HYDROTHERMAL TRANSFER MEASURMENTS USING A TRACER

Faivre-Pierret R.X. , Burghoffer
CEA-DAMRI 17 rue des Martyrs 38041 Grenoble France. Tel 33 * 76884593, FAX 33* 76885156, e-mail FAIVRE@basilic.cea.fr
Le Guern F. LSCE CNRS-CEA Avenue de la Terrasse 91190 Gif sur Yvette CEDEX France Tel 33 1 69 82 35 42; Fax 33 1 60 10 15 40 E-mail lFrancois.Le-Guern@LSCE.cnrs-gif.fr

Introduction:
The Department des Applications et de la Methodologie des Rayonnements Ionisants (DAMRI) of CEA Grenoble has developed different methods using chemicals, radioactive or fluorescent tracers to study mass transfers of fluid hydrodynamics in ground water hydrology, aquifer or karstic circulation studies, surface hydrology, civil ingineering, pollution and sanitary techniques.
These know how has been applied to evaluate he fluxes from Hot Springs along the coast of the volcano Satsuma Iwojima (Japan). This study has been supported by the Geological Survey of Japan (GSJ), the Agency of Industrial Science and Technology (AIST) And the Japan Industrial Technology Association (JITA) in co-operation wit the Commissariat à l'Energie atomique (CEA) and the Centre de la Recherche Scientifique (CNRS) France.

Method used:
One litre of rhodamine WT has been injected in the hydrothermal source of Higashi Onsen. entering the sea on the coast of Satsuma Iwojima.
Water samples were collected in a fix point 250m away from the coast and on water plume cross section 50, 100 and 200 meters from the coast.
Rhodamine is not toxic and can be detected to a concentration of 10-8 to 10-11 kg.l-1.
We used the « piston dispersion model » giving

$$M = Q \int C(t)dt$$

M being the mass of the tracer injected and Q the measured flowrate.
To be valid we must assume that during the experiment the tracer is conservative and that the dilution in water is well made .

The previous equation has been solved using the concentration obtained analysing the samples collected.

Results
Q= 4,5 105 l min-1 or 27000m3h-1
The hydrothermal water being at 55°C a thermocline was observed at a depth of 1m.

Analysing the iron, aluminium and silicium content of some selected samples it was possible to evaluate the hydrothermal source flowrate for these species :

Hydrothermal water flowrate : 20l.s-1
Si : 1.80gs-1
Al : 5.76g-s-1
Fe : 1.94g.s-1