Mechanism of electron transfer during dissimilatory Mn(IV) reduction by *Shewanella oneidensis* MR-1

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The mechanism of dissimilatory Mn (IV) reduction by *S. oneidensis* MR-1 remains poorly understood. In a recent study, we provided complementary genetic and chemical evidence that *S. oneidensis* reduces Mn (IV) through two successive transfers of one electron with Mn (III) as a transient intermediate and that the Mn (III) (but not Mn (IV)) reduction step is linked to energy generation and growth. Here, the mechanism of each reduction step was examined with a suite of known *S. oneidensis* deletion mutant strains fed either Mn (IV) oxides or soluble Mn (III)-pyrophosphate as terminal electron acceptor. The results indicate that MtrB, a β-barrel protein embedded in the outer membrane, and MtrC, a *c*-type cytochrome peripherally attached to the cell surface, play important roles in each electron transfer step. In turn, OmcA, another decaheme *c*-type cytochrome found on the cell surface, does not participate in the reduction of Mn (IV) or Mn (III). Finally, the Type II secretion system of *S. oneidensis* plays a crucial role in each reduction step, most likely by translocating MtrC to the cell surface. These findings indicate that the mechanism of dissimilatory Mn (IV) reduction involves a complex electron transfer pathway that is different than that of Fe (III) reduction.

The application of hydrosialite method to protect hydrocarbon reservior

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Hydrosialite method is used very widely in stratigraghic classification, depositional environment analysis and reservior protection [1, 2].

Hydrocarbon reservoir sensitivity experiment

The main Hydrosialite of Upper Triassic Xujiahe formation are andreattite, chlorite and kaolinite. Choose 4 block specimen which the content of chlorite and the permeability are high to do the reservoir sensitivity experiment. Our results are showned in the tables below.

Well Name	Formation Name	Content of clay mineral(%)		Velocity Sensitivity Character			Water Sensitivity Character		Salt Sensitivity Character	Acid Sensitivity Character		
		Illite-smectite	Chlorite	Velocity Sensitivity Index	Velocity Sensitivity Degree	Threshold Velocity	Water Sensitivity Index	Water Sensitivity Degree	Threshold Salinity (mg/L)	Acid Sensitivity Index	Acid Sensitivity Degree	Input Time Number
HC7	T3x2	32	68	0.18	weak	\	0.457	mid bias weak	37500	0.329	mid	1.53
GA126	T3x4	22	78	0.46	moderate	4.11	0.136	weak	\	0.832	strong	1.13
GA5	T3x4	35	65	0.439	moderate	4.05	-0.02	none	\	0.661	near to strong	
GA109	T3x6	21	79	0.182	weak	\	0.55	mid bias weak	37500			

Table 1: Clay mineral sensitivity experiment result.

Discussion results

Clay mineral is the most significant reason of hydrocarbon reservoir damage. Include three aspects below. Draw up the difference steps to aim at different damage.

1. Atomy emigration. Illite-smectite and kaolinite make the velocity sensitivity damage. The resolve way is to control the velocity of fluid to go into reservior, below 4.11m/d.

2. Acid treat generate chemical precipitate. Chlorite make acid sensitivity damage. There are two ways to resolve, one is to use clear water to substitute formation water before acid, then flowback acidizing fluid. Another is to add chelant and oxygen scavenger.

3. Water sensitivity damages the reservoir. When the smectite touch the operating fluid (like fresh water)-the salinity is below formation water, may cause swell and genertate damage. The way to take precaution against water sensitivity is that the salinity of operating fluid is higher than threshold salinity. This is higher than 37500mg/L.

[1] Wilson (1999*) Clay Minerals* **34**(1), 7–25. [2] Jian Li *et al.* (2005) *Organic Geochemistry* **36**, 1703–1716.