Reply

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SUMMARY

Rokityansky *et al.* in their comment on Pham *et al.* presented an evaluation of the influence of sea water in the Gulf of Corinth by 2-D modelling and the magnetic variation profiling (MVP) method. A reply is given here to their comment, and remarks made on their results.

Key words: Gulf of Corinth, magnetotellurics.

1 PROBLEM OF TRANSMISSION OF SEISMOELECTRIC SIGNALS (SES)

In their introduction, Rokityansky *et al.* (2005) discuss the problem of the transmission of the so-called seismoelectric signals (SES) proposed by the VAN group (Varotsos *et al.*). Pham *et al.* (2000) has no connection with this problem. The electrical heterogeneity of the Earth's crust in the Gulf of Corinth is the general characteristic of many regions of continental crust, especially in tectonic regions such as the Hellenides range. The relatively conductive layer (not highly conductive layer) at about 10 km depth revealed in Pham *et al.* (2000) cannot constitute a transmission layer for SES over a long distance (a few hundred kilometres) as proposed by the VAN group in various papers cited by Rokityansky *et al.* (2005). We have demonstrated the artefact origin of the so-called SES in our recent paper (Pham *et al.* 2002). Until now, this demonstration had not been contested by VAN's supporters.

2 EXISTENCE OF A RELATIVELY CONDUCTIVE LAYER IN THE MIDDLE CRUST

In their section 2, Rokityansky *et al.* (2005) write, 'At longer periods ($T = 50$ s) the 3-D behaviour is again obvious, but, in the central part of the area, low apparent resistivities are observed. Pham *et al.* (2000) interpreted this as a conductive layer at a depth of 10 km.' This assertion is inexact: the existence of a relatively conductive layer in the middle crust was obtained by quantitative modelling (Section 6 of Pham *et al.* 2000) and not by an apparent resistivity map, which is essentially qualitative. Moreover, we have demonstrated and modelled the low apparent resistivity zone in the central part, the Sotaina (and not Sataina) zone, as a local and shallow 3-D structure. This 3-D behaviour was also recognized by Rokityansky *et al.* (2005), and has no connection with the relatively conductive mid-crustal layer, contrary to the assertion by Rokityansky *et al.* (2005).

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3 INFLUENCE OF SEA WATER

In order to demonstrate the influence of sea water, Rokityansky *et al.* (2005) present the results of a 2-D model of the Gulf of Corinth (figs 3 and 4). Let us recall that a 2-D model corresponds to a cylindrical structure infinitely long along one direction, so that the divergence of apparent resistivities along the two principal directions is strengthened in comparison with the case of limited cylindrical structure. The pattern of 2-D structure is purely theoretical and does not always correspond to the real geological structure encountered in the field. This is exactly the case for the northern coast of the Gulf of Corinth, which is very rugged with several peninsulas and bays (see fig. 1 in Pham *et al.* 2000). Therefore the 2-D model, shown in fig. 3 of Rokityansky *et al.* (2005), is inappropriate for the evaluation of the influence of sea water. The 3-D model is more realistic and will show a weaker divergence of the apparent resistivities along the two principal directions (see figs A3 a and b in Pham *et al.* 2000). This explains why the apparent resistivities do not show strong divergence for the stations located along the northern coast, but the apparent resistivity maps show local conductive zones which indicate the penetration of sea water into the porous or fractured rocks along the coast, for example under the Psaromita peninsula (see figs 4a and b, figs 13a and b in Pham *et al.* 2000). This confirms the fact that on the northern side of the Gulf of Corinth the influence of sea water is principally local along a jagged coast. This influence does not correspond to the unrealistic 2-D model proposed by Rokityansky *et al.* (2005) showing a strong divergence of the E- and B-polarization near the coast (right-hand side of their fig. 3). Rokityansky *et al.* (2005) did not examine carefully our apparent resistivity maps at different periods: these show a lower B-polarization apparent resistivity (ρ_a NS) zone along the northern coast, increasing towards the internal zone, contrary to the 2-D model which shows the higher B-polarization apparent resistivity zone near the coast, decreasing towards the internal zone (see their fig. 3). This again confirms that their theoretical 2-D model is unrealistic.

4 THE MVP DATA

In their section 3, Rokityansky *et al.* (2005) also present magnetovariational profiling (MVP) data obtained at one site, Amygdalea, located near the conductive Sotaina zone (figs 1 and 4). The fundamental principle of the MVP method requires the measurement of three magnetic components at several stations along a profile (the P in MVP denotes profiling). Unfortunately, Rokityansky *et al.* (2005) carried out at Amygdalea site only one station, located far away from the northern coast. A single induction vector is obviously inadequate for studying the influence of the Gulf of Corinth. Moreover, in order to justify their experimental results, they used again the 2-D model (fig. 3). Clearly their fig. 4 shows that their observed data (open circles) do not fit with the theoretical 2-D model data. To explain this discrepancy, Rokityansky *et al.* (2005) suggested the influence of the Ionian, Mediterranean and Aegean seas. Presently, it is impossible to verify this hypothesis. The most plausible explanation is that their 2-D model does not take into account the strong heterogeneity of the crust around the Amygdalea site, which is located near the northern part of an important overthrust between the resistive transition zone and conductive Pindos zone. For details, see fig. 1 of Pham *et al.* (2000) and fig. 1 of Rokityansky *et al.* (2005). In their 2-D modelling, Rokityansky *et al.* (2005) have ignored the influence of the perturbed tectonics of the Hellenides range.

5 CONCLUSION

Our conclusion is contrary to that of Rokityansky *et al.* (2005), who claim that 'the Gulf of Corinth has a dominant effect on MT and induction vector data in the period range 3–300 s'. Their conclusion is based on a theoretical model that is geologically unrealistic and on an insufficient quantity of MVP data.

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