources can be considered as small regional industrial clusters on the whole CCUS (carbon capture utilisation and storage) chain can be implemented. Through the tertiary injection of CO2 into the above-mentioned fields, we can estimate that extra production of 1 to 5 million tonnes of oil can be extracted per oil field over the next 20 years, so the increase in oil reserves could be 25 to 100 million tons. The geological formations (Triassic, Sarmatian, Meotian, etc.) which are suitable for safe storage and are marked with a high degree of geological and physical knowledge, are widely distributed in the country.

CO2-EOR has emerged as a major option for productively utilizing CO2 emissions captured from electric power and other industrial plants. Typically, only about one-third of original oil in place is recovered from a conventional oil field with traditional primary and secondary methods. In most cases, CO2 is compressed and pumped to oil reservoirs to recover a significant portion of this “left behind” oil in a process known as enhanced oil recovery (EOR) as described in Fig. 1. In the past two decades, this method began to be associated with CO2 geological storage. Although much of the CO2 is recycled and reinjected for hydrocarbon production, a significant quantity of CO2 is permanently stored in the reservoir.

CO2-EOR activities in western part of Moesian Platform

In Romania, CO2 injection experiments were designed for several oil fields :Bradesti (sarmatian), Balteni (sarmatian), Bibesti (sarmatian), Samnic (triassic), Moreni (meotian). Also, operations to stimulate the production of oil were applied by short-term injection of CO2 into many wells. The short CO2 injection experiments were applied to wells in the following oil reservoirs :Bradesti and Balteni

CO2-EOR possibilities in Romania

In terms of economic efficiency of the enhanced production from oil fields, the most favourable ones for operation by injection of CO2 are located near sources of CO2 because the transport costs are relatively low(fig.2). Oil fields near industrial sources of CO2(fig.3) are the most appropriate because in the first stage, the injection of CO2 can be used to increase oil exploration and increase recovery and the second stage the the operation can switch to CO2 injection for long-term storage.

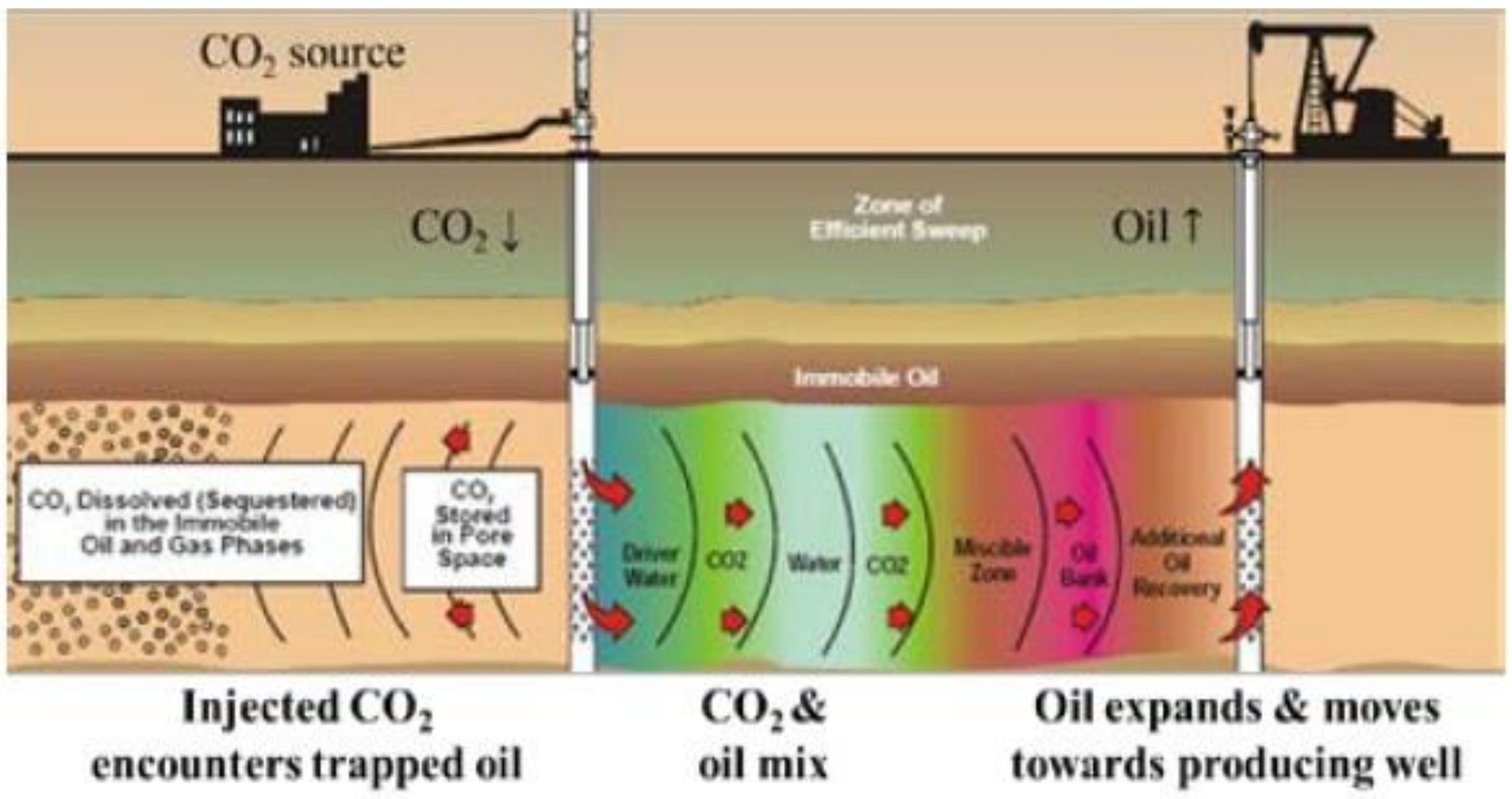

Fig.1 CO_2 –Enhanced oil recovery

The most suitable reservoirs for CO2-EOR are the ones which are in the final exploitation phase (location in Figure 1), which are hydrodynamically sealed or in other words do not communicate with other layers around the reservoir, have at least one well which can be used for injection and at least 3-4 reaction (production) wells, is at a depth of more than 800m and a reservoir rock which is preferably homogeneous.

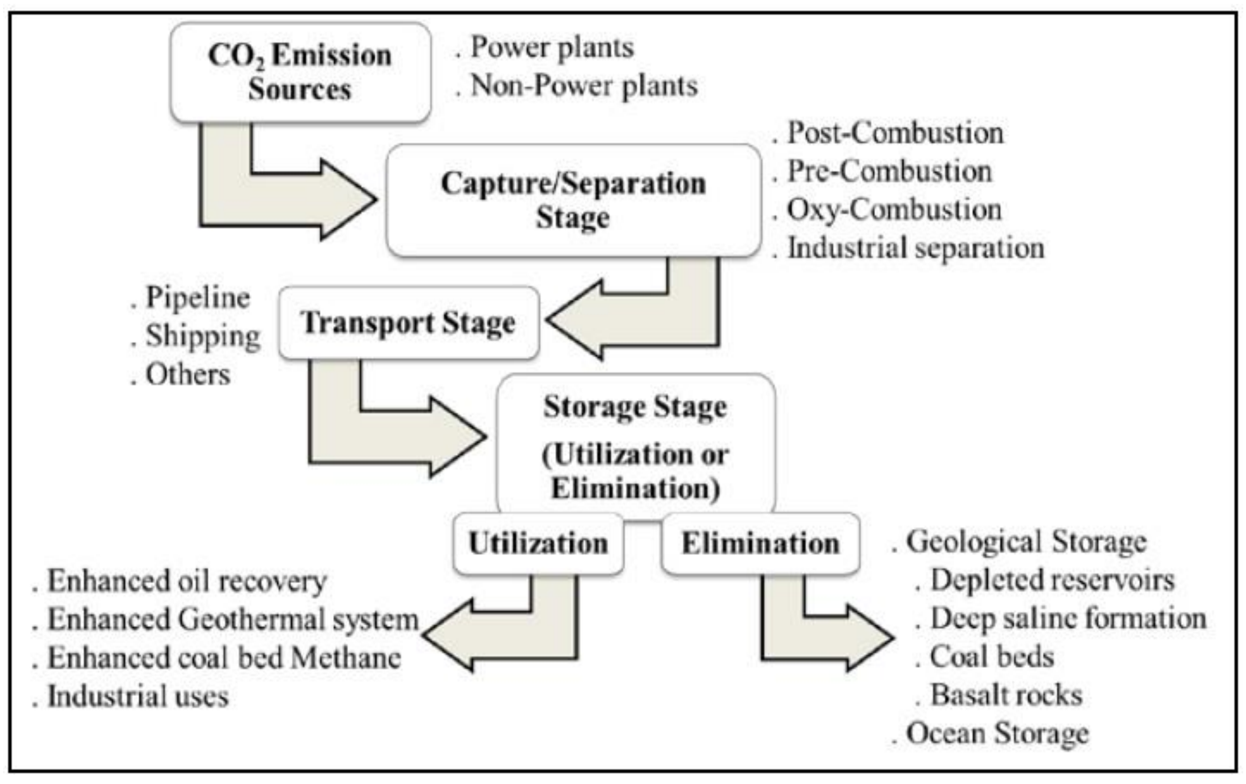

Fig.2 Carbon Capture and Sequestration technology stages

The oil fields from the western part of Moesian platform are appropriate because they have the same structure, or very close, to natural CO2 reservoirs or free gas reservoirs with high CO2 (40 - 80%). Such deposits are the structures Bradesti, Balteni and others. These combinations of reservoirs and sources can be considered as small regional industrial clusters on the whole CCUS chain can be implemented. By applying the CO2 injection into the above-mentioned fields, we can estimate that an extra production of 1 to 5 million tonnes of oil can be extracted per oil field over the next 20 years, so the increase in oil reserves could be 20 to 80 million tons.

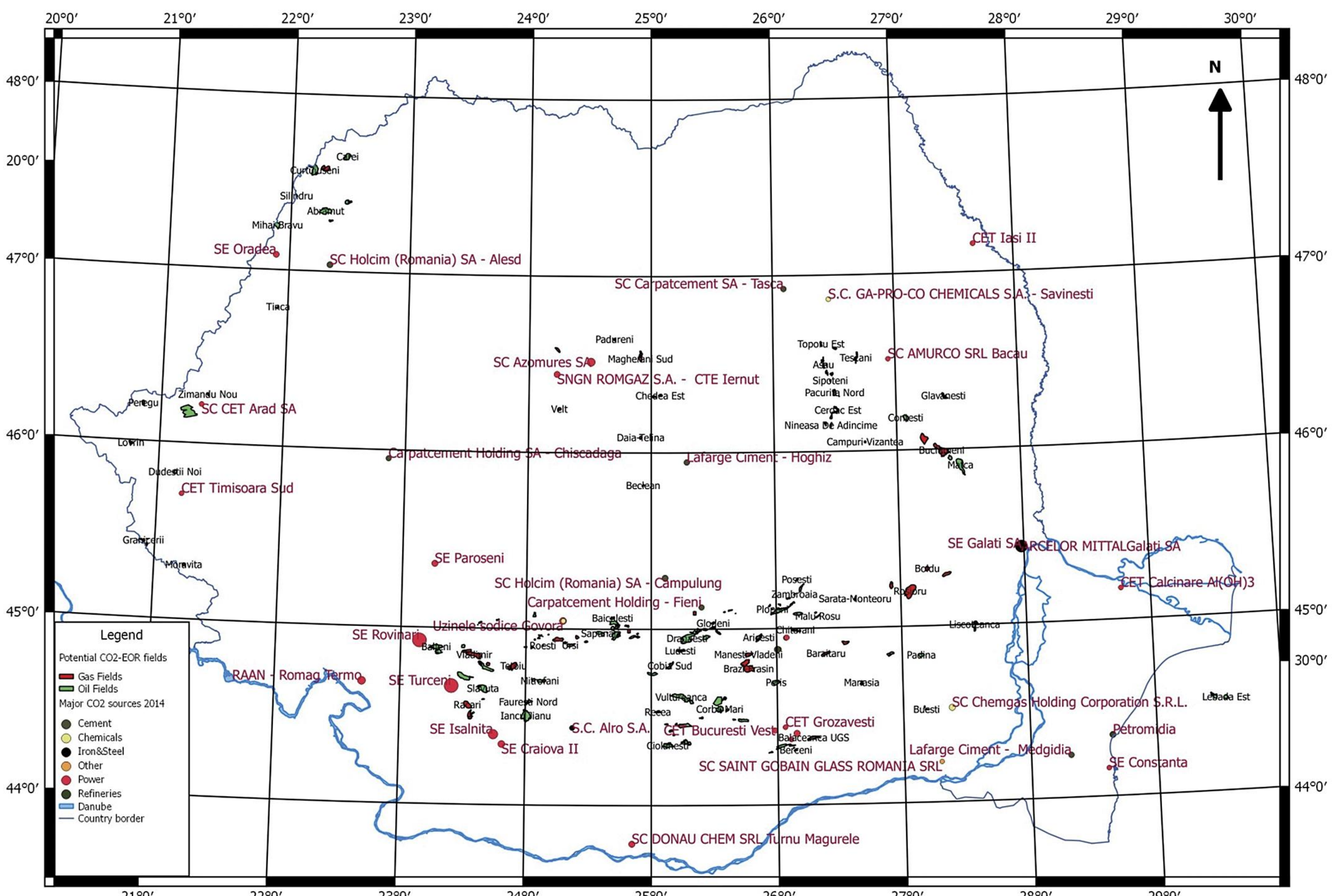

Fig. 3 Distribution of major CO2 major emission sources for 2022 (the last published verified emissions)

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