5. Conclusions

I have presented a few general characteristics of the 2001 Enola earthquake swarm that can be summarized as follows:

1. The analysis of daily seismicity rates reveals that the occurrence rate of 2001 "aftershocks" does not appear to have an Omori temporal decay. Even on a day-long or several-day long scale, the absence of an unique temporal decay is clearly expressed. It is also clear that the seismicity rate does not follow a simple definition of an earthquake swarm. Instead of having an increase, the maximum, and time decay of seismic activity (swarm-like behavior) the actual seismicity rate of the 2001 sequence greatly fluctuates in time. The swarm attribute can be only loosely used in the case of the 2001 Enola sequence.
2. The numerous (re)location procedures do not reveal a simple fault plane but rather two clusters of seismic activity. However, both clusters appear to have a NW-SE trend. The shallow cluster had developed ~50 located earthquakes in only one day. The deep cluster on the other hand, had produced about the same number of the largest earthquakes but over a significantly longer time span, approximately 2 months. The beginning of the deep cluster had occurred below the future shallow cluster connecting them both eventually with a dispersed cloud of seismicity. This migration of seismicity might be a strong indicator of fluid induced seismicity.
3. The b-value of 0.89 for the size distribution of the Enola earthquakes (almost all are smaller than magnitude 2) is quite clearly expressed. The large magnitude end of the distribution reveals a notable roll-off. Such a b-value (close to value of one)

suggests that the Enola swarm region (stable continental crust) differs from volcanic swarm-producing environments where b-values reach values of 1.5 and higher (Sykes, 1970).

4. I calculated 15 well-constrained focal mechanisms. Seven focal (pure strike-slips) mechanisms are identical (day 182). These earthquakes took place within a day. Because of the proximity of their hypocenters it is very likely that they shared a single source. The focal mechanisms of the events recorded early in the period of data acquisition (lower parts of the future shallow cluster) also exhibit strike-slip faulting but with a slight thrust component. All the focal mechanism solutions are compatible with the regional compressive stress regime (ENE) and both focal plane solutions would produce strike-slip motion.

The results do not contradict the claim that the earthquakes result from the regional stress regime. The mapped faults surrounding the Enola swarm region, being parallel to the regional stress field, are not favorably oriented for a major seismic stress release. Instead, seismicity occurs in a confined volume in between the faults. The role of fluids remains elusive. Qualitatively speaking they might help faults to slip by reducing the "fault locking" stress at depth and be the principle force in earthquake nucleation. It is very hard to test the hypothesis detailing the fluid influence in a seismogenic process. Sources of fluid pressure, on the other hand, might not be so difficult to find; vicinity of Hot Springs, AR for example, could be one.

Perhaps the regional stress field together with specific medium properties of the swarm area (cracks filled with fluids) is the reason of having such highly localized seismicity and observed spatial/temporal patterns of both Enola earthquake sequences.

At the end I want to give a few guidelines for future work that could shed more light on this peculiar seismic zone.

1. *More data*. I believe that in spite of the repetitive nature of the swarms 1982, 2001 these two only spotlight two largest episodes of the continuous Enola seismicity. Both swarms exhibited the episodic nature of the seismicity during the periods of data acquisition. It is unreasonable to assume that this character ends once the seismographs have been removed. After the first swarm and apparent relatively high intense seismicity during 1982-1984, the PANDA array was deployed in the same region for about 4 months in 1987 (Pujol, 1989). The 40-instrument array recorded only 12 earthquakes. Nevertheless the earthquakes not only occurred in this seismically quiescent time span for the Enola region but also occupied the very same, well-confined 5x5 km area. Two seismographs permanently deployed and constantly surveying the area would give more information on the time character of the Enola seismicity.
2. *Waveform propagation model*. Obtaining focal mechanism solutions for earthquakes recorded on only three stations would give better insight into the source chronology of the sequence. Many observed waveforms reveal complexities of SV and SH arrivals and multiple P arrivals. Noted time differences between SH and SV phase arrivals, for numerous earthquakes, suggest either a higher degree of medium anisotropy (oriented cracks might cause shear wave splitting) or just complex medium layering; maybe both. Therefore, it is not possible to consistently use correct SH & SV arrivals without identifying the source and wave propagation properties.

3. *A seismic line section across the swarm area.* It is not clear whether the missing strong reflectors on the seismic reflection section across the swarm area (Schweig, 1991) are due to the actual fractured character of the medium or just an indicator of a chosen velocity model. Pujol et al., (1989) clearly shows a circular pattern of the velocity change in the swarm region. Rocks in the immediate swarm region seem to exhibit lower seismic velocities than the surrounding rock by 12-15 %. How much this change would affect the corrections (i.e. stacking, NMO) and final interpretation of the seismic section must be investigated.

I wrote numerous computer scripts to better and faster interpret the collected data. Although using already existing algorithms for waveform cross correlation, I introduced a flexible computer code that can aid future seismic data analysis, in particular for data obtained using the CERI portable seismic network. It is possible to customize and organize the scripts in a computer application package alleviating numerous difficulties in rapid "on-the-fly" earthquake location and preliminary analysis.